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Marine Scotland Science

Management of The Scottish Inshore Fisheries; Assessing The Options for Change

Technical Reports

marine scotland science

MANAGEMENT OF THE SCOTTISH INSHORE FISHERIES; ASSESSING THE OPTIONS FOR CHANGE

TECHNICAL REPORT

TENDER REFERENCE – CR/2012/08

Prepared for

Marine Scotland

The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

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EXECUTIVE SUMMARY

Introduction

It is generally accepted that fish stocks in Scottish waters are a national resource[1] and should be managed on behalf of all stakeholders. Despite the inherent complexity of the task, an economic evaluation of fisheries policy options must therefore endeavour to capture all stakeholder interests.

This study was tasked with evaluating a 0-1 nautical mile (NM) and a 0-3 NM restriction on the use of mobile gear. These two policy options will affect the wellbeing of very different stakeholders in multidimensional and complex ways. Initially the impact of mobile gear restrictions will be experienced in the commercial fishing sector. Those affected in this sector will include mobile and static gear operators and crew, the upstream and downstream links in the supply chain, and the local economies which benefit from the spending of all those involved in the commercial fisheries sector.

A significant proportion of the general public also needs to be included because they may have altruistic concerns for the marine environment (which here is termed General Public Non-User Value (GPNUV)). There are also marine recreational interests to be considered, among which there is probably a spectrum of sensitivity to changes in fish stocks. At one end, there are sea anglers and, to a lesser extent, marine divers whose recreational experience involves direct interaction with fish stocks. For others, such as ornithologists and marine wildlife tourists and charterers their enjoyment and participation is sensitive largely to changes in fish predator populations. At the other end of the spectrum, might be sea kayakers, sailors and informal visitors to coastal areas. For these participants, whilst the prospect of interaction with sea birds or sea mammals is not a necessary ingredient of their recreational experience, the increased probability of sightings might enhance their experience and possibly boost activity levels. Unfortunately existing knowledge and available data did not enable the analysis of marine recreation to extend beyond those who interact directly with fish stocks (ie anglers and divers). In some respects, Recreational Sea Angling (RSA) and Recreational Diving (RD) are proxy for all marine recreational activity.

This study embraces stakeholders by using both Net Economic Value / Cost Benefit Analysis (NEV/CBA) and Economic Impact Assessment (EIA) to provide an evaluation of the two policy options. In doing so, NEV/CBA and EIA estimates are produced separately for Scotland, the 6 Scottish Inshore Fishery Groups (IFGs) and Shetland.

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[1] For example, Scottish Government 2014 Consultation on the Allocation of Fish Quota

[2] This Executive Summary does not summarise the work on these objectives and readers should refer to the main body of the report.

[3] It is possible that fish stocks may recover sufficiently to support a commercial line fishery.

[4] IFG population estimates are presented in Table 20.3 in the main report.

[5] http://www.scotland.gov.uk/Publications/2013/10/1091/3

[6] Technically, different arrangements might exist for Orkney, but for the analytical purposes of this report the Orkney area is regarded as an IFG.

[7] http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/InshoreFisheries/IFGsMap/ifgremit

The study was also required to satisfy the following subsidiary and complementary objectives:[2]

- An assessment of the economic dependency on the fishing sector in Scottish coastal communities.
- An evaluation of alternative creel management regimes.

Approach

Any economic evaluation is based on comparison about what might happen with and without the policy initiative. This requires practitioners to make predictions about how the marine environment and stakeholders groups would respond to the proposed restrictions on mobile gear. These predictions are based on existing knowledge but inevitably require assumptions and informed judgements. Since the NEV/CBA and EIA results are sensitive to the assumptions, it would be inappropriate for this study to seek to provide single definitive estimates. Instead, this study has developed a model which allows informed users to vary the assumptions and parameters for themselves, and thereby explore how these changes impact the results.

It is hoped that this approach will enlighten and provide greater equality in the opportunity to engage in debate about these inshore policy options. For example, the study provides estimates relating to illustrative scenarios where the restrictions on mobile gear produce a change in the marine environment and scenarios where they do not. This enables those involved in the debate to see whether transformation of the marine environment is a necessary condition for delivering additional jobs, or generating an excess flow of policy benefits over policy costs.

Process

There were a number of key steps in building and running the model. Whilst there is good data on landings there is more uncertainty about where landed fish are caught. Using data from Marine Scotland's Scotmap exercise and the Vessel Monitoring System, benchmark information was produced for zones 0-1 NM, 1-3 NM, 3-6NM and 6-12NM. This was done for Scotland, each IFG area and Shetland. These benchmarks were scrutinised for anomalies by every Fishery Office in Scotland. The benchmark tables provide a highly detailed account of commercial fishing inside Scottish territorial waters.

One of the potential benefits of the 0-1 NM or 0-3 NM restrictions on mobile gear is the reduction in the incidence of gear conflict. The quantification of these benefits required detailed information on gear conflict incidence, the gears involved and the costs involved. This required a survey of fishery operators across Scotland.

The benchmark estimates for RSA, RD and the general public were derived from an assessment of the literature, and in the case of diving, interviews with key personnel and charter operators.

Having established the baseline for all the key stakeholder groups, the study then estimated what might happen to the baseline estimates without the policy (the status

[2] This Executive Summary does not summarise the work on these objectives and readers should refer to the main body of the report.

quo scenarios) and what might happen with a 0-1 NM or 0-3 NM restriction (the policy impact scenarios). The model produces results for two status quo scenarios and three policy impact scenarios.

The impacts on commercial fishing were developed by making informed judgements about how mobile operators would respond, and the knock on effects on both the static sector and stakeholders outside the management area (displacement). The model enables these judgements to be altered. The consequences for the recreational sector and the general public were estimated using benefit transfer.

Presenting the Model Results

In presenting the results, this study provides a set of four indicative NEV/CBA estimates and four indicative EIA estimates. These are presented for both the 0-1NM and the 0-3 NM restriction. The four indicative estimates correspond to four combinations of assumptions. The Least Favourable Outcome (LFO) is generated by combining the assumptions which would produce the least number of jobs in the EIA evaluation and the lowest NEV estimates for the NEV/CBA evaluation. The Most Favourable Outcome (MFO) combines the assumptions that would produce most jobs and the highest NEV estimates. The other two indicative results are based on combining less extreme assumptions.

The economic impact is presented as the change in Full Time Equivalents (FTEs) immediately, in 10 and in 20 years.

In the report, for each of the four indicative NEV/CBA estimates, five NEV estimates are provided. These relate to different time horizons and whether the estimates include the public's GPNUV and/or recreational Options Values (OV). In this Executive Summary only one NEV estimate is provided. This particular estimate excludes any benefits or costs arising after 20 years, includes OV but only 50% of GPNUV.

The Results for Scotland

EIA for Scotland (0-1 NM)

		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-340	-103	-90
	Recreational Sector	3	53	105
	Total	-337	-51	15
Most Favourable	**Fishing**	-128	122	148
	Recreational Sector	21	1342	1342
	Total	-106	1464	1490
Typical A	**Fishing**	-227	-14	-1
	Recreational Sector	11	252	252
	Total	-216	238	251
Typical B	**Fishing**	-227	-106	-80
	Recreational Sector	5	545	1089
	Total	-221	438	1009

The above table informs us that even with a combination of the most pessimistic assumptions, with a 0-1 NM restriction on mobile gear there would be a small positive impact (15 jobs) across Scotland. Using the most optimistic assumptions there is a net gain of 1,490 jobs.

NEV Results (£m) for Scotland (0-1 NM) over 20 Years

		NEV Including Options Value & 0.5 of GPNUVs
Least Favourable	**Commercial Fishing**	-£60
	Recreational Sector	£154
	All	£105
Most Favourable	**Fishing**	-£56
	Recreation	£1,380
	All	£1,324
Typical A	**Fishing**	-£57
	Recreation	£187
	All	£130
Typical B	**Fishing**	-£60
	Recreation	£1,303
	All	£1,243

A positive NEV informs us that the discounted value of the flow of benefits exceeds the discounted value of the flow of costs. From the above table, the LFO suggest an excess of £105m, whilst the MFO projects an NEV of £1.3bn.

EIA Results for Scotland (0-3 NM)

		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-340	-103	-90
	Recreational Sector	3	95	189
	Total	-337	-9	99
Most Favourable	**Commercial Fishing**	-128	96	109
	Recreational Sector	21	2598	2598
	Total	-106	2694	2707
Typical A	**Commercial Fishing**	-227	-14	-1
	Recreational Sector	11	461	461
	Total	-216	447	460
Typical B	**Commercial Fishing**	-227	-132	-119
	Recreational Sector	5	1068	2136
	Total	-221	936	2017

The Tables above strongly suggest that the 0-3 NM restriction would deliver both more jobs than the 0-1 NM restriction. The LFO would produce 99 more jobs across Scotland whilst the MFO would produce 2,707 more jobs.

NEV Results (£m) for Scotland (0-3 NM) over 20 Years

		NEV Including Options Value & 0.5 of GPNUVs
Least Favourable	**Commercial Fishing**	-£56
	Recreational Sector	£190
	All	£134
Most Favourable	**Commercial Fishing**	-£53
	Recreational Sector	£1,553
	All	£1,500
Typical A	**Commercial Fishing**	-£53
	Recreational Sector	£231
	All	£179
Typical B	**Commercial Fishing**	-£57
	Recreational Sector	£0
	All	£1,348

In the Table above, the LFO suggest an NEV of £134m. The MFO projects an NEV of £1.5bn over 20 years. As with the economic impact results, the 0-3 NM restriction is predicted to deliver a better return than the 0-1 NM restriction.

The results suggest that Scotland as a whole would be better off rather than worse off with a more diverse and productive marine environment. The proposed restrictions on mobile gear mean that Nephrops and scallops will still be caught within 0-1 NM or 0-3 NM, albeit in smaller quantities using more labour intensive static gear and hand-diving[3]. Changing the way we harvest Nephrops and scallops in near shore areas is expected to generate some improvement in environmental quality and deliver more economic benefits to broader sections of the population. Some sections of the population would be better off simply knowing that parts of the marine environment are protected and improving (GPNUV). Others might be better off because of improvements in their marine recreational activity and, as they spend more, this increases the income and employment of those supplying marine recreational services.

However, the case for Scotland wide restrictions is not compelling. This is because, as explained below, the analysis predicts that the North West and Outer Hebrides could conceivably deliver negative contributions to employment and NEV. A Scottish wide restriction on mobile gear that included these areas might therefore deliver less employment gains and a lower NEV contribution than more selective restrictions. Until further research reveals otherwise, the Scottish wide results should also be regarded as equivocal in terms of the case for a Scotland wide restrictions on mobile gear.

The Results for the IFG's and Shetland

In practise the estimated benefits and costs, and jobs created (or lost) are not evenly spread across Scotland's IFGs. In IFG areas such as the South West IFG area and the East Coast IFG areas mobile gear restrictions are estimated to have highly beneficial impacts on jobs and NEV. In some other areas the case for introducing mobile gear restrictions would be harder to argue on the basis of the scenario estimates.

In the main report, tables comparable to the four Scottish tables (see above) are presented for each IFG (i.e. NEV/CBA and EIA tables for both the 0-1 NM and the 0-3 NM restriction). The Table below extracts the year 20 employment estimates for the six IFGs and Shetland. The sensitivity of the results to changes in assumptions is very evident.

[3] It is possible that fish stocks may recover sufficiently to support a commercial line fishery.

Economic Impact All IFGs 0-3 NM

		FTE's Year 20						
		South West	**North West**	**Outer Hebrides**	**MF& NC**	**Orkney**	**East Coast**	**Shetland**
Least Favourable	**Commercial Fishing**	-58	-56	-30	-27	5	3	72
	Recreational Sector	122	9	13	20	7	62	5
	Total	64	-47	-16	-7	11	65	77
Most Favourable	**Commercial Fishing**	-7	-17	-11	1	5	34	65
	Recreational Sector	1692	127	181	268	75	850	75
	Total	1686	109	170	269	80	883	140
Typical A	**Commercial Fishing**	-49	-42	-23	-13	4	15	65
	Recreational Sector	299	23	32	48	15	151	13
	Total	251	-19	8	35	19	166	77
Typical B	**Commercial Fishing**	-49	-50	-26	-31	3	6	64
	Recreational Sector	1392	103	148	220	61	699	63
	Total	1343	53	122	189	64	705	128

From the Table above, the South West, East Coast, Orkney and Shetland IFG areas are estimated to experience an increase in employment, even if the conditions described by the LFO prevailed. The South West IFG and the East Coast IFG offer the greatest potential in terms of job creation. This is because these two areas account for 44.6% and 47.4% respectively of the Scottish population[4]. The expansion of the marine recreational sector could thus create large numbers of jobs in these areas. The Moray Firth and North Coast (MF&NC) IFG accounts for (5.8%), and whilst its commercial fishery would probably lose jobs, there is the possibility of job creation in marine recreation.

Areas with small populations such as Outer Hebrides (0.5% of Scottish population), and the North West (0.8%) might suffer from loss of employment in commercial fishing but might not attract large numbers of participants in marine recreation. The structure of Orkney's and Shetland's commercial fisheries means their commercial fisheries do not suffer a net loss of employment but in the case of Shetland the estimated gains in the recreational sector are modest. Orkney is estimated to gain recreational employment from RD.

The Table below presents the comparative NEV results for each of the IFGs and Shetland.

[4] IFG population estimates are presented in Table 20.3 in the main report.

NEV Results (£m) for all IFGs (0-3 NM) over 20 Years

		NEV Including Options Value & 0.5 of GPNUVs						
		South West	**North West**	**Outer Hebrides**	**MF& NC**	**Orkney**	**East Coast**	**Shetland**
Least Favourable	**Commercial Fishing**	-£23	-£7	-£6	-£9	-£1	-£7	-£2
	Recreational Sector	£85	£3	£3	£13	£2	£80	£2
	All	£63	-£4	-£3	£4	£1	£73	£1
Most Favourable	**Commercial Fishing**	-£7	-£17	-£11	£1	£5	£34	£0
	Recreational Sector	£690	£35	£30	£97	£10	£614	£17
	All	£683	£18	£20	£98	£15	£648	£17
Typical A	**Commercial Fishing**	-£49	-£42	-£23	-£13	£4	£15	£1
	Recreational Sector	£131	£39	£23	£22	-£1	£67	£4
	All	£82	-£2	£0	£9	£3	£82	£5
Typical B	**Commercial Fishing**	-£49	-£50	-£26	-£31	£3	£6	-£2
	Recreational Sector	£0	£0	£0	£0	£0	£0	£0
	All	£248	£11	£11	£82	£10	£612	£10

From the illustrative estimates presented in the Table above, all areas apart from the North West and Outer Hebrides generate an excess of benefits over costs, even under the LFO scenario. In the case of the South West, and East there is a substantial excess of benefits over costs and to a lesser extent in the MF&NC IFG. In the case of Orkney and Shetland the excess of benefits over costs are relatively modest.

Implications of the Results

A single set of results would have a spurious level of accuracy and probably should not be allowed to influence policy. This report therefore has chosen to present indicative sets of results for Scotland as a whole and for each IFG area. Significantly, the indicative results for each IFG are bookended by the MFO and LFO outcomes. This has produced a wide range with some MFOs being a factor of 10 times the LFO. Rather than being a cause for concern, the wide range should be a re-assurance that the evaluation process has captured the uncertainty associated of an economic evaluation which is reliant on informed judgements about the future.

The problem with presenting the analysis for each IFG as an indicative set of results is that the implications for policy can be equivocal if the range of results straddles positive and negative estimates. The North West, Outer Hebrides, MF&NC delivered negative LFO estimates for NEV or Employment or both. In the case of Orkney and Shetland, the estimates for employment and NEV are all positive but only marginally positive and have a relatively narrow range. Before being used to inform policy it would probably be sensible to also regard these areas as being worthy of further targeted research aimed at reducing uncertainty, particularly around the LFO estimates which create the unease. This research should focus on the stakeholder groups which have the greatest impact on the results and be targeted on the key assumptions and parameters which relate to them.

With respect to the South West and East Coast IFG areas, even the LFO cannot generate negative values for NEV or the change in employment.

In these two IFG areas, the significant excess of policy benefits over policy costs implies there is a current resource misallocation. Thus, one clear implication of the South West and East Coast results is that the gear restriction is an opportunity to correct a resource misallocation. If corrected, we would expect that, over time, the flow of economic benefits would exceed the economic costs (regrettably, with any policy initiative there will always be some losers). With respect to the employment issue, it is indeed highly unfortunate that some jobs, directly or indirectly, dependent on mobile gear would be lost. However, it would appear that, for the South West and East Coast areas, based on the range of modelled assumptions, restricting mobile gear use would create many more jobs than it loses. Thus, rather than creating employment in the South West and East Coast, the current deployment of mobile gear might be constraining economic and employment growth.

1 OBJECTIVES AND APPROACH

Scotland's inshore waters (out to 12 nautical miles) provide diverse and productive fisheries which are exploited by a variety of gears including demersal, nephrop and pelagic trawls, dredges, hand lines, hand diving, and creels. Within the commercial fishing sector there are concerns relating to excessive levels of exploitation of some stocks and conflicts between gear types, particularly between mobile and static gears.

It is also recognised that inshore fisheries are an important resource for recreational activity such as sea angling and scuba diving, whilst inshore biodiversity is a concern for those participating in wildlife observation and tourism. The inshore is very much a shared resource and policy needs to recognise demands of a diverse range of stakeholders and be based on robust evidence. This study is designed to help fill the substantial and widely recognised evidence gap which exists on inshore fisheries and which currently constrains the formation of policy.

1.1 The Study Remit

The tender document stipulated that the project will use **cost benefit analysis** and **economic impact assessment** to provide estimates of the impacts to Scotland of a number of nation-wide options. These were:

1. One nautical mile (NM) limit on the use of mobile fishing gear.
2. Three NM limit on the use of mobile fishing gear.
3. Limit on the permitted number of creels per vessel which would operate in conjunction with an overall cap on creel numbers or, equivalently, a fixed number of licences for vessels in the fishery. The analysis should also consider sub-options where trading of creel allocations between vessels is and is not permitted.
4. Introduction of catch limits or landing quotas which would operate in conjunction with an overall cap on catches or landings or, equivalently, a fixed number of licences for vessels in the fishery. The analysis should consider sub-options where trading of quota allocations between vessels is and is not permitted.

In addition, the analysis was to be disaggregated to the level of the six Inshore Fishery Groups (IFGs) plus Shetland. Given the 4 policy options and 7 geographical areas this implies 28 cost benefit analyses and 28 economic impact assessments.

Options 1 and 2 presented no real problems in interpretation. With respect to Options 3 and 4, as work progressed clarification was requested on a number of issues and it became apparent that seemingly minor changes in specifications could significantly alter economic outcomes. In the time available, it was not feasible for Marine Scotland to fully specify their preferred creel and catch limit regimes. In the absence of a clear specification, an economic evaluation was not feasible. At the same time, a 2013 Marine Scotland consultation on new controls in the Nephrops and crab and lobster fisheries concluded that there was no appetite for the imposition of **national creel limits** and that, given the lack of evidence, there is no proposal to introduce them[5]. For these reasons, this study's applied economic modelling of specific **nation-wide policy options** was therefore restricted to Options 1 and 2.

However, the majority of IFG's have indicated a desire for local creel limits, as well as some other gear restrictions. The 2013 consultation concluded that, at the local level, creel or other limits may have a role to play. There is therefore a more immediate need for a more nuanced understanding of **local** creel limits. It was therefore agreed that the study would develop a general discussion on the consequences of different creel limits regimes. The purpose is to identify the various incentive effects, behavioural responses and economic outcomes of different creel limit regimes. The study was not charged with evaluating the relative merits of alternative creel limit regimes. Indeed, this is not possible since the merits any management instrument can only be assessed in line with the declared objectives.

The issue of gear conflict has been increasing in importance and Marine Scotland's required better knowledge on the nature, the extent and the economic consequences of gear conflicts. It was originally intended that the study would rely on secondary data on gear conflict. In lieu of the applied analysis of creel and catch limits, the study was able to extend its analysis of the gear conflict by generating much needed primary data. Thus, an on-line questionnaire for fishery operators was developed, along with an email based survey of fishery officers.

1.2 The Amended Remit

The agreed remit was that project will use cost benefit analysis and economic impact assessment to provide estimates of the impacts to Scotland of a number of nation-wide options. These were:

1. One NM limit on the use of mobile fishing gear.
2. Three-NM limit on the use of mobile fishing gear.
3. The study would provide an overview of the nature, extent and economic consequences of gear conflicts in Scottish inshore waters. This information would also inform the analysis of the proposed mobile gear restrictions.
4. The study will provide an analysis, predominantly aimed at IFGs, setting out at a conceptual / qualitative level the key factors that they need to consider in order to determine whether and how to introduce regional or local creel limits. The analysis would set out the main issues that need to be evaluated before making decisions on regional or local creel limits.
5. As an additional element of the study, if IFG's can provide an explicit statement of what they are seeking to achieve by introducing creel limits, the contractor would work closely with the IFG to provide a detailed bespoke ex ante analysis which would evaluate the relative merits of alternative local creel limit regimes.

[5] http://www.scotland.gov.uk/Publications/2013/10/1091/3

The analysis was to be disaggregated to the level of the six IFGs plus Shetland[6]. Given the 2 policy options and 7 geographical areas this implies 14 cost benefit analyses and 14 economic impact assessments.

It is very important to note that the analysis of option 1 and 2 relates to the impact of nation-wide restrictions on individual IFG areas. This might differ from the impact on an IFG of a restriction that applied exclusively to that particular IFG. This is primarily because, mobile operators might respond differently to a national restriction than to a local restriction. These differences are also explored.

[6]Technically, different arrangements might exist for Orkney, but for the analytical purposes of this report the Orkney area is regarded as an IFG.

1.3 Approach

The two policy initiatives being evaluated will probably result in some stakeholders being worse off and others better off. There are therefore sensitivities that need to be acknowledged, particularly with respect to the inshore mobile sector. Against that background, the authors have sought to deliver an independent report by applying agreed economic principles consistently and without knowingly favouring any particular interest group or outcome. The expectation is that broadly similar results would emerge if this study were undertaken by other independent economists.

In some instances adherence to complete neutrality can be difficult. For example, there may be situations where there are two or more sources of estimates of economic parameters, which, though different, are equally valid in terms of logic or provenance. In these circumstances the benefit of the doubt is given to those stakeholders who would be made worse off (i.e. that segment of the mobile sector fishing the inshore). Thus, other things being equal, this report utilises estimates which produce lower costs and higher benefits for the mobile sector, and vice versa for those stakeholders who might prosper from a 1 or 3NM restriction. This bias towards the mobile sector only arises when there are no other criteria that can be used to rank alternatives.

Though independently produced, the evaluations in this report are not objective in the sense of being completely devoid of value judgements. On the contrary, any economic evaluation has some underlying value judgement(s). In practice, there are two types of economic evaluations and, though complementary, each starts from a different set of value judgements defining "what matters" and therefore what should be included and quantified.

Though not seeking objectivity, the authors have tried to ensure that the recognised value judgements of economics are clear and explicit. By doing do, we hope that all those engaged in debate are better able to understand the basis and implications of the results.

As it transpires, the value judgements used by economics are readily embraced by democratic mixed market economies, hence the commissioning of this kind of work and its influence on decision making. Sections 3, 4, and 5 explain the key concepts and how they are applied in this study.

As well as seeking to be independent, the authors have sought to be transparent. This is to enable their efforts to be scrutinised, criticised, checked and replicated. Since the primary purpose of this document is to better inform public debate on management of Scottish inshore fisheries, the authors very much welcome further input and comment from all interested parties.

In this context, neither the authors nor Marine Scotland regard this document as a finished entity. The uncertainty about the underlying biology and absence of some economic data and knowledge mean that the present results have the capacity to be improved. This improvement may come through; constructive criticism, better biological and economic data becoming available, or a better appreciation of how creelers, trawlers, dredgers, anglers and others might respond to policy initiatives.

Indeed, there are so many scientific and economic uncertainties that assumptions and informed judgements are unavoidable if progress is to be made. Since the results are sensitive to the assumptions, there needs to be a clear understanding of how varying the assumptions impact the results. Normally, this would be explored through a sensitivity analysis. The study goes beyond this by producing a model where users of the model can vary the assumptions themselves, produce their own sensitivity analysis and explore whether the balance of estimated costs and benefits is altered significantly by tweaking the model's assumptions.

Viewed overall, this study is designed to:

- Produce a clearly articulated and logically coherent framework of economic analysis relating to inshore fisheries policy options. This will promote greater equality in the opportunity to engage in debate about inshore policy options and help to ensure that the debate is not logically compromised through culpable or innocent misuse of economic concepts and data.
- Produce an evaluation of the economic consequences of policy options which is based on knowledge currently available.
- Produce a model which will enable the economic evaluation to be updated as knowledge advances and other stakeholders to produce their own estimates.

1.4 Limitations of the Evaluations

The estimates produced are a combination of a snapshot of the economics of Scottish inshore fisheries as currently exists and speculation about the economic conditions that might prevail were the 1 or 3 NM limits eventually to result in the revitalisation of the ecosystem and recovery of demersal fish stocks.

This study itself does not consider whether the policies being implemented would result in successful ecosystem restoration. Most of the debate among stakeholders will thus probably focus on these practical and biological issues, rather than the economics.

There is a regular flow of vessels entering and leaving a fishery and there can be significant fluctuations in fishery characteristics between different years. In this report, landings estimates relate to average gross vessel earnings in the period 2007-2011 and care needs to be exercised when reconciling estimates produced here with current ground level observations. Because of such variations, inferences should only be drawn from the orders of magnitude rather than the fine detail.

Finally, we would emphasise that this is largely desk study which has assembled existing knowledge to produce estimates of the economic indicators associated with ecosystem recovery, but only in terms of broad orders of magnitude. Depending on the results, what really matters is the relative magnitudes of key indicators, rather than the precision of the estimates themselves. It is the relative magnitudes which are likely to influence policy formation. Moreover, the relative magnitudes should provide some insight as to whether further economic research targeted at refining estimates would alter the implications of the results.

1.5 Structure of the Document

Sections 1 and 2 outline some of the key features of Scotland's inshore fisheries and explain how they are managed and monitored. This background is necessary to enable an understanding of the evidence and data available and the constraints which shaped the generation of new data.

Sections 3, 4, and 5 explore relevant economic analysis and together they build a coherent framework of economic analysis which is used to evaluate the inshore fisheries management policy options.

Section 6 explains how this study generated and manipulated fisheries data to build a comprehensive benchmark description of fish where fish are caught within each IFG area, as distinct from landings in the IFG ports.

Section 7 addresses the issue of economic dependency on inshore fishing and considers how economic dependency is defined and how it can be measured. The dependency of fishing communities across Scotland is then assessed.

Sections 8 through to 15 present the baseline descriptions for Scotland's inshore fisheries and for each of the IFG areas and Shetland. Each benchmark embraces; species type, where the catch was made (0-1, 1-3, 3-6, or 6-12 NM) the gear, the vessel size, the catch volume and value. The 3-6 and 6-12 NM zones were included in the baseline to enable an assessment of the potential displacement effects arising from the imposition of restrictions in the 0-1 and 0-3 NM zones.

Section 16 addresses the issue of gear conflict and presents the result of a survey of fishery operators' experience of gear conflict. Estimates of the financial implications are inputs into the model used to evaluate policy options.

Sections 17, 18, and 19 broaden the analysis to embrace recreational interests who directly use or interact with Scotland's inshore marine environment and who potentially could be impacted by the policy options. These recreational interests might include sea angling, sub aqua, ornithology, marine wildlife charters, sea kayaking, yachting and informal visits to Scottish coastal areas.

Section 20 addresses the issue of the general public's non-user value. This arises when members of the general public, despite having no direct or indirect interaction with the marine environment, are not indifferent to its quality. Their well-being, as they themselves define it, would be increased with improvements in the marine environment.

Section 21 explains the Excel model used to produce both an economic impact analysis and a cost benefit analysis for Scotland, for each IFG and for Shetland.

Sections 22, 23 and 24 presents the results and discuss their implications.

Section 25 presents the discussion on creel limits.

2 INSHORE FISHERIES: MANAGEMENT AND INSTITUTIONAL BACKGROUND

This study is reliant on primary and secondary data collected by Marine Scotland (MS) for use in particular functions and inevitably for the purposes of this study the existing data is not in an ideal form. This is because landings are reported according to ICES Statistical rectangles which are not correspond with the 0-1 and 0-3 NM zones. MS data therefore needed to be trimmed, scaled and variously manipulated to provide benchmark information on catches in the zones 0-1 and 1-3 NM. In addition to enable an assessment of the potential displacement effects, similar benchmark information was required for zones 3-6 and 6-12 NM. This benchmarking exercise had to be conducted for each IFG plus Shetland.

To understand how benchmark estimates were produced it is necessary to appreciate the starting point and the provenance of the MS data that were available. With respect to MS data, it is important to know such things as where, how, when and by whom data were collected. These issues are shaped by how inshore fisheries are managed, monitored, administered and enforced.

Another reason for highlighting aspects of institutional background is that this study is seeking to model the behaviour of fishery operators. Their response to the proposed mobile restrictions is influenced by economic stimuli such as changes in costs and revenue, but highly constrained by current fisheries policy measures.

Explanations in this study therefore make reference to various MS institutions, protocols and terminology. The policy options imply that it might be undesirable to use mobile gear in inshore areas. It is therefore appropriate briefly to outline the fisheries involved and the reasons for concern about the deployment of mobile gear inshore.

This section therefore outlines some key features of inshore fisheries management. It deals with the following

- Inshore Fishery Groups
- Key Species
- Fishing Vessel Registration.
- Vessel Licensing
- Transfer and Use of Licences.
- Quota Management.
- Managing Effort.
- Recoding Scottish Landings.
- Registration of Buyers and Sellers.
- Vessel Monitoring System

2.1 Inshore Fishery Groups (IFGs)

The UK is a Member State of the EU and the terms of the CFP apply to all member state sea area. However, the 6NM fishery limit is the area within which there are no historic access rights for non UK fishing vessels and thus, the Scottish Government has sole jurisdiction over these waters for fisheries management purposes. Scottish territorial waters extend to 12NM, but between 6 and 12NM the Scottish Government has sole jurisdiction for fisheries management purposes for shellfish apart from some areas where France and the Republic of Ireland have historic access rights between 12 and 6 for shellfish.

As an EU member any technical conservation measures under the CFP including the setting of a Minimum Landing Size (MLS) for species of fish and shellfish applies can apply to all Scottish waters. The Scottish Government could seek to increase the MLS or enhance other technical conservation measures within its territorial waters, but these would only apply to UK vessels.

The IFGs are non-statutory bodies and aim to improve the management of Scotland's inshore fisheries out to 6 nautical miles and to give commercial inshore fishermen a strong voice in wider marine management developments.

Originally, six pilot IFGs were established in 2009 (covering the Outer Hebrides, the Clyde, the South-East of Scotland, the North West, Small Isles and Mull, and Moray Firth) and each developed an inshore fisheries management plan for their area.

Following on from this pilot, six new Inshore Fisheries Groups (IFGs) cover the entire Scottish coast (except Shetland which has its own management arrangements). Arrangements for Orkney differ from other IFGs to reflect the local situation.

2.1.1 IFG Remit and Operation

"Having regard to the Marine Scotland Inshore Fisheries Strategy 2012 and the National Marine Plan, the Inshore Fisheries Group will consider, and work with Marine Scotland to advance, recommendations and proposals on matters connected to:

- The development and implementation of regional policies and initiatives relating to the management and conservation of inshore fisheries, and impacts on the marine environment so as to ensure a viable fishing industry in the IFG Area and in Scotland more generally and the maintenance of sustainable fishing communities;
- The development and implementation of measures designed to better conserve and sustainably exploit stocks of shellfish and sea fish (including salmon) in local IFG waters, and to enable local fishermen, other fishermen who rely on local waters for their livelihood, and other persons with an interest to contribute to such development; and,
- The development of proposals for and approaches to Marine Scotland, IFMAC, Marine Planning Regions, other IFGs, and others with an interest in the fishery in relation to inshore fisheries management" [7]

[7] http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/InshoreFisheries/IFGsMap/ifgremit

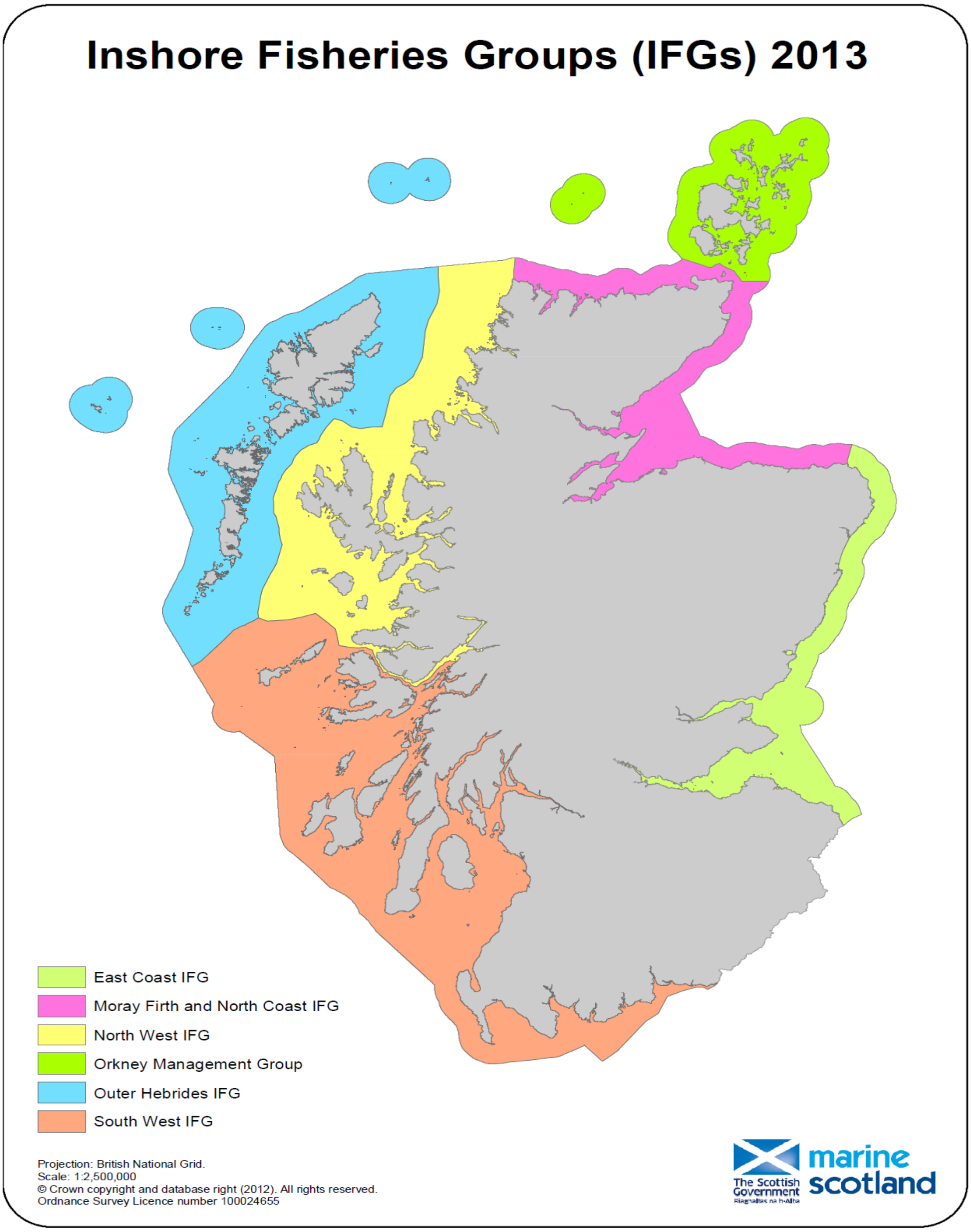

Figure 2.1.1 IFG MAP

The intention is that IFGs will be inclusive with respect to all relevant commercial fishing sectors within their area though representatives of fishermen from other Administrations may be included, whether as a full member or observer, at the discretion of IFGs. Members will generally be representatives of fishermen's associations comprising at least 10 vessels, although smaller associations can be included. Individual fishermen may also be members, to represent groups of non-affiliated fishermen, where Chairs agree.

2.2 The Key Species[8]

2.2.1 Nephrops

There are nephrop populations in the North Sea and waters to the west of Scotland, in open waters and sea lochs. They can be found at depths ranging from a few meters down to over 500m. Nephrops is the only shellfish species managed through the CFP Policy. Scotland is allocated the majority of the Total Allowable Catches (TAC) in both the North Sea and on the Scottish west coast and takes over one third of the landings worldwide.

Nephrops are caught by trawls or by creels. Trawls for Nephrops are very similar to whitefish demersal gear but are generally more lightly rigged and have smaller regulation mesh size. A comparatively recent development is twin-trawling where a vessel tows two bottom trawls side by side using a single pair of otter boards to spread both nets enabling the vessel to catch more by sweeping a much greater area of sea bed. Nephrops spend most of their time in burrows, only coming out to feed and look for a mate. They are thus protected from trawls when in burrows. Males are more heavily exploited than females because 'berried' females rarely come out of the burrow.

Scottish creeling is for the most part undertaken by relatively small inshore vessels less than 18 metres. In 1999 monthly catch limits for Nephrops were established for the 10 m & under fleet. Virtually all creel caught Nephrops are sold to the live market, mostly on continental Europe. Creel caught Nephrops are tubed and stored in sea water before being transported live to market. The trawl fishery usually supplies fresh or frozen tails which require on-shore processing for, though some mobile operators are using tubes and live storage.

Current minimum landing sizes for Nephrops in the VIa are total length 70 mm and carapace length 20 mm, with tail sizes at 37 mm, whereas those in for the North Sea are total length 85 mm, carapace length 25 mm, with tail sizes being 46 mm. These MLs apply to both the creel and the trawl fishery.

With respect to the North Sea grounds of Farn Deep, Fladen Ground, and Moray Firth the ICES conclusion about stocks was that fishing mortality was below or near **F_{MSY}. This can be interpreted as the highest possible catch that can be maintained indefinitely.** The Firth of Forth harvest rate was above **F_{MSY}.** On the west Coast there are Nephrops fisheries in the North Minch, South Minch, the Clyde and the Sound of Jura and to a lesser extent at Stanton Bank. Over these areas stocks appear to be stable and fished around or below **F_{MSY}.** For 2013 ICES advised the following limits on landings Barreto and Bailey (2013)

[8] This section relies heavily on MS online material and in particular Barreto and Bailey (2013)

Functional Unit	Landings Limit (Tonnes)
Farn Deeps	1,400
Fladen	10,000
Firth of Forth	1,400
Moray Firth	950
North Minch	4,200
South Minch	5,800
Clyde	5,600
Sound of Jura	800

2.2.2 Scallops

Two species of scallop are commercially exploited in Scottish waters; the larger king scallop and the smaller queen scallop.

In UK waters King Scallops (Pectin Maximus) king scallops become sexually mature at approximately 2-3 years old and 80-90 mm in shell length, but may live for over 20 years and grow to over 200 mm in undisturbed populations. (Tang 1941) They normally live buried within seabed sediment and in adulthood are relatively static and after settlement have predictable patterns of distribution. Over 95% of all king scallops landed in the UK are caught by “Newhaven” scallop dredges (Barreto and Bailey 2013). Newhaven dredges have a spring-loaded bar of 8-9 teeth, each up to 11 cm long designed to rake scallops out from the sediment and into a dredge net. The teeth on Newhaven dredge penetrate anywhere between 3-10 cm into the seabed with the spring-loaded bar flexing backwards to prevent snagging. The dredge net itself is made from steel rings to prevent damage to the net from the abrasive contact with the sea bed. Dredges are typically towed in gangs suspended from a towing bar which is fitted with rubber wheels designed to roll along the seabed Vessels can tow anywhere between 2 and 22 dredges on each side (Howarth and Stewart 2014).

According to Cappell et al (2013), there are 153 vessels with scallop licence entitlements but the active scallop fleet is around 100 vessels. The active fleet comprises two segments with smaller (generally <15 m) vessels exploiting inshore waters and larger vessels (20 m + length) exploiting inshore and offshore grounds around the UK.

King Scallops are also caught by hand divers with hand caught scallops commanding higher prices. Hand diving for scallops does not damage the scallop and does not have the benthic impact of dredges. Scallop divers can be more selective leaving smaller scallops to be harvested when they have reached the size preferred by the market. Commercial hand diving in Scotland involves around 40 to 50 full time divers (Cappell et al 2013)

Current EU legislation specifies a minimum landing size of 100 mm length, except in the Irish Sea where the limit is 110 mm. But there are no limits on landings in the form of TACs or quotas. In Scotland, additional management measures specific to the scallop fishery have been introduced.

- In 1999, a restricted scallop licensing scheme was introduced in response to concerns about the expansion of scallop fishing effort.
- In 2003 gear restrictions were introduced that vary according to where fishing takes place:
    - A maximum of 8 dredges per side can be towed in Scottish inshore waters (out to 6 nautical miles);
    - a maximum of 10 per side in any other part of the UK territorial sea adjacent to Scotland (out to 12 nautical miles);
    - 14 per side in any other part of the Scottish zone (out to 200 nautical miles).
    - The use of "French" dredges (a design incorporating water deflecting plates and rigid fixed teeth) is prohibited in Scottish inshore waters.

The main scallop assessment areas are: West of Kintyre, North West, Shetland and North East.

To the west of Scotland, Spewing Stock Biomass (SSB) has declined markedly in the last ten years. Estimates of fishing mortality for the west of Kintyre assessment area are high. The ICES advice is for a reduction in fishing mortality. Measures to increase spawning stock biomass should be considered for both the west of Kintyre and the North West assessment areas. These might include; limits on kilowatt-days or fleet size, spatial and temporal closures or limits on the quantity landed, either alone or in combination. ICES do recommend an increase in the minimum landing size for Scottish fisheries because the survival of discarded scallops is high and therefore most undersized scallops returned to the sea have the potential to grow. An increase in minimum landing size should increase the reproductive capacity of the stock, provided that there is no associated increase in fishing effort.

In the North West assessment area fishing mortality has reduced but stock levels remain low. The ICES, advice is for no increase in fishing mortality. In the North East and Shetland SSB appears relatively stable in recent years and the ICES advice is for no increase in fishing mortality in these areas. Barreto and Bailey (2013)

The smaller Queen scallops (*Aequipecten opercularis*) are also commercially targeted in Scotland though their landings are much less valuable than king scallops. Queen scallops mature between 1-2 years old and approximately 40 mm in shell length, and rarely live for more than 5-6 years or grow to more than 90 mm (Vause et al. 2006).

Queen scallops tend to sit on the surface of the seabed, are much more mobile than King Scallops and can swim 2-10 metres to avoid predators. Different fishing gears are used to catch queen scallops since unlike king scallops, queens are not buried. “Skid dredges” are similar to the Newhaven dredge but have skids which run along the top of the seabed instead of rubber wheels used on tow bars on the Newhaven dredge. On a skid dredge, a “tickler” chain replaces the Newhaven tooth. Tickler chains disturb queens on the seafloor, causing them to swim upwards where they can be caught by the net.

Queen Scallops can also be fished with otter trawls where a net is dragged across the seabed, held open by two trawl doors in front of the net. The otter trawl also features a tickler chains on the bottom of the net to disturb queens resting on the sea bed. Skid dredges are more effective in rough / coarse sediment areas and skid trawls in sandy / muddy areas (Vause et al. 2007). It is believed that fishing for queen scallops causes less of a disturbance to the seabed than dredging for king scallops (Collie et al. 2000)

2.2.3 Brown Crab

The brown crab is found all around the Scottish coast from inshore areas to offshore waters to depths exceeding 100 m. It inhabits rocky reefs, mixed coarse grounds and soft sediments particularly on the offshore grounds. Adults can undertake extensive seasonal migrations. The brown crab creel fishery is long standing and economically significant across Scotland with landings increasing in recent years. From the mid 1980s technological advances allowed the fishery to expand to offshore areas to the west and north of Scotland. The majority are landed in the second half of the year and a large proportion are exported live to markets in Europe.

The fishery is not subject to EU TAC regulations or national quotas although there are EU measures in place to restrict the fishing effort (kw days) of all vessels > 15 m. (including creel boats) in ICES Subarea VI. Vessels landing brown crabs in Scotland are required to hold a licence with a shellfish entitlement. Without this entitlement, vessels can only land 25 crabs per day. The main regulatory mechanism is a minimum landing size of 140 mm to the north of 56 degree line and 130 mm to the south of the 56 line (except for the Firth of Forth).

ICES assessments for the period 2006-2008 showed that most brown crab assessment units in Scotland were fished close to or above $\mathbf{F_{MAX}}$, which is used as a proxy for $\mathbf{F_{MSY}}$ (-which can be interpreted as the highest possible catch (mortality) that can be maintained indefinitely). Fishing mortality was estimated to be significantly above $\mathbf{F_{MAX}}$ in the Clyde, South Minch and South East. In the Hebrides and Sule, fishing mortality was close to $\mathbf{F_{MAX}}$. In Shetland, Orkney, North Coast and East Coast, the fishing mortality for females was close to $\mathbf{F_{MAX}}$, while males were fished above $\mathbf{F_{MAX}}$. Thus in many areas, reduction in fishing effort would produce a higher yield of brown crab.

2.2.4 Velvet Crab

Velvets are fast moving and most commonly found on rocky substrates down to depths of about 25 m. They are caught in the inshore creel fishery along with lobster and brown crab. Very few fishermen fish solely for ‘velvets’ and it was once viewed as a pest species. The Scottish creel fishery expanded in the early 1980s to satisfy demand in southern European markets, eventually becoming the largest velvet crab fishery in Europe. Historically, the fishery was associated with the Hebrides, South Minch and Orkney, but since 2002 landings on the east coast have increased substantially.

The fishery is not subject to EU TAC regulations or national quotas. Vessels landing velvets in Scotland are required to hold a licence with a shellfish entitlement. Without this entitlement, vessels can only land 25 crabs per day. The main regulatory mechanism is a minimum landing size of 65 mm in all areas except Shetland (70 mm, under the Shetland Regulating Order

ICES assessments for the period 2006-2008 showed that most velvet crab assessment units in Scotland were being fished close to or above $\mathbf{F_{MAX}}$ Thus in some areas a higher yield could potentially be obtained by reducing the level of fishing effort.

2.2.5 Lobsters

The European lobster is found all around the coast of Scotland, typically on hard ground in relatively shallow waters and on the fringes of kelp beds. The majority of lobsters are caught in waters shallower than 30 m but they may be found as deep as 150 m. They do not undertake extensive migrations. There are important lobster creel fisheries in many areas around the Scottish coast.

Landings by Scottish vessels have increased substantially and in recent years, the majority of lobster landings have come from the South East, East Coast, Orkney, Hebrides, and South Minch.

The fishery is not subject to EU TAC regulations or national quotas. In Scotland, vessels landing lobsters are required to hold a licence with a shellfish entitlement. Without this entitlement, vessels can only land 5 lobsters per day. The main regulatory mechanism is a minimum landing size of 87 mm CL in all areas except Shetland (90 mm CL, under the Shetland regulating Order). There is a maximum landing size of 155 mm CL for females.

In most Scottish lobster fishery areas, ICES assessments for the period 2006-2008 show that mortality was close to or above $\mathbf{F_{MAX}}$. Thus in some areas a higher yield could potentially be obtained by reducing the level of fishing effort

2.3 Fishing Vessel Registration

With the exception of certain 10 m and under vessels, all commercial fishing vessels must be registered with the Registry of Shipping and Seamen (RSS). Vessel registration is renewable every five years. Registration is important because fishing vessel licences are only issued to vessels on the register. Also, any fishing vessel which has not held a fishing licence for at least 6 months may be removed from the register. RSS is therefore a potentially useful database.

2.4 Vessel Licensing

The fishing vessel licensing system is primarily a policy instrument which is used to control fishing effort so that fisheries management objectives can be met.

In the UK, a vessel that is registered with the Register of Shipping and Seamen is only allowed to fish commercially for sea fish and land its catch for profit, if it has the necessary licence to do so. The licence is crucial it authorises the Sea Areas in which a vessel can fish and the species of fish that can be targeted and landed. It is the mechanism of control that enables UK Fisheries Administrations to regulate fishing.

2.4.1 Licence categories[9]

There are some species which are prohibited and therefore cannot be fished by any UK vessel in any ICES Sea Area (e.g. salmon, migratory trout, big-eye tuna, bluefin tuna, angel sharks) Other species are unavailable in specific sea areas (e.g. Black Scabbardfish in Areas VIII, IX, X; Undulate Ray in VI, VII, VIII, IX).

Available fish stocks which can be fished are categorised as Category A (formerly “pressure stocks”), Category B (formerly non pressure stocks) or Category C (formerly “miscellaneous species”)

A species could be defined as a stock which in one Sea Area no UK vessel may fish (e.g. Whiting in Area VIII), a pressure stock in one Sea Area (Whiting in Area IV) and a non pressure stock in another area (Whiting in Area VIIa).

This categorisation of stocks provides the basis of licence categories, as follows:

- **Category A (formerly 'Pressure Stock') Licence**
  Authorises fishing vessels over 10 metres overall length to fish for all available stocks, including 'pressure stocks' and up to 500 tonnes per calendar year of combined 'pelagic species' stocks.
- **Category A (Pelagic) Licence**
  There are separate licences for pelagic trawlers, pelagic pursers and pelagic freezers
  with full fishing entitlement for all available Category A stocks, including demersal species and with the authority to fish for pelagic species stocks in excess of 500 tonnes per calendar year
- **Category A (10 Metre and Under) Licence**
  Authorises fishing vessels of 10 metres and under overall length to fish for all available (as for over 10m vessels) stocks
- **Category B (formerly 'Non-pressure Stock') Licence**
  Authorises fishing vessels over 10 metres overall length to fish for all available stocks, including 'non-pressure stocks' but excluding 'pressure stocks' (as previously defined)
- **Category C (formerly 'Miscellaneous Species') Licence**
  Authorises fishing vessels over 10 metres overall length to fish for all available stocks, except 'pressure stocks' and 'non-pressure stocks' (as previously defined)

2.4.2 Transfer and Use of Licences

- No new licences are issued
- To obtain a licence for the first time a new entrant would normally have to acquire the entitlement to licence a vessel from a current licence/entitlement holder.
- A licence entitlement becomes available when it is no longer attached to an active fishing vessel. The vessel might have been scrapped or sold without

[9] A Scottish Licensing Review Working Group is currently undertaking a review of the entire fishing vessel licensing scheme in Scotland.

the licence attached. This is commonly referred to as a 'hip pocket' entitlement.

- An entitlement can remain valid for up to 5 years but if not used by then to license a vessel, it is surrendered and lost forever[10].
- Licences are transferable between vessels, either by single licence transfer or by aggregation of two or more entitlements.
- 10 m & Under and Over 10 m groups are separate fleets for licensing purposes - no transfers of licences are permitted between these two groups.
- Only licence entitlements of the same type and category, within each group may be aggregated together for the overall authority to continue; if not, the resulting authority of the 'new' licence is downgraded to the lowest common level.
- Similarly all donor entitlements must have the same permission(s) for Beam Trawling and/or Scallop Dredging and/or Shellfishing, for these to be continued in the new licence.
- With limited exceptions (license vessels by means of single licence transfer are exempt from penalty on tonnage and kilowatts), all aggregations are subject to capacity penalties: Currently, a capacity penalty of 5% is paid on both the kilowatts and tonnage, in transactions involving the aggregation of two or more full licence entitlements (AFL7). When elements of kilowatts and/or tonnage from disaggregated licence entitlements (ALF19) are used to license a vessel by either single licence transfer or by aggregation, then a capacity penalty of 10% is payable on those elements. For licence transactions involving the use of both full and disaggregated entitlements, a capacity penalty rate of 5% is applied against both the kilowatts and tonnage of the full entitlement and a capacity penalty rate of 10% is applied against the elements of kilowatts and/or tonnage from the disaggregated entitlement(s).

In addition to specifying the Sea Areas and species, under the Quota System the licence can specify the amount of a species that may be caught.

2.5 Quota Management

In December each year the EU Council of Ministers sets "Total Allowable Catches" (TACs) for various fish stocks for the following year. The UK Government is the allocating authority for UK fish quotas. Since May 2012, there has been agreement (the 2012 Concordat) through which the UK Government initially apportions UK fish quotas among the 4 UK Fisheries Administrations (i.e. Scotland, England, Northern Ireland and Wales). The amount of quota that each Administration receives for each quota stock is calculated in general on the basis of the number of Fixed Quota Allocation (FQA) units on the fishing licences administered by each Administration. (There are FQA units for almost all quota stocks). Once the UK quotas are apportioned, it is up to each Administration to decide how they wish to allocate their quota. In relation to most quota stocks, these allocations are made by the Scottish Government (mostly to fish Producer Organisations) according to the FQA method

[10] The Scottish Licensing Review Working Group is SLRWG is considering extending this to 10 years.

but, subject to consultation, the Scottish Government may (and indeed has) departed from this methodology where, for instance, it has allocated an increased share of the Scottish quota (e.g. North Sea cod) to the Scottish inshore fleet. Under current quota management arrangements, quotas are shared out, to the following three groups:

2.5.1 Individual Fish Producers Organisations (POs)

POs manage quota for the vessels in their group. The POs are collectively described sometimes as "the Sector". If the vessel is fishing within a PO, the fishing vessel licence will list the stocks which the vessel is prohibited from retaining on board or landing. Individual vessels are allocated quota by their PO for the stocks they are allowed to catch. Allocation is usually based on the PO member vessels' Fixed Quota Allocation (FQA) units. POs seek to allocate their total fish quota according to the needs of their member vessels and take action to ensure that quotas are not overfished.

2.5.2 10 Metre and Under Non-Producer Organisation Group,

This comprises those vessels of 10 metres and under overall length, which are not fishing against quota allocations managed by POs but are managed centrally within a “pool” by quota managers in Marine Scotland in consultation with relevant industry interests. If the vessel is fishing against "pool" allocations for the 10 m and Under Non-PO group, the uptake for those stocks (primarily Nephrops, NS cod and mackerel in Scotland) are subject to either weekly (in the case of mackerel) monthly or, in the case of nephrops, quarterly catch limits. These will be shown in the licence, along with those stocks which all 10 metre and under vessels (not in a PO), are prohibited from retaining on board or landing.

2.5.3 The "Non-Sector"

This group comprising all vessels Over 10 m overall length, which are not fishing against quota allocations managed by POs but are managed centrally within a “pool” by quota managers in Marine Scotland in consultation with relevant industry interests. The Monthly Catch Limits will be shown on the licence, along with all stocks which all non-sector vessels are prohibited from landing. Vessels in these groups fish against catch limits set by the Government. These limits may be monthly or three monthly and are enforced in fishing licences.

2.5.4 FQAs and Marine Scotland

Quota (tonnes of fish) can be transferred or swapped between POs during the course of the quota year (1 Jan to 31 Dec). Thus if one PO is under fishing a stock against its quota it can swap with another PO which might be overfishing that stock. In addition vessel owners are allowed to separate FQA units from licences when undertaking vessel licensing transactions. Effectively, they can sell their quota entitlement to other licence holders. Against that background MS plays the following roles in managing quota and FQAs within Scotland:

- Maintains an overview of quota uptake by Scottish POs and has a regular dialogue with Scottish POs during the quota year;
- Directly manages the “pool” quotas allocated to the Scottish non-sector and 10 metre and under groups;

- Approves in-year quota swaps between POs and undertakes quota swaps on behalf of the Scottish non-sector and 10 metre and under groups;
- Processes international quota swaps;
- Facilitates the transfer of fixed quota allocation (FQA) units between licences (since 30 June 2014, through the on-line FQA Register – a publicly-accessible register of FQA holdings in the UK first launched in December 2013);
- Where necessary, closes specific fisheries to POs and the non-sector and 10 metre and under groups when their quota allocations are exhausted in order to ensure no overfishing at both a PO and, ultimately, UK level.

2.6 Managing Effort

Whilst technical measures and rebuilding plans for stocks, such as cod, are decided at the EU level, member states can decide how their fishing vessels are regulated with, as long as the EU legislation is not violated. As part of the EU Cod Recovery Plan, the Scottish Government's scheme for managing fishing effort ('days at sea') is called the Conservation Credits Scheme (CCS). The purpose of the scheme is ensure stocks of valuable whitefish in Scottish waters, particularly cod, are able to recover to sustainable levels. The CCS allocates limited fishing time to vessels that use particular types of fishing gear (principally, trawls for whitefish and Nephrops) and rewards them with additional time in return for the adoption of conservation minded fishing practices.

Under the effort management scheme, if a vessel is 10 metres or greater, is eligible for an allocation of days to be spent in the Cod Recovery Zone (CRZ), has an appropriate fishing vessel licence etc and wishes to be in the CRZ, carrying regulated gear, an application must be made for an allocation of days at sea. Regulated fishing gears are: demersal trawls (except beam trawls) with mesh size of 70 to 99 mm; demersal trawls (except beam trawls) with mesh size of 16 to 32 mm; beam trawls; trammel nets; and long-lines.

The table below which is the basic allocation of days for 2013-14, provides some indication of the level of detail embedded in the CCS[11].

[11] http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/2013

Table 2.6. Basic Allocation of Days for 2013-14

Gear category	Description	Number of days
TR1	Whitefish demersal trawls – equal to or greater than 100 mm	90
TR1	Supplementary Under 5 per cent cod catch allocation*	50
TR2	*Nephrops* demersal trawls – equal to or larger than 70 mm and less than 100 mm	North Sea – 130; West of Scotland – 110; Irish Sea – 75
TR3	Demersal trawls, Seines of mesh size equal to or larger than 16mm and less than 32mm	228
BT1	Beam trawls of mesh size of 120mm or greater	152
BT2	Beam trawls of mesh size equal to or larger than 80mm and less than 120mm	152
GN1	Gill nets and entangling nets, excluding trammel nets	140
GT1	Trammel nets	140
LL1	Longlines	172

Vessels measuring less than 10 metres and those using only unregulated fishing gear, are exempt from the effort management scheme and therefore, need not apply for days at sea. Unregulated fishing gear types include pots and creels, which are used mainly to target prawns, crabs and lobster.

Vessels may transfer days to other vessels, but there are detailed restrictions. There are also restrictions that apply in transferring days to and from Scotland. Transfers must, in the first instance be sought within Scotland. Thereafter, transfers of days at sea that involve vessels administered by another UK Fisheries Administration (FA) will be subject to exceptional controls. A vessel administered by Marine Scotland that wishes to apply to transfer days at sea to a vessel administered by another UK FA must make that application to Marine Scotland. A vessel seeking to transfer in days from a vessel administered by another UK FA must first seek confirmation from Marine Scotland that the proposed transfer conforms to the Conservation Credits Scheme rules and any exceptional controls imposed on inter-FA transfers.

The result of effort management is that vessels are now more constrained in where they can choose to fish and the gear they can use. In effect the licence category dictates the stock they can fish (i.e. which species they can fish in specific locations). Depending on the stock they fish, the FQA determines the amount they can land and their "days at sea" allocation determines how many days they can use particular gear in specific areas. An individual vessel's track record was an important determinant of its FQA and days at sea allocation.

2.7 Recording Scottish Landings:

There are two recording systems, the logbook system for vessels over 12 m and the weekly reports submitted by under 10 m vessels landing lobster, crabs and Nephrops.

2.7.1 Logbooks and the Electronic Recoding System (ERS)

Council Regulation 1224/2009 requires fishing vessels to record and report landed catch data electronically. This began in January 2010 for vessels of 24 metres and greater length and the rest of the fleet is following until every vessel of more than 12 m is covered. All EU registered vessels are obligated to have electronic logbooks. Scottish vessels operating in distant waters are expected to comply with this requirement and arrangements have to be made to have an electronic logbook system fitted as soon as practicable. Marine Scotland is considering extending the replacement of paper logbooks with electronic reporting to the 10-12 metre sector. The logbooks also provide details of the buyer of the catch (see registration of buyers below)

2.7.2 Under 10 m vessels landing shellfish

With respect to Nephrops, it is a condition in the 10 m & Under licence which requires vessel owners to complete the FISH1 form recording all landings of Nephrops over 12 kg. These returns are required to be submitted on a weekly basis to the Fishery Office at which the vessel is administered.

It is also a condition in the 10 m & under licence requiring owners of vessels with a shellfish entitlement to complete FISH1 form all landings of lobsters and crabs and submit on a weekly basis to the Fishery Office at which the vessel is administered. Licensed vessel owners who do not hold the Shellfish Entitlement are allowed to land up to 5 lobsters and 25 crabs per day.

The FISH! forms identify the buyer of the landing and enables cross checking between landings and sales as provided through the Register of Buyers and Sellers (see below)

2.8 Registration of Buyers and sellers

In addition to vessel operators catch recording registered buyers and sellers, who are responsible for the first marketing of fishery products and have an annual financial turnover in first sales of fishery products of €200,000 or more, are required to record and report sales data electronically. Marine Scotland has a system to facilitate the delivery of electronic sales notes.

2.9 Recording Effort: The Vessel Monitoring System (VMS),

VMS is a form of satellite tracking using transmitters on board fishing vessels and is a legal requirement for all vessels which exceed 15 m overall length. This is now being rolled out to 12-15 m fleet. VMS consists of a GPS receiver which plots the position of the vessel and a communications device which reports the position at a minimum of every two hours. VMS automatically sends; the vessel identification, geographical position, date/time of fixing of position, course and speed.

Each member state monitors the VMS data of their flag fishing vessels wherever they may be and fishing vessels within their waters. Marine Scotland is responsible for all Scottish based vessels anywhere in the world and for non-UK vessels operating in waters within Scottish jurisdiction.

Vessel masters must ensure VMS is working and are only allowed to power down when in port. Vessel on guard ship or non-fishing duties must continue to report as normal. However, they can request dispensation to turn off VMS.

By itself, VMS does not provide any detail of catch, however through the vessel identification MS is able to link with the vessels landing declarations.

3 THE POLICY OPTIONS AND THEIR ECONOMIC EVALUATION

The fish stocks in Scottish waters are a national resource and need to be managed with the interests of all stakeholders in mind. Given this, policy options such as the proposed 0-1 NM or 0-3 NM mobile gear prohibition have to be evaluated in terms of their impact on the public and not just the commercial fishing sector. Indeed, a failure by policy makers to embrace the interests of all groups would lead to public concern that “their” resources are improperly managed.

Resource managers tasked with delivering best value for society need to concentrate on ensuring that we produce less of the things society does not want and more of the things it does. Given this focus, it is equally important that Scotland’s marine resource managers accept that society’s wants are broader than just physical items which they might buy in the market place. The public’s wants do of course include items, such as fish, which have market prices, but also includes other things the inshore marine environment provides, but which have no market price such as sea angling, diving and marine wildlife observation. Society’s wants also include some benefit flows that arise in even in the absence of any direct use. An example would be the benefit that many individuals derive from simply knowing that the inshore marine environment is diverse and resilient and is not being compromised by damaging activities.

Being inclusive therefore means having to accept that inshore fisheries policy affects the wellbeing of very different stakeholders, often in multidimensional and complex ways. For commercial fishermen, the primary concerns are probably their own future income and continued employment, the value of their licences and preservation of fishing opportunities for family members. Members of the public who have altruistic concerns for the environment would focus on the impact of policy on the diversity and resilience of the inshore ecosystem. Sea anglers and divers would worry about the impact of fisheries policy on the quality of their angling and diving experience, whilst hoteliers and tourism businesses would consider whether policy measures would enhance the attractiveness of the local area to visitors.

Given this stakeholder heterogeneity and an explicit requirement to manage resources on behalf of the public, a coherent economic evaluation must embrace the interests of all these stakeholders, despite the inherent complexity of the task. The remainder of this Section explains the basis of the 0-1 NM and the 0-3 NM restrictions on mobile gear and how economic evaluations capture the public interest.

3.1 The Policy Options: Background

Most fisheries need to be managed to prevent excessive effort developing. Overcapacity in fisheries arises because fishermen will seek to enter fisheries which are profitable. These new entrants drive up existing operators’ costs of catching fish because the new effort reduces their catch per unit of effort. Whilst it is rational for the individual to enter the fishery, the unfortunate consequence is that effort levels only stabilise when profit is competed away and entry is no longer an attractive prospect. At which point, a significantly diminished and vulnerable biomass is being exploited by excessive amounts of fishing effort. Correcting this problem often involves reducing fishing effort. This could mean labour and vessels lying idle for an uncertain period of time until the fishery hopefully recovers.

It is possible that some gear types are so inefficient that their impact on the biomass is not really a cause for concern. In discussion with fishermen, this argument has been advanced with reference to hand diving for scallops, and for static gears targeting Nephrops, crabs and lobsters. Whilst this seems a reasonable proposition for dived scallops, we know of no direct evidence to support this assertion. On the other hand, some (e.g. Beukers-Stewart et al. 2005) express concerns about the potential impact of dive fisheries on scallop stocks because they concentrate on the largest, most valuable scallops. This is a concern because larger scallops contribute disproportionally to recruitment by producing considerably greater quantities of eggs than do smaller scallops.

A reasonable starting position is to believe that there is nothing innate about creeling, dredging and trawling for shellfish which would suggest that these fisheries would be somehow immune from the endemic overfishing problem. It is therefore probably the case that they all should be managed to prevent over capacity developing. Fortunately, as described in the previous section, in Scotland there is presently a range of measure such as licensing and highly specific technical measures which mean that there are some constraints on the further expansion of fishing effort.

Although there are controls on fishing effort, it is appropriate to consider whether the existing (constrained) levels of shellfish effort are excessive. This might arise if historically fishing effort was excessive. The review of ICES shellfish advice by Barreto and Bailey (2013), presents a mixed picture. As outlined in the previous Section, with respect to lobsters, brown crabs and velvet crabs the ICES advice is that effort levels are above $\mathbf{F_{MAX}}$. With respect to scallops, the ICES advice is that some areas need to reduce fishing effort, whilst in remaining areas there should be no further increase in fishing effort. In the case of Nephrops, effort levels in the Firth of Forth area are probably excessive, whilst effort levels are probably around or below $\mathbf{F_{MAX}}$ in the Clyde area North Minch, South Minch, Staton Bank and Sound of Jura. Effort levels are not excessive in the Farn Deep, Fladen Ground, Moray Firth, Farn Deep, Fladen Ground, and Moray Firth.

In those fisheries where fishing effort is above $\mathbf{F_{MAX}}$, the implication is that yields might increase if we decreased fishing mortality by reducing fishing effort. Thus reducing costs (by reducing effort) possibly results in an increase in revenue. It would seem that in some shellfishing areas we might have already reached the position where additional vessels are adding more to costs (their costs and the costs they impose on fellow operators) than they are adding to revenue.

In addition to decreasing the catch per unit of effort of other operators, shell fishermen can impact on each other through gear conflict. Irrespective of whether the contact between gears is intended or accidental, it results in a cost to those involved. It would appear that almost all gears types experience some kind conflict. From our survey of gear conflict (see Section 16) there is conflict between mobile and static gears, and between static gears types, though conflict between mobile gear types is quite rare. Thus in some locations and for some gear types, the gear conflict costs that operators impose on fellow operators should perhaps be considered.

In the context of this study, we have defined gear conflict as physical contact between gears. This is quite a restrictive definition because it excludes the costs associated with the avoidance of gear conflict. Thus mobile operators may have to regularly change their towing plans because of the presence of static gear. Similarly in shooting their gear, static operators may avoid locations where there is a higher probability of entanglement, accidental or otherwise, with other static or mobile gear. There is therefore a territorial congestion cost that should perhaps also be recognised.

Thus, even before we consider the impact of Scotland's inshore shellfish fishery on other stakeholders, there are some inshore fishery areas where perhaps some shellfishing effort should be reduced. The case for reducing effort levels become stronger once we factor in the benefits that other stakeholder groups might derive from these reductions in fishing mortality. Also, as discussed below, when other stakeholders are included, we might change our view of the Nephrop fishing effort in those areas where fishing effort is currently below $\mathbf{F_{MAX}}$.

3.2 The Impact on Other Stakeholders

The impact on other stakeholders is best considered in two stages: the first is the physical impact of fishing for Nephrops and scallops; the second is the anthropogenic consequences. It should be stressed that this discussion, particularly about the first stage, is not seeking to provide a comprehensive review of the literature, or a mapping of the actual physical impacts. The purpose of the discussion is to enable an understanding of the causal chain linking changes in the catching sector to the eventual impacts on other stakeholders. Given the policy options under consideration (0-1 NM and 0-3 NM), the implicit focus of discussion is the 0-3 NM area, which for the purpose of this document we shall term the "near-shore." For the purpose of this document the "inshore" is defined as 0-6 NM area.

3.2.1 The Physical Impact[12]

Of all fishing gears, Howarth & Stewart, (2014) identified king scallop dredges as the most damaging to benthic communities and seafloor habitats. This is because the dredge apparatus drags along the sea bed with the dredge teeth penetrating the seafloor. In addition, fishers tend to perform repeated tows within the same area, thereby exacerbating any impacts they have on marine ecosystems (Dare et al. 1993). Howarth and Stewart state that the use of scallop dredges causes considerable physical impacts to the seabed which cause homogenisation of the sea bed, re-suspension of sediments, and alteration of the nutrient cycle. These impacts vary with seabed type. For example, scallop dredging's impact will be less significant

[12] Two of the studies cited in this section (Ryan and Bailey 2012 and Howarth & Stewart 2014) were commissioned by the Sustainable Inshore Fisheries Trust (SIFT) which believes that the use of mobile demersal gear in near shore areas should be curtailed. Whilst SIFT is not disinterested in the conclusions of these studies, the authors are acknowledged academic experts with their professional reputations dependent on their capacity for objective scientific enquiry.

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in high energy environments where there is on-going natural seabed disturbance. Howarth and Stewart also state that dredging can impact on mobile species through by-catch, the majority of which is discarded damaged, dying or dead. Dredging can also cause considerable levels of damage and mortality to organisms which are impacted but left uncaught on the seabed. Damage increases with the number of dredge tows performed. Howarth & Stewart (2014) conclude that there is an urgent need for better management of scallop fisheries in the UK. They present case studies where the setting aside of different areas for different fisheries has proved a successful management strategy generating unexpected conservation benefits as well as reducing gear conflicts.

The combination of dredge damage to habitat and benthic organism mortality reduces an area's capacity to support biodiversity. This can negatively impacts on local and regional commercial fishing for other species, including other shellfish and demersal fish stocks.

With respect to Nephrops trawls, in a study of catch and discard composition from Nephrops trawls in the Clyde Sea area, Bergmann et al (2002) concluded that Nephrop otter-trawls generate large amounts of unwanted by-catch. They estimated that Nephrops constituted only between 14% and 23% of the total catch volume; other invertebrates and fish accounted for the remainder of the trawl catch. On average, 9 kg of discards were produced per kilogram of Nephrops. Crustaceans and echinoderms accounted for up to 83% and 73% of the discards, respectively.

Similarly, Stratoudakis et al (2001) estimated that 36 tonnes of fish were discarded on 106 nephrop fishing trips observed over sixty research visits to the Clyde during 1998. On average, about 60 % by weight of the fish by-catch was discarded per trip. Around twenty species were usually discarded per visit. The total weight of fish discards produced in the Clyde Sea Area by the Nephrops fleet in 1997 was estimated to be at least 25000 tons (Wieczorek et al. 1999). Given a nephrops catches of between 3000 and 4000 tons in 1997, tons of fish were being discarded for each ton of nephrops. Whilst not necessarily indicative of current levels of discards, they do provide insight into the relationship between nephrop landings and discards that previously existed.

In contrast Combes and Lart (2007) report that, in 2006, discards were only 38% of the total weight of catch nephrops catch. There is a clear discrepancy between this study and earlier work cited above. This might be explained by a decreased abundance of by catch species, which itself might be a consequence of the previously much higher ratio of discards to nephrops landed. If so, provided that the changes are reversible, the discrepancy might be indicative of the benefits that might be realised from future management of mobile effort. However, the discrepancy might be explained by the use of more selective gear, or slower towing speeds or increased abundance of nephrops.

Marine Scotland provided discard data which was more recent, though unlike the studies above these data were not restricted to inshore areas.

Table 3.2.1 North Sea and West Coast Landed and Discarded Fish by TR2 Vessels[13] (2013)

	North Sea				West Coast			
	Discard Weight	**Landed Weight**	**Discard as %of Landed**	**Discard Number**	**Discard Weight**	**Landed Weight**	**Discard as %of Landed**	**Discard Number**
Cod	330	76	44.1%	1,337,907	337	337	6584.3%	2,537,828
Haddock	65	1017	6.4%	270,284	820	105	783.1%	8,426,288
Whiting	676	967	69.9%	4,414,085	831	13	6630.8%	16,465,277
Saithe	29	331	8.8%	6,988	3	7	40.6%	6,988
Monkfish	10	394	2.5%	66,703	42	40	104.7%	36,786
Megrim	2	8	26.1%	5,145	1	10	10.2%	3,562
Hake	192	26	733.3%	541,029	348	15	2358.2%	1,933,862
Total	1,304.00	2,819	46.3%	6,642,141	2,382	527.00	452%	29,410,591

Source: Personal Communication, Marine Scotland.

Some of the fish discarded will be fish for which the vessel does not have quota. The Table below combines the data for the North Sea and the West Coast and calculates the average weight of the discards. From the table below, it is clear that many millions of small fish are not managing to egress through the trawls escape panels

[13] Nephrops demersal trawls: demersal trawls, seines or similar towed gears, except beam trawls, of mesh size between 70 and 99mm.

Table 3.2.2 Scottish Recorded Landed and Discarded Fish by TR2 Vessels (2013)

	Total Discard Weight	Total Discard Number	Average Weight (Grams)
Cod	667	3,875,735	17.2
Haddock	885	8,696,572	10.2
Whiting	1507	20,879,362	7.2
Saithe	32	13,976	229.0
Monkfish	52	103,489	50.2
Megrim	3	8,707	34.5
Hake	540	2,474,891	21.8
Total	3686	36,052,732	10.2

The table below is extracted from Pastoors (2014) and shows the landings and discards from Scottish vessels using TR2 (Nephrop) trawling gear in the North Sea from 2010 to 2012

Table 3.2.3 North Sea landings and discard: Scottish vessels using TR2 (Nephrop) gear

	2010			2011			2012		
	Landing	**Discard**	**%**	**Landing**	**Discard**	**%**	**Landing**	**Discard**	**%**
Nephrop	15230	0	0.0%	10764	0	0.0%	7741	0	0.0%
Cod	418	979	70.1%	237	912	79.4%	174	996	85.1%
Haddock	2335	4841	67.5%	1876	4678	71.4%	1665	1981	54.3%
Whiting	1251	2742	68.7%	1621	2723	62.7%	1401	1353	49.1%
Plaice	218	52	19.3%	255	131	33.9%	188	85	31.1%
Saithe	201	106	34.5%	217	815	79.0%	141	33	19.0%
Hake	82	1	1.2%	70	0	0.0%	31	58	65.2%
Angler Fish	1139	0	0.0%	862	0	0.0%	572	0	0.0%
Ling	114	1	0.9%	73	0	0.0%	48	0	0.0%
Lemon Sole	206	34	14.2%	240	26	9.8%	158	54	25.5%

Source Pastoors M (2014)

From Scottish Fisheries Statistics we obtained total Scottish landings and subsequently West Coast landings of Nephrops. Our own benchmarking tables in Section 8 below provide estimates of total nephrops catches within 12 NM, 6 NM, 3 NM and 1 NM. It is important to note that the level of nephrop fishing activity inside the 12 NM zone is much larger on the West Coast compared to the North Sea. Assuming that the number of discards is linearly related to nephrop catches we estimated the spatial distribution of the number of fin fish discarded by nephrops trawlers across Scotland[14]. This is shown in the Tables below.

[14] In reality the relationship between catches and discards will vary from location to location with differences in variables such as gear used, speed of towing, sea bed topography, vessel size and the stock abundance of nephrops and discarded species

Table 3.2.4 Estimated Fish Discards by Nephrop Trawlers within 1 NM (number of fish)

	Cod	Haddock	Whiting	Saithe	Monkfish	Megrim	Hake
South West	257,797	855,957	1,672,571	710	3,737	362	196,445
North West	115,578	383,750	749,862	318	1,675	162	88,072
Outer Hebrides	39,679	131,746	257,437	109	575	56	30,236
West Coast	413,054	1,371,453	2,679,870	1,137	5,987	580	314,753
MF & NC	32,822	206,718	403,934	171	902	87	47,442
Orkney	3,848	24,234	47,354	20	106	10	5,562
East Coast	36,959	232,771	454,844	193	1,016	98	53,422
Shet'nd	86	539	1,054	0	2	0	124
North Sea	73,714	464,262	907,185	385	2,027	196	106,550
Total	486,768	1,835,715	3,587,055	1,522	8,014	776	421,303

Table 3.2.5 Estimated Fish Discards by Nephrop Trawlers within 3 NM (number of fish)

	Cod	Haddock	Whiting	Saithe	Monkfish	Megrim	Hake
South West	537,772	1,785,552	3,489,034	1,481	7,795	755	409,790
North West	274,845	912,560	1,783,175	757	3,984	386	209,436
Outer Hebrides	79,482	263,903	515,676	219	1,152	112	60,567
West Coast	892,099	2,962,014	5,787,884	2,456	12,931	1,252	679,792
MF & NC	67,289	13,594	222,003	351	3,355	259	27,211
Orkney	5,786	1,169	19,088	30	288	22	2,340
East Coast	91,624	18,510	302,291	479	4,568	352	37,051
Shet'nd	607	123	2,002	3	30	2	245
North Sea	165,306	33,395	545,384	863	8,242	636	66,847
Total	1,057,404	2,995,409	6,333,268	3,320	21,173	1,888	746,639

What is noticeable is the number of small, high value species such as Cod and Haddock that potentially being discarded by Nephrop trawling within the 1nm and 3nm zones.

3.2.1.1 Comparing the Physical Impact of Gear Types

All forms of fishing are damaging and creels may also impact on the sea bed. However, it is not unreasonable to suggest that, compared with using creels and pots, the dragging of gear across the sea bed would appear to have a greater physical impact on the sea bed. With respect to discards, compared with mobile gear, it is reasonable to suggest that ratio of discards to landed shellfish would be less for creel operators and hand divers. This is because mobile organisms largely self select to enter a creel or pot whereas mobile gear is less discriminatory. Also, smaller individuals can more easily egress from a creel whilst on the seabed or during hauling, whereas a bigger proportion of non-target species caught by trawls or dredges can have their egress prevented through entanglement with other organic and inorganic matter in the net. Even with escape panels the TR2 Nephrops gear may still capture significant numbers of small fish (see tables above).

There may also be differences in discard survival rates with a higher proportion of mobile caught discards being returned dead or dying. This is because with mobile gear there is a greater opportunity for injury during towing and hauling and a longer time lag between being landed on deck and being returned to the sea. Finally, static gear probably causes less mortality by impacting with organisms and leaving them uncaught on the seabed. On the other hand ghost fishing is possibly a more significant issue with static gear since more static gear becomes lost, discarded and abandoned but continues to ensnare fish and shellfish.

The implication is that whilst all gear is damaging, per kg of nephrops or scallops landed, mobile gear has a greater physical impact on habitat, produces more by-catch, more discards and causes greater reductions in geodiveristy, biodiversity and the biomass of benthic species. In some inshore areas, especially nursery areas, there could be negative consequences for other species, particularly demersals, some of which might be commercially harvested, or be important for recreational activities such as recreational sea angling, snorkelling and diving.

In personal communication with fishermen it has been argued that trawling and dredging has beneficial effects through the occasional turning over of the sea bed; in much the same way that ploughing agricultural land improves crop yields. The implication being that biomass might be reduced if restrictions are imposed on trawling and dredging.

We can find no supporting scientific evidence to support this hypothesis. However it should be noted that Denderen et al (2013) produced a theoretical model where under some specific circumstances trawling (but not dredging) removed large crustaceans and shellfish. This is fortunate for smaller, softer species in the sandy seabed, such as worms, flourish with fewer predators. These smaller species tend to be the main source of food for fish and the overall effect is more marine life. Theirs was a theoretical outcome which in their model only works under highly restrictive conditions.

The conclusion we draw is that all forms of fishing impact on the environment, but that demersal trawls and dredges have a bigger impact per kg of shellfish landed compared with static gears and hand diving.

3.2.2 The Anthropogenic Impacts

The impacts on other stakeholders arise because of undesirable environmental impacts such as reductions in geodiveristy, biodiversity, and the biomass of benthos species and other stocks including other shellfish and demersal species. These undesirable impacts might be greater if the areas being trawled and dredged are nursery areas.

There are four categories of stakeholders who might be adversely affected by commercial shellfishing, and who might benefit from decreased levels of fishing activity.

a) Other Commercial Fisheries.

Other commercial fisheries might experience decreased catches which can be traced back to the undesirable impact of fishing for nephrops and scallops, particularly in nursery areas.

b) Recreational Users.

Among marine recreation interests, there is probably a spectrum of sensitivity to changes is fish populations. At one end, there are sea anglers and, to a lesser extent, marine divers whose recreational experience involves direct interaction with fish stocks. Further along the spectrum there is bird watching and marine/coastal wildlife tours and charters whose sensitivity to changes in fish stocks operates through changes in fish predator populations such as sea birds and sea mammals. At the other end of the spectrum might be sea kayakers, sailors and informal visitors to coastal areas. For these groups a decreased probability of sightings dolphins, porpoise, minke whales, seals, sea eagles, puffins etc would detract from their experience.

With respect to the well-being of participants, it is axiomatically true that their well-being would to a greater or lesser decline with a reduction in the quality of their recreational experience. As the quality of the recreational experience declines so does activity levels and expenditure and this lowers the income and employment of those supplying services, such as equipment, accommodation, food and drink, charter vessels, transport etc. Reductions in marine recreational activity might have adverse consequences other sections of society (see Section 17 for a full discussion).

c) Informal Coastal Visitors.

Visitors probably prefer a diversity of on-going activity in the coastal communities they visit, including different types of commercial fishing, more divers, more anglers, more wildlife charter vessels etc. In the long run, excessive levels of trawling and dredging might mean that there is less diversity in coastal activity.

d) Non-Users / General Public.

There is a proportion of the general public who have an altruistic or vicarious concern for the well-being of natural assets both sentient and non-sentient. These concerns are independent of the actual use or direct contact with the marine environment. Such individuals are therefore not indifferent to adverse impacts on the marine environment and, other things being equal, would prefer that these impact were not occurring. This is often known as Existence Value. In this study it is termed **General Public Non-User Value (GPNUV)** (see Section 20 for a fuller discussion).

3.3 The Case for Evaluating the Policy Options

The two policy options were specified by MS and the following discussion attempts to re-create the basic argument for wanting to evaluate them. The issue here is not which option (if any) should be implemented, but the case for undertaking the evaluation in the first instance. The argument most probably rests on a suspicion that presently the flow of benefits from having mobile gear in the near shore is less than the resulting costs imposed on a range of stakeholders.

Before addressing these benefits and costs, it is appropriate to highlight the relative importance of the near shore areas. In Section 8, this study estimates that across Scotland shellfish worth £98.16 m was caught within 0-12 NM of the shore. Of this total, 38% was caught within 0-1 NM, 66% within 0-3NM and 86% within 0-6 NM. There is some variation around the coast. For example, in the South West IFG area, the near shore shellfish catch was a bigger proportion of the South West 0-12 NM shellfish catch. Compared with Scotland as a whole, in the East Coast IFG area the 3-6 NM zone was relatively more important in terms of the spatial distribution of the areas total shellfish catch.

As a generalisation we can say that the near shore constitutes around two thirds of the Scottish shellfish fishery within 0-12 NM. In terms of Scotland inshore fishery area (0-6 NM), the 0-3 NM zone accounts for 77% of the shellfish catch.

With respect to the current flows of benefits and costs from mobile gear fishing activity, the flow of theoretical benefits from near shore areas comprises:

Nephrops and scallops for consumption caught by mobile gear in the near shore areas

Income and employment on trawlers and dredgers dependent on near shore access

Income and employment on-shore dependent on employment trawlers and dredgers fishing the near shore areas.

As explained above the flow of costs from mobile gear fishing activity comprises:

Costs imposed on other Nephrop and scallop fishers, both static and mobile operators. This is because in near shore areas they catch the same target species and this drives down other fishers catch per unit of effort. In this context, it was explained above that in a few of Scotland's nephrop fisheries, effort is above $\mathbf{F_{MAX}}$. In these areas, yields and profit from the fishery might increase if fishing effort was reduced. Thus in a few areas, additional vessels might already be adding more to costs (their costs and the costs they impose on fellow operators) than they are adding to revenue.

Costs imposed on other shellfish operators (mobile and static) through gear conflict and territorial congestion in the near shore areas.

Costs arising from undesirable environmental impacts such as reductions in geodiveristy, biodiversity, and the biomass of benthos species and other fish stocks such as demersal species. As explained above there might be costs imposed on:

- Other Commercial Fisheries.
- Recreational Users.
- Informal Coastal Visitors.
- Non-Users / General Public.

In addition to the *a priori* considerations of costs and benefits there is some relevant historical experience.

Prior to the Inshore Fisheries (Scotland) Act 1984, inshore demersal trawling was effectively prohibited and scallop dredging effort in the near shore was a different order of magnitude. Rightly or wrongly, many stakeholders believe that much of the decline in inshore demersal stocks is a consequence of the post 1984 increase in trawling and dredging within 3 NM of the shore. There are three factors that underpin this belief.

First there is little doubt that inshore trawling and dredging inshore did increase. For example with respect to the Clyde, Ryan and Bailey (2012), state that the *"opening of the Clyde to towed gears was accompanied by gear improvements that opened previously unfished areas to trawling and dredging pressure. Approximately 83% of the Clyde is now subject to fishing pressure, with many heavily fished areas being trawled multiple times in a given year."*

Second, as discussed above, Nephrop trawls and scallop dredges have the potential to cause habitat damage and benthic organism mortality which could negatively impact on local and regional commercial and recreational fishing for other species. Ryan and Bailey (2012) explain that post 1984 increase in Nephrop trawling effort and scallop dredging would have damaged habitat. Depending on the nature of the sea bed, both mobile gear types can smooth the seafloor, destroy emergent epifauna, remove or bury plants, cause high mortality to maerl beds and thus may adversely affect the habitat for juvenile fish and crustaceans[15]. Ryan and Bailey argue that, with respect to the Clyde fishery area, these changes would compromise the area's role as a nursery for cod, herring, whiting, and scallops. In addition, the associated increased by-catch mortality of non-target fish species would also cause negative impacts on local demersal fish populations.

Third there is evidence of a notable decline in sea angling following the 1984 Act, the primary cause of which was believed to deteriorating quality of sea angling, as reflected in species diversity, weights of fish and specimen size. In 1988, the White Horse whisky sea angling shore competition produced a particularly poor return of shore caught cod[16]. In response to this and similar developments, the Scottish Tourist Board was concerned enough to write to all local tourist boards requesting information on sea angling. All boards reported adverse effects on sea angling related businesses (Radford et al, 2009). The Scottish Tourist Board also commissioned The Clyde Sea Angling Study (CSAS) which had both biological and economic objectives. The biological objectives were to assess the extent and cause of the decline in fish stocks. The economic objectives were to estimate the economic impact of the decline and the economic impacts associated with remedial policy initiatives. The CSAS concluded that the Clyde fish stocks declined as a result of the increased commercial fishing effort, much of which resulted directly from the 1984 Act (PIEDA Ltd, 1988).[17]

While it is plausible that the 1984 Act was significant, that there is no direct evidence to support an unequivocal conclusion that the 1984 Act was primarily responsible for the decline in inshore demersal stocks. For example, there is evidence that inshore demersal stocks were declining prior to 1984, and that other causal factors may have been significant. These would include eg climate change, fishing pressure further offshore, end of the 'gadoid outburst', changes to land management and water treatment practices etc.[18]

Taking all things into consideration, it is possible that potentially the current levels of trawling and dredging within the near shore might not always represent best value for society. This is because, in crude terms, each kilogram of Nephrops and scallops landed by mobile gear probably causes more ecosystem damage and imposes more costs on other stakeholders than the equivalent weight landed by creelers, potters and hand-divers.

A number of studies support this view. For example, Zeigler (2006) estimated that the entire Swedish west coast creel fishery affects the same seafloor area during

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[15] The impact is highly variable. Nephrop trawls towed over mud, or dredges used in high energy locations subject to high levels of natural disturbace, would be less damaging than dragging scallop dredges over maerl beds supporting diverse epifauna.

[16] This now defunct competition regularly attracted around 1,000 anglers fishing the shore from Saltcoats to Greenock.

[17] More recently, the recent review of the Scottish scallop fishery concluded that the near unanimous view of stakeholders was that effort in the fishery had expanded to unsustainable levels (Cappell et al. 2013). The Scottish government has recently suggested removing scallop fishing entitlements from boats which have not used them in the past 7 years to prevent the re-entry of latent scallop effort.

[18] Many alternative explanations can be advanced with varying degrees of plausibility. Occam's razor might be relevant in ranking alternatives.

one year as does one hour of trawling[19]. The same study provided the following comparative impacts for each Kg of Nephrops landed:

Table 3.3 Comparative Impact of Nephrops Trawling and Creeling

Impact per Kg of Nephrops	Trawling	Creeling
Diesel	9.0 litres	2.2 litres
Area of Sea Bed Swept	33,000m^2	1.8m^2
Undersized fish and Nephrop Mortality	4.5Kg	0.15Kg

Negative aspects of creel fisheries cited by Ziegler (2006) were: safety and working conditions onboard which in Sweden are better on the trawlers; a higher risk of ghost fishing and higher risk of recruitment overfishing because creels capture a higher proportion of berried females.

Not only do creels, pots and hand-divers appear to have less of an environmental impact, buyers are willing to pay more per kilogram for creel caught Nephrops. Creel caught Nephrops command a price differential premium of between 200% and 500% per kg[20]. This is because buyers will pay more for a kilogram of large Nephrops than a kilogram comprised of smaller Nephrops. They are also willing to pay more for a kilogram of live Nephrops than dead Nephrops. Nephrops landed by trawls have a higher proportion of smaller animals and the catch is generally sold dead and processed in the UK. Though more trawlers are now using tubes and landing live Nephrops. There is also a premium for hand-dived scallops.

Given both the higher value per kilogram, each £1 worth of Nephrops and scallops landed by creelers, and hand-divers probably causes less ecosystem damage and imposes fewer costs on other stakeholders than an equivalent £1 landed by mobile operators. If this is correct then a re-balancing Nephrop and scallop landings in favour of creelers, potters and hand divers might decrease the total costs which society endures as a consequence of landing each £'s worth of nephrops and scallops.

Whilst the re-balancing might reduce prices for creel or hand caught shellfish and increase prices for trawl or dredge caught, the price differential is unlikely to be eliminated[21]. Discussions with buyers indicated that the increased supply of Scottish creel caught live Nephrops is unlikely to significantly reduce Nephrop prices across fish markets in Spain, France, Italy and Portugal. Indeed, the current expansion into further afield high end markets such as in China is likely to help sustain current prices levels of live Nephrops[22].

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[19] In the process the Swedish west coast creel fishery caught 20% of the west coast catch.

[20] Personal communication with buyers. In addition, Marine Scotland have informed us that logbook data shows average 2010-2013 of 273% (£8,139 vs £2,985)

[21] The potential elimination of the differential should not be a reason for postponing the rebalancing of fishing effort. This is because, the elimination of the differential would be the consequence of producing more of the higher valued product and less of the lower valued. The elimination of the differential, were it to happen, would indicate that, other things being equal, the process had gone far enough.

[22] This discussion focuses on the NEV/CBA type evaluation. There are additional considerations when discussing impacts on income and employment. Whilst the static sector is more labour intensive per kilo of landings, the mobile sector's landings are subject to a higher degree of on-shore processing. Therefore rebalancing may not necessarily create more employment within the fishing

Support for rebalancing is provided by Leocadio et al (2012). They compared the financial viability of trawl and creel fisheries for Nephrops off the Portuguese coast, but did not include the differential environmental impacts. Despite smaller landings, the Nephrops creel fishery provides individuals of larger size and in better condition thereby obtaining higher prices per kg. Whilst trawlers provided 85% of the landings in weight, they only generated 74% in value.[23] In the South and South West Portuguese coast nephrops were subject to an intense fishing and Leocadio et al concluded that in these areas a rebalancing of effort between the creel and trawl fishery might be appropriate.

Given the discussion above, there would appear to be a case for evaluating management options directed at mobile gear in Scotland's near shore areas.

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sector, though there would be additional employment and income associated with sea angling and diving. These issues are discussed throught this report.

[23] Marine Scotlnad estimate that the Scotland equivalent (2010-2013) is 92% of landings weight generates 82% of value.

Types of Economic Evaluation

There are two kinds of economic evaluations that can be applied to the two policy options. Each type focuses on a slightly different aspect of the consequences for the public of restricting the use of mobile gear in the inshore area.

The two types of economic evaluations are the **Net Economic Value / Cost Benefit Analysis (NEV/CBA)** framework and **Economic Impact Assessment (EIA).**

Net Economic Value / Cost Benefit Analysis (NEV/CBA)

This kind of evaluation focuses on how, within a defined society, changes in resource use affects the wellbeing of individuals, as they themselves perceive their own well-being. The defined society is usually taken to mean the entire population of Scotland (or the UK). As well as the consequences for commercial fishing, a NEV/CBA assessment would seek to embrace effects of policy on fish consumers, anglers, divers and individuals who are concerned about conserving the Scottish inshore ecosystem.

Economic Impact Assessment (EIA)

The basis of an EIA is an underlying judgement that in evaluating fisheries policy "what matters" is the impact on household income and employment. In other words, the scope is much narrower that the NEV/CBS approach, with the primary focus the impact of inshore fisheries policy on household income in the form of wages, self-employment, rents and profits (the sum of these is known as Gross Value Added (GVA)) and/or employment (measured in Full Time Job Equivalents (FTEs)).

An EIA normally has to specify a geographical area, which might be an administrative region, or Scotland as a whole. An EIA would embrace the impacts on all income and employment of all stakeholders (not just the commercial fishing sector) within a geographical area. It should be noted that an EIA study whose geographical area was an IFG area would not necessarily provide insight into the economic impact for Scotland as a whole, because income and employment in the IFG area could be increasing at the expense of income and employment in other areas of Scotland.

These two types of economic evaluation are not mutually exclusive. This is because they both share a common aim of providing insights into how fishery management ultimately affects some dimension of the public's well-being.

Although not additive, taken together, the two approaches provide a rich insight into the effects of the proposed mobile gear inshore restriction on the wider public. Some of the effects of fisheries policy may not be measurable in money terms. Nevertheless, their description and articulation should help to ensure that decision makers understand and appreciate the diverse and complex values individuals and groups derive from the inshore marine environment. If these wider considerations are embraced, decision making will be seen by the public to be more legitimate and credible.

These two approaches are further explained in Sections 4 and 5.

Specifying the Underlying Change

It should also be appreciated that any economic assessment (NEV/CBA or EIA) must relate to some underlying change. For example, if one is assessing the *total* current income and employment (or *total* costs and benefits) associated with the *entire* inshore commercial fishery, one is asking the question, albeit implicitly, "how much income and employment (or costs and benefits) would be lost and what would be gained if the *entire* commercial fishery were to cease to exist." These types of studies can produce impressively high estimates. The closure of an entire fishery is a relatively unusual event and economic assessments of the entire flow of income and employment (or benefits and costs) should be similarly rare.

More commonly, an economic evaluation would normally relate to less dramatic changes. The proposed inshore 1 NM and 3 NM mobile gear restrictions are good examples. In these cases, only the *resulting change* in economic values is relevant. This is called the *marginal value.* Just because a particular commercial fishery currently generates a large total flow of income and employment (or surplus of benefits over costs) it does not mean that we should devote even more resources to it. It is the change in income and employment (or benefits and costs) that matter. For example, well intentioned subsidisation of profitable fisheries can simply hasten the process of stock decline and eventual migration of labour and capital[24]. Indeed some profitable fisheries can be made even more profitable if capacity reduction increases biomass and the sustainable catch per unit of effort of the remaining vessels.

The key point is that in undertaking an economic evaluation (EIA or NEV/CBA) there needs therefore to be a description of the change. The relevant comparison is between how the ecosystem would develop if there was no policy intervention (status quo trajectory) and what the inshore ecosystem would be like if mobile gear was removed from within 1 NM or 3 NM.

It is therefore necessary to make two judgements; one about the status quo and one about the impact of the policy intervention. Both are problematic because of the lack of knowledge about the causal chain linking trawling and dredging with biophysical functions and processes and anthropogenic impacts, as well as the feedback loops.

The discussion below about scenarios is necessarily general rather than specific. For example, regional variations are ignored. In some areas, such as complex and diverse ecosystems which may also be spawning and nursery areas, the damaging effects of trawls and dredges may be particularly severe. Thus, if the status quo trajectory is continued decline, the benefits from protecting and reversing this process will much greater than in other locations where mobile gear is causing less damage.

Status Quo Scenarios

[24] Heymans, S., Mackinson, S., Little, A., Sumaila, R. and Dyck, A. "The impact of subsidies on ecological sustainability and future profits from the North Sea fisheries" Scottish Association for Marine Science Report no 266.

With respect to the direction of travel implied by the status quo management scenario, one could speculate that, if trawling for Nephrops and dredging for scallops is allowed to continue fishing within 3 NM, there will an inexorable reduction in geodiversity, biodiversity, and the biomass of benthos species and fish stocks such as demersal species. Thus one scenario is continued decline.

On the other hand, one might argue that a stable equilibrium has now been reached because the near shore and inshore marine ecosystem has now fully adjusted to the increase in fishing effort. Moreover, further increases in fishing effort are precluded by a combination of the Cod Recovery Plan, the current licensing system, effort controls, gear controls and other measures. Thus, with this scenario, there is the prospect of a flow of ecosystem goods and services which, though less than the historic flow, will remain undiminished for the foreseeable future.

There is one further possible scenario which embraces the potential impact of the MPA network. It could be argued that the MPAs will result in restrictions on the use of mobile gear in near shore areas. In which case, there is a potential status quo scenario of improvement in the near shore which is driven by emerging MPA management plans.

It is appropriate to consider this further. The 30 MPAs announced will collectively cover an area of 62,500 Km^2. Of this, we estimate only 5,996 Km^2 (8.7%) is within Scottish territorial waters and 2.4% and 4.5% within 0-1 NM and 0-3 NM respectively.

The Table below presents estimates of the relative importance of MPA sites to each IFG. The East Coast IFG and Shetland are not impacted by MPA's within 3 NM.

Table 3.5. Relative Importance of MPA's to IFG Zones

	Areas of IFG Zones (Km^2)			Areas of MPA (Km^2)within IFG Zones			
IFG	**1nm**	**3nm**	**6nm**	**Within 1nm**	**% of 1 NM**	**Within 3 NM**	**% of 3 NM**
MF&NC	1339	2961	5316	106.3	8%	122.1	4%
North West	2796	5265	9976	713.9	26%	1266.6	24%
Orkney	1416	2991	4923	44.8	3%	48.3	2%
Outer Hebrides	2236	5315	13137	0.1	0%	438.8	8%
South West	4034	8537	17456	780.9	19%	1210.6	14%
Total	11,821	25,069	50,808	1646	14%	3086.4	12%

In the above table, the 3,086 Km^2 of MPA inside 0-3 NM is only 12% of the 0-3 NM zones of the IFGs[25]. It should also be recognised that the presumption of MPA's is that there will be continued use, and in some areas the additional restrictions on mobile gear may be minimal. This could be because the area is already protected from mobile gear and the MPA simply ratifies restrictions already in place, or an area is not currently exploited by mobile gear, or the feature being protected does not require mobile gear to be restricted. It is also the case that an MPA management plan could recommend mobile restriction, but only in sensitive locations and not over

[25] The East Coast and Shetland are not included. Their incluosn would reduce the percentage considerably

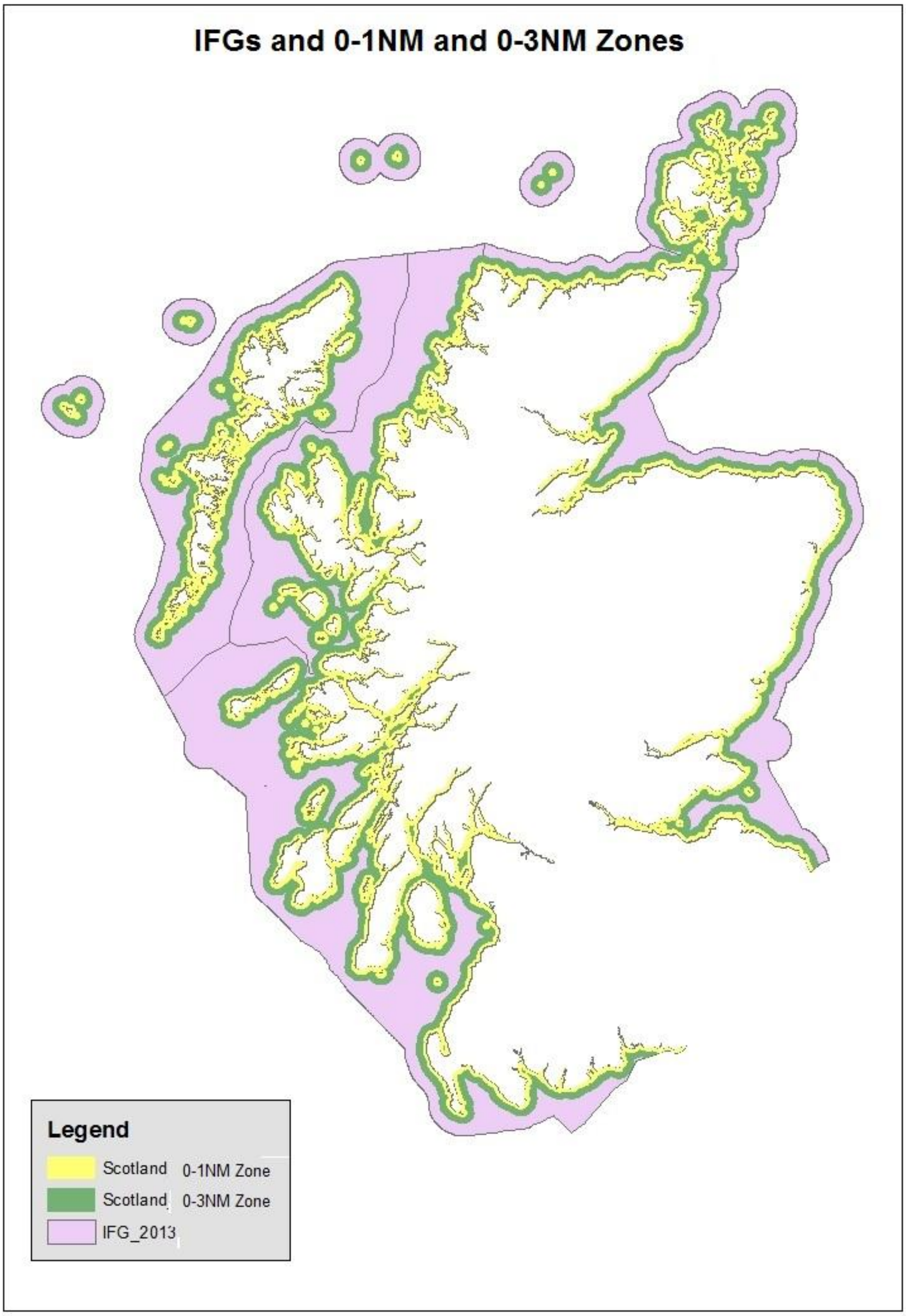
the whole MPA. Thus only a proportion of the 12% will have any implications for mobile gear use.

The South West is the area with the greatest area of MPA relative to the size of the 0-1 NM and 0-3 NM zones. The implications for mobile gear depend on the individual MPA. For example, in the South West, the MPA area, Clyde Sea Sill, already has mobile gear restrictions. The South Arran MPA Management Plan does not necessary mean that mobile gear will be restricted across the whole of the South Arran MPA.

Given the above considerations, this study is undertaking the evaluation against a background where there are only two general status quo scenarios; a diminishing flow and a stable flow of environmental goods and services. However, If MPA derived restrictions on mobile gear near shore areas are likely to significant for individual IFG areas these should be considered on a case by case basis.

Policy Impact Scenarios

The map below provides a visual representation of the IFG areas (0-6 NM) and the 0-1 NM (yellow zone) and the 0-3 NM zone (yellow and green areas) as provided by MS.



From inspection it can be seen that the IFG areas (0-6 NM), especially on the West Coast are more than double the area covered by the 0-3 NM zone. This is because the IFG boundaries provided by MS Scotland are based on straight lines linking points 6 NM from significant headlands. The 0-1 NM and 0-3 NM zones provided by MS are based on lines drawn 1NM and 3 NM from the coastline. These zones therefore hug the coastline capturing a proportionately smaller sea area[26].

There are a number of possible scenarios that could describe the impact of the above restrictions.

As explained above, this study takes the view that the interaction of trawls and dredges with the sea bed is unlikely to be beneficial and may often be damaging to a greater or lesser extent depending on the type of fishing activity and the characteristics of the benthic habitat. Consequently, it is likely that the environment would benefit from having less rather than more or this activity. Thus, compared to any status quo scenario, we might expect a positive environmental effect over the medium to long term. As mentioned, spatially the strength of this effect would be highly variable, simply because some inshore habitats which previously supported diverse and complex ecosystems were also important nursery areas (e.g. the Clyde fishery area). It is beyond the scope of this study to develop a spatially differentiated assessment of the policy impacts and the discussion below is therefore generalised.

At one end of the spectrum, there could be a **major transformative effect** on inshore habitat and a significantly enhanced flow of environmental goods and services. We know the inherent capacity of the system and the flora and fauna that it could support. Up to the early 1980s the coasts of Scotland, including the Clyde system, was capable of supporting a renowned recreational fishery predicated on large specimen fish and demersal species diversity. The past should therefore not be completely discounted as an indicator of what might be possible. For example, the proposition that Scotland could attract sea anglers from all over the UK might seem fanciful. Yet in 1973 the Scottish Tourist Board declared that, "*Scotland is now recognised by sea anglers as one of the most exciting sea angling countries in Europe."*[27] Not only was Scotland an attractive proposition for sea anglers, the demersal fisheries of the Clyde were sufficient to attract anglers from England and overseas[28]. It is also reported that 51 charter boats had operated in the upper Clyde in the early 1980s[29,30].

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[26] The relative size of these areas may influence displacement effects. The migration of vessels will result in a reduction in environmental damage inside 3 NM, but there may be a broadly equivalent increase in environmental damage outside 3 NM. There are many factors which will have a bearing on both the extent of the reduction inside and the increase outside 3 NM. Not least is the spatial distribution of targeted shelfish, because this largely drives the location of mobile fishing effort. The relative size could matter, however. If some mobile gear is diverted outside 3 NM and fishes in the remainder of the IFG area (3-6 NM zone), the diverted effort could potentially be spread over a much larger sea bed area. The reduction in the density of fishing effort means that, for a given area of sea bed outside 3 NM, the benthic habitat can better cope with mobile effort because of the longer average recovery interval between tows. Thus, other things being equal, the increase in habitat damage outside 3 NM could be less than the decrease inside 3 NM.

[27] Scotland For Sea Angling, 1973. Published by Scottish Tourist Board.

[28] For example a 1987 guide to angling in Scotland stated *"the coastline from Largs to Greenock is probably the most popular area in Scotland for shore angling, with many anglers from the Midlands and beyond making regular trips north."*

[29] Radford and Riddington (2009)

Therefore one scenario is that the measures would a) protect the current flow of environmental goods and services obtained from within 1 NM or 3 NM, and, b) result in a **major transformative effect** which delivers a significantly enhanced flow of environmental goods and services. The significantly enhanced flow is a consequence of recovery of the near shore system enhancing biomass, biodiversity and geo-diversity. Recovery of demersal fish stocks are key to increases in the quality and frequency of sea angling, sub-aqua and other marine based recreation, as well as more commercial vessels targeting demersal fin fish using lines.

A less optimistic view is that the policy impacts are enough to protect the current flow and enable an increase in the flow of environmental goods and services, but a significant increase is not possible because the ecosystem damage is not fully reversible. Biomass, biodiversity and geo-diversity might be enhanced, but unfortunately with characteristics which do not replicate the past, and never will. For example, we might have more fish but there may still be relatively few large demersal fish to be caught. Thus although there is more biodiversity and fish biomass, the flow of ecosystem goods and services is less because it does not include more sea angling, diving or commercial line fishing for demersal fish. Under this scenario, there is some enhancement of the flow of environmental goods and services.

More pessimistically, it could be argued that the post 1984 inshore expansion of the more damaging forms of fishing effort was perhaps not the principal reason for the decline in near shore demersal fish stocks. The decline in demersals could have been due to changes in water temperature, or fishing effort outside the near shore area. If so then changes in levels of inshore demersal trawling and dredging might only have a limited impact on future demersal biomass in the near shore areas. In this scenario, the impact of restrictions on mobile gear might be sufficient to protect the existing flow of environmental goods and services, whilst offering only a minimal enhancement of the flow.

The Scenarios

The table below describes various scenarios that could be evaluated. Scenarios 1, 2 and 3 will be associated with high magnitude estimates since under these it is assumed that the policy options will prevent an inexorable decline in environmental goods and services. Scenarios 4, 5 and 6 ignore the value of the current flow of environmental goods and services and focus on the enhancement elements. This is because these scenarios assume that in the absence of the policy options the there would be no change in the current flow.

[30] Not all of these were full-time charter vessels, and some only operated during peak periods.

Table 3.6. Status Quo and Policy Scenarios

		Policy Impact Scenarios		
		Major Transformative Effect	**Environmental Change not Fully Reversible**	**Limited Impact**
Status quo scenarios	**Continued Decline to zero**	1. Current Total Value Protected plus Significantly Enhanced Flow	2. Current Total Value Preserved plus Some Enhanced Flow.	3. Current Total Value Preserved plus Minimal Enhanced Flow
	Stability	4. Significantly Enhanced flow	5. Some Enhanced Flow	6. Minimal Enhanced Flow

In the interests of including the full range of costs and benefits, the study embraces all these scenarios. We have previously stressed that commercial fisheries have inbuilt incentive effects which result in overcapacity which is not self-correcting. This applies to creel based fisheries and creeling effort needs to be managed. We are assuming that an effective management system will be implemented which will ensure that fishing effort is controlled and that the benefits from the Nephrops creel fishery will not be eroded over time.

Thus when we evaluate, say, recreational sea angling or diving we have two potential status quo scenarios. One scenario is where demersal stocks and other flora and fauna decline and completely compromise these activities and one where these activities would continue at their current level. For each of these scenarios we then assess each of the possible policy impacts.

3.3.1 Commercial Fishing Status Quo Scenario

When we attempted to apply this approach to commercial fishing the status quo scenarios were not realistic. With respect to shellfish the scenario of continued decline is probably unreasonable.

As explained earlier, crabs and lobsters in most areas are fished beyond $\mathbf{F_{max}}$. However, these are caught using creels and pots and are not specifically targeted by demersal trawls and dredges. It is possible that mobile gear induced changes in the inshore ecosystem changes are impacting on the crab and lobster fisheries. Nonetheless, it is unlikely that near shore use of demersal trawls and dredges are an important determinant of the flow of benefits from crab and lobster fisheries.

As outlined previously, there is a mixed picture with respect to scallops and Nephrops. In the absence of the near shore restrictions, there will be expansion of effective effort through technical change and there will be episodic problems with some “hot spots”, but effort is not going to expand as it has in the past. This is because effort is heavily constrained through the licensing system, gear restrictions, effort control and other initiatives. This conclusion needs to be tempered through an appreciation that there is undoubtedly latent capacity in the part-time segment.

This study takes the view that the status quo scenario of a *decline to zero* is not sufficiently relevant for Scottish shellfish. This scenario would produce very high values for policy benefits. As stated previously, this study is seeking explicitly to avoid procedures which possibly over-estimate the policy benefits and underestimate the costs. Consequently we eschew this scenario for shellfish.

On the other hand, the decline to zero is highly relevant to demersal stocks, if they have been declining because of by-catch, discarding and the impact of trawls and dredges on inshore habitats. The problem is that whilst inshore demersal stocks are (just) sufficient for sea anglers, there is very little inshore commercial fishing for these species. Some ports do record healthy landings (e.g. Lochinver) but these are typically caught by non-Scottish vessels outside of the IFG area. In effect, inshore demersal stocks are so low that it is not worth the computational effort to apply the decline to zero scenario to commercial fishing for inshore demersals.

It is difficult to specify the precise mechanisms whereby the proposed gear restriction results in a transformation of the inshore ecosystem, or how long the process would take. In the modelling we therefore allow for assumption about the timing of response to be varied.

4 NEV/CBA ANALYSIS OF RESTRICTING MOBILE GEAR: AN OVERVIEW

This framework seeks to provide a monetary measure of the public's preferences for alternative uses of its scarce resources. The next relevant question is how does one measure the strength of preference and therefore changes in wellbeing? In economics, the strength of an individual's preference is usually measured in terms of their *Willingness to Pay (WTP)*. The rationale for using this type of monetary measure is based on a simple proposition. Namely, that the more positively (or negatively) individuals are affected by a change the more of their finite income and wealth they will be WTP in order to secure (or prevent) the change.

This approach to assigning value is not only relatively straightforward but has the considerable advantage that it can be applied to a very diverse range of goods and services.

4.1 Defining Economic Benefits and Costs

In economics the term, 'goods and services' embraces anything that people value. This is broader than just physical items which they might buy in the market place. As explained earlier, the flow of goods and services from the inshore environment includes items, such as fish, which have market prices, but also includes other things the marine environment provides, but which have no market price (e.g. sea angling, marine wildlife observation). The term *goods and services* will also include flows that generate well-being in the absence of any direct use. An example of a non-use value is the benefit that some derive from simply knowing that the Scottish inshore marine environment is being enhanced.

It follows that the flow of goods and services might embrace things that are non-quantifiable in money terms, either because estimation would be prohibitively expensive, or because economic science is not capable of the quantification.

In short, the term goods and services from the Scottish inshore ecosystem means anything which enhances public wellbeing as it increases and diminishes wellbeing as it decreases.

Following the above, the value of something (e.g. annual fish output, sea angling) is simply what we are willing to pay it. In economics, the ***Gross Economic Value*** **(GEV)** of allocating resources to produce something is simply the sum of individuals' WTP for it. Thus, the GEV of sea angling is the aggregate WTP of sea anglers, or, the GEV to society of the Scottish catch from commercial fishing is the collective amount we are willing to pay for the catch.

Unfortunately exclusive focus on the WTP for output produced (i.e. GEV) ignores the resources used to produce the catch. From society's perspective, these resources could (most probably) have been used to produce something else for which there is also a WTP[31]. The value of this foregone alternative is known as ***Opportunity Cost*.**

The more relevant concept of ***Net Economic Value*** **(NEV)** is obtained by subtracting from GEV, the opportunity costs of the resources used. In applied economic work it is normal, and reasonable, to assume that the market value of resources used (e.g. energy, labour, raw materials) reflects society's opportunity costs. Therefore the market value of the fuel, labour, equipment is assumed to reflect society's opportunity cost of the resources used.

Other things being equal, NEV will increase (decrease) when GEV increases (decreases). Using the same reasoning NEV will decrease (increase) when opportunity costs increases (decreases).

Generally increases in NEV are desirable and decreases undesirable. Therefore **Economic Benefits** are things that increase NEV, whilst **Economic Costs** are things that decrease NEV. We can therefore define Economic Benefits and Economic costs as follows:

Economic Benefits are:

A. Any increase in the flow of goods and services we enjoy and are willing to pay for.
B. Any reductions in opportunity costs. This means reductions in the value of goods and services we forego.

Economic Costs are:

A. Any increases in opportunity costs. This means increases in the value of goods and services we forego.
B. Any reductions in the flow of goods and services we are willing to pay for.

We first explain the economic costs to society which are either reductions in the flow of goods and services, or increases in opportunity costs.

4.2 The Principal Economic Costs

- Society would lose the output of Nephrops and scallops caught by mobile gear within the prohibited area as vessels retire, convert to static gear or divert their effort outside 1 NM or 3 NM. (Decreased flow of goods and services).
- There would be one off costs associated with using resources to convert some vessels to static gear. (Increased opportunity cost).

[31] There are some resources which otherwise might not be used to produce something else. Labour is a case in point. If workers would otherwise be permanently unemployed then opportunity cost could simply be foregone leisure.

- There would be recurrent costs associated with increased running costs of those vessels continuing to use mobile gear but fishing outside 1 NM or 3 NM (Increased opportunity cost)
- The costs associated with the increased benthic mortality and habitat damage occurring outside 1 NM or 3 NM as a result of mobile vessels diverting effort outside 1 NM or 3 NM. (Decreased flow of goods and services).

The full range of possible economic costs is explained in the table below:

Table 4.2. The Economic Costs of Limiting Trawling within 1 mile and within 3 miles

Cost	Indicator	Key Valuation Variables	Estimation Issues
Less mobile caught Nephrops and scallops from within 1 mile and within 3 miles. (decreased flow of goods and services)	Lost output of vessels retiring, diverting outside 3 and outside 1 mile or converting to static gear	• Value of reduced catch per vessel • Number of mobile vessels fishing within 1 mile and within 3 miles	Can be estimated quite readily using available market data
Increased capital cost within 1 mile and within 3 miles (increased opportunity cost)	Costs of converting to static gear	• One-Off Conversion costs per vessel • Number of vessels converting	Can be estimated quite readily using available market data. Needs to be converted to annual equivalent.
Increased costs of fishing 1 mile to 12 and 3 to 12 miles. (increased opportunity cost)	Increased running costs of vessels diverted outside the I mile or 3 mile area	• Increased costs per vessel • Number of vessels diverting	Can be estimated quite readily using available market data. Not accurate but probably relatively small.

Costs imposed on statics inside 1 mile or inside 3 miles. (decreased flow of goods and services)	Increasing competition for sea bed territory from vessels converted to static gear	• Current incidence of territorial conflict between static operators • Proportionate increase in creels • Proportionate increase in sea bed availability.	There is some territorial conflict between static operators, but presently this does not seem to be a serious issue. Such conflict might even decrease, depending on the balance between more creels and the increased territory available to creels.
Costs imposed on mobile operators outside 1 mile and outside 3 miles. (decreased flow of goods and services)	Decreased catches of existing vessels fishing outside 1 mile and outside 3 resulting from mobiles diverting to outside 1 or 3 miles.	• Proportionate increase in vessels in 1 to 12 and 3 to 12 miles • Judgements about catch and effort relationship.	Magnitude depends on the depends on the numbers diverting and those converting to creels Difficult to estimate because of unknown existing effort.

Reduced marine recreation outside 1 mile and outside 3 miles resulting from the environmental damage caused by mobile vessels diverting outside 1 mile and 3 miles (decreased flow of goods and services)	Decreased marine based recreation outside 1 or 3 miles.	• Number of vessels switching in the long run to fish outside 1 mile and 3 miles • Impact on marine habitat and benthic mortality outside 1 mile and 3 miles • Changes in fish stocks available to direct users (anglers and divers) whose activity is located outside 1 mile and 3 miles • Changes in fish predator populations outside 1 mile and 3 miles • Changes in predator populations which impacts on other marine based users (bird watching, wildlife tourism etc).	In the long run, because of shellfish stock improvements inside 1 mile and 3 mile, the increase in mobile effort outside 1 mile and 3 mile could be minimal. Although there might be deleterious effects outside 1 mile and 3 miles, most marine based recreation takes place very close to the shore. Information is only available for sea angling and to a much lesser extent, diving. Overall, this dimension is not worth serious research effort.

The environmental damage caused by mobile vessels diverting outside 1 mile and 3 miles reduces the benefits non-users obtain from simply knowing that the inshore ecosystem is protected - (General Public Non-User Value. (GPNUV)) (decreased flow of goods and services)	Number of individuals who are not indifferent to the status of inshore marine environment for its own sake	• Number of vessels switching in the long run to fish outside 1 mile and 3 miles • Impact on marine habitat and benthic mortality outside 1 mile and 3 miles • WTP of non-users to prevent the likely change in the marine environment outside 1 mile and 3 miles.	• Primary research on WTP is not feasible. • Unlike user values, GPNUV is probably not very sensitive to relatively small one-off changes in the marine environment. • Some allowance might need to be made to accommodate this.
Loss of workers' satisfaction bonus for labour leaving fishing and having to take up less satisfying or well-paying occupations. (decreased flow of goods and services)	Labour in fishing may be able to obtain higher earnings by switching occupation, but prefer fishing. The income sacrifice reflects a **'workers satisfaction bonus' (WSB).**	Number of individuals involuntarily exiting fishing	If fishing employment decreases, this could be a benefit. (Increased flow of goods and services). Only relevant if large reductions in employment arise

Some members of the general public may feel worse off simply knowing that mobile gear is no longer used within one or three miles. (General Public Non-User Value of activity, rather than marine environment itself) (decreased flow of goods and services)	% of general public with (other than commercial operators) with vicarious concerns for mobile gear operators within 1 mile and within 3 miles	WTP of general public individuals to prevent the inshore gear restriction for GPNUV	Not a traditional or long-standing feature of the inshore area Mobile gear will still be used No evidence of GPNUV for mobile gear use. Indeed, regarded by some as a destructive form of fishing
Some members of the general public may feel worse off simply knowing that future generations will not be able to use mobile gear within three miles. (bequest value of activity)	% of general public with (other than commercial operators) with vicarious concerns for future generations' use of mobile gear operators within 1 mile and within 3 miles	WTP of these individuals to prevent the inshore gear restriction because of Bequest Value	If GPNUV of the activity (see above) is not worth estimating neither is Bequest Value

Preliminary conclusion:

The increase in economic costs is likely to be restricted to reductions in mobile caught Nephrops and scallops and increases in capital and running costs. These can be estimated using value of landings and monetary costs. It will be difficult to estimate precisely how many vessels will convert to creels, retire or migrate. Undoubtedly, estimates of the total economic costs will be sensitive to assumptions about how mobile vessels would respond. As stated previously, normally, this would be explored through a sensitivity analysis. However, an analysis of the sensitivity in economic costs to assumptions is only worthwhile undertaking if the cost and benefit increases are of similar orders of magnitude The study goes beyond this by producing a model where users of the model can vary the assumptions themselves, produce their own sensitivity analysis and explore whether the balance of estimated costs and benefits is altered significantly by tweaking the model's assumptions.

4.3 Costs and Displacement Issues[32]

With respect to displacement, a key issue is the proportion of Nephrop trawlers wholly or partly fishing within 0-3 NM who would continue to use mobile gear but would now be displaced to fish outside 3 NM. This displacement imposes costs on fishers operating outside 3 NM, and simply shifts the impact of mobile gear on the marine environment beyond the near shore. The individual trawler operator's decision on whether to continue trawling will be influenced by a number of factors.

The safety of vessels and crew is an issue. Many smaller trawlers would not be able to cope with the sea conditions they would regularly encounter fishing exclusively outside 3 NM. Consequently, they would have to spend more days in port, with the real prospect of not being able to cover their overheads. We were informed by MS Fishery Officers that in some areas, such as Moray Firth and the North Coast IFG, a significant proportion of operators would have to either upgrade their vessel, fish inside 3 NM using creels or retire from fishing. Fishery operators indicated that many older operators would rather retire from fishing than use creels. Though, it should be noted that if they retire there is the prospect that a proportion of their shellfish entitlement would eventually become attached to vessels using static gear.

Another consideration is access to the territory beyond 3 NM. In some IFG areas, operators would have to steam quite large distances to get beyond 3 NM of the nearest landfall. This is particularly the case on the west coast of Scotland with its topography of long sea lochs and a patchwork of islands which trawlers would have to steam past because the islands are within 3 NM of the coast. In these areas operators' choices are; to relocate to another west coast port offering easier access to water beyond 3 NM, to switch to creels, or to retire. If they retire a proportion of their shellfish entitlement will become attached to vessels using creels.

The spatial distribution of stocks is also important. Many trawlers will be fishing partly or exclusively inside 3 NM because that is where they catch the most Nephrops. The assumption that trawlers would simply fish outside 3 NM presupposes that there would be Nephrops to catch and the value of landing would cover the operators' costs. If trawlers are forced off their preferred location their business may not be viable. In which case they must convert to something else (perhaps creels) or retire from fishing.

The assumptions we made about the proportion switching locations were informed by interviews conducted with Fishery Officers from every Fishery Office in Scotland. As stated previously, if these assumptions are felt to be inappropriate, users of the model can vary the assumptions themselves and observe the consequences.

4.3.1 Estimating Displacement Effects: Nephrops

Estimating the magnitude of the displacement effects was problematic. The issues are clarified if we initially consider nephrops and focus on two extreme scenarios. At one extreme, we could assume all nephrop trawlers currently fishing inside 3 NM

[32] To simplify the discussion of displacement this section refers only to 0-3 NM restriction and Nephrops, but the general argument in this section applies to Scallops and 0-1 NM restriction.

either convert to creels, or retire with their licence entitlement subsequently being attached to a vessel using static gear fishing inside 3 NM. With this scenario, there would be no displacement impacts in the areas beyond 3 NM.

It should also be appreciated that, with this scenario, there would be sufficient territory inside 3 NM to accommodate all those vessels switching to static gear. This is because, as previously outlined, vessels using mobile gear require a larger area of sea bed than the equivalent sized creelers. Thus, if 50 mobile vessels switch to static gear they must release territory which could accommodate more than 50 additional static vessels. Also, compared with an equivalent creeler, the higher annual Nephrop mortality of a trawler means that the conversion of 50 trawlers into 50 creelers should enhance Nephrop stocks inside 3 NM. Both the catch per unit of effort of static vessels and the average size of Nephrops landed by all static vessels should increase. It is therefore conceivable that, if 50 trawlers were withdrawn from within 3 NM, more that 50 additional static vessels could be accommodated with no reduction in the average value of static vessel landings.[33] Provided that the starting position was not characterised by excessive fishing effort, the net addition to the number of vessels fishing the area would be a welcome development.

In terms of benefits and costs, in this particular scenario we would lose the 0-3 NM catches of trawlers. Total landings of Nephrops within 0-3 NM would probably decrease, but the value of landing would fall by less, because landings would now comprise larger and live Nephrops. Inside 0-3 NM, benefits would be realised in the form of less gear conflict and less territorial congestion, plus the benefits predicated on the change in the marine environment. Outside 0-3NM, there would be no displacement effects.

Indeed, in this extreme scenario, given the spare capacity that would be released inside 3 NM, there might even be a transfer of fishing effort from outside to inside 3 NM. In other words, there could be a reversal of the expected displacement effects. This positive feedback flow might arise because some creelers currently operating outside 3 NM might move inshore to take advantage of the increased availability of territory and the Nephrop stock enhancement inside 3 NM. Also some Nephrop trawlers operating outside 3 NM may convert to creels with a view to exploiting the territory released inside 3 NM. Finally; the shellfish entitlement of retiring operators who worked outside 3 NM might become attached to static vessels fishing inside 3NM. Thus, in this extreme scenario the restriction on mobile activity might reduce Nephrop mortality, gear conflict and territorial congestion across a broad swathe of the inshore area. In conclusion, if trawlers convert, displacement is not an issue and each trawler converting generates positive feedback effects producing positive displacement effects.

At the other extreme, there is a scenario where all the existing Nephrop trawlers working inside 3 NM switch their activity to outside 3 NM limit. If this happens, there will be costs imposed on fishers operating outside 3 NM. These costs would arise through decreases in their catch per unit of effort, increased gear conflict and more territorial congestion. There would also be impacts on the marine environment

[33] Total landings from the 0-3 NM zone could be less.

outside 3NM. These additional costs should be taken into account and, relative to the magnitude of benefits, they could be significant.

It is worth noting however, this 100% displacement of trawler activity cannot be an equilibrium position because, inside 3 NM, catch per unit of effort and the average size of Nephrops would be increasing whilst gear conflict and territorial congestion would be falling. The opposite would be happening outside 3 NM. It is highly likely that in due course static effort will increase within 3 NM. With a fixed number of licences having shellfish entitlement, this will have to come from part-time fishers converting to full-time activity, or shellfish entitlement attached to trawlers gradually migrating to creelers. Over the longer term, the displacement costs associated with trawlers moving location might be lower than one would expect, because over time the incentive to convert will be increasing. As explained above, as more trawling effort migrates to using creels, then outside 3 NM there is the prospect of positive rather than negative displacement effects.

In conclusion, if trawlers convert we do not have to worry about displacement but instead we should recognise positive displacement effects. On the other hand, if trawlers move outside 3 NM there are displacement costs. However, over time these could be less than expected because of improvements in the relative attraction of fishing inside 3 NM.

Given the above consideration, in the absence of primary research, there is no basis on which to estimate displacement costs. On balance this will probably underestimate the costs of the two policy options, the extent of that underestimation being positively related to the proportion of trawlers moving rather than converting or retiring. Over time, because of the positive feedback effects, the proportion of trawlers converting should increase. In addition in some areas constraints such as safety issues, topography and stock availability could prevent many trawlers moving outside 3 NM. It is therefore conceivable that displacement cost associated with Nephrops might not be significant.

4.3.2 Estimating Displacement Effects: Crabs and Lobsters

In the case of Nephrops, trawlers and creelers are targeting the same species. Consequently, the removal of trawling effort from within 0-3 NM confers significant gains on static gear targeting Nephrops. Along large areas of the easy coast of Scotland static gear is predominantly targeting crabs and lobsters which trawlers and dredgers do not target.

There would be some benefits to crab and lobster fishers from the removal of trawlers and dredgers but they are less significant and are delivered by more indirect routes. The benefits to the crab and lobster operators will be less gear conflict, less territorial congestion and some increase in landings of crabs and lobsters. Landings will increase because trawlers and dredgers by-catch includes crabs. Also, the environmental impact of mobile gear, particularly dredgers, possibly adversely affects crab and lobster stocks.

In the case of crabs and lobsters, the benefits from curtailing mobile effort with 0-3 NM are less obvious. Thus, if any trawlers or dredgers did convert to static gear targeting, nephrops crabs and lobsters inside 3 NM there would be minimal improvement in the relative attraction of fishing inside 3 NM. Thus a bigger proportion of mobile effort will simply be displaced outside 3NM. In conclusion we would expect the costs associated with displacement effects to be larger in the crab and lobster fisheries.

4.3.3 Other Displacement Effects

The displacement discussed above relates to what happens within the commercial fishing sector. One of the benefits from curtailing mobile effort is a reduction in environmental damage within the 0-1NM or 0-3 NM zone. If the entire fleet converts to static gear, there would be no increase in damage beyond 3 NM. If a proportion of the trawling fleet switches location the environmental damage will follow that proportion.

As can be seen from the map in Section 3.5.2, the IFG area 3-6 NM is very much more than twice the 0-3 NM zone. This is because the IFG boundaries provided by Marine Scotland are based on straight lines linking points 6nm from significant headlands. The 0-1 NM and 0-3 NM zones provided by MS are based on lines drawn 1 NM and 3 NM from the coastline and not just headlands. The displaced mobile effort is therefore spread over a much larger area. To the extent that environmental damage is function of the frequency of disturbance, the reduction in the density of fishing effort might facilitate better habitat recovery before the next disturbance. Nonetheless, there will be some displaced damage. The issue is addressed in applied work by downgrading estimates of benefits to the general public (GPNUV) (see Section 22).

4.4 The Principal Economic Benefits

- Society would gain the marketed output of Nephrops, shellfish and scallops caught by static gear or diving. This is of much higher quality and is more highly valued by society as reflected in higher prices. (Increased flow of goods and services which exceeds opportunity cost)
- In due course, there may be a commercial demersal fishery producing an output which is more highly valued than the costs of catching it (Increased flow of goods and services which exceeds opportunity cost)
- Increased **Consumers Surplus** of those engaged in marine recreational activity. This is the additional user benefits through increased personal enjoyment and the improved mental and physical health of participants (increased flow of goods and services). As discussed previously there is a spectrum of sensitivity to changes is fish populations. As discussed later, existing knowledge and available data does not presently enable the analysis of marine recreation to extend beyond those who interact directly with fish stocks (sea anglers and divers). In this context sea angling and diving should be considered as a proxy for all marine recreation interests.
- Societal benefits from increased marine recreation such as reductions in anti-social behaviour in some coastal communities, improved productivity of participants, reduced demands on health care budgets. (Decrease in opportunity costs)
- Insurance role of biodiversity (Reduced risk because of enhanced biodiversity) (Increased flow of goods and services)
- Increased Non-user benefits in the form of **GPNUV**. This is the benefit some obtain from simply knowing that many marine species could be restored and protected. (Increased flow of goods and services)
- Non-user benefits some obtain from knowing that the Inshore Marine biodiversity has been restored protected and can be appreciated by future generations. (**Bequest Value** of Inshore Marine Ecosystem). (Increased flow of goods and services)

The economic benefits are more diverse and complex than the economic costs. In the Table below economic benefits have been categorised according to the following sectors:

A. Commercial Fishing.
B. Recreational Sector
C. Informal Visitors to Coastal Areas
D. The General Public

Table 4.3 The Economic Benefits of Limiting Trawling within 1 mile and within 3 miles

A. Benefits Associated With Commercial Fishing				
	Benefit	**Indicator**	**Key Valuation Variables**	**Estimation Issues**
A1	**1. Additional output (Nephrops and scallops) within 1NM and within 3 NM from conversion to static gear.** (increased flow of goods and services)	Output of vessels converted to static gear	Value of catch per vessel. Number of vessels converting.	WTP can be estimated from the market value of the catch. Prices per kg will be higher because of quality
A2	**2. Additional output within 1 mile and within 3 miles from exploitable sea bed released from mobile exploitation.** (increased flow of goods and services)	Output of enabled vessel expansion	Proportionate increase in exploitable sea bed area	Estimation of additional vessels output valued at market prices
A3	**3. Additional output of vessels diverted outside 1 or outside 3 miles.** (increased flow of goods and services)	Output of diverted vessels	Value of catch per vessel 1 to 12 and 3 to 12 mile zone. Number of vessels diverting.	Can be estimated quite readily using market data

A4	**4. Resources released by vessels retiring.** (decreased opportunity cost)	Resources released from fishing	Number of vessels retired from fishing	Given the fixed number of licences, the retirement of one vessel transfers the licence to another. There is no net reduction in resource use
A5	**5. Increased catch of fin fish immediately outside 1 and outside 3 miles** (increased flow of goods and services)	Additional demersal landings	Value of demersal landings	Past landings will need to be used as a guide to the future. Potentially large values with large margins of error
A6	**6. Reduced gear conflict** (decreased opportunity cost)	Less gear and time being lost by static and mobile operators	Monetary value of costs of gear conflict	Estimates by operators
Note: The benefits and costs of the commercial sector are either increases in revenue to operators or decreases in operators' costs. It therefore follows that changes in profit levels are synonymous with the balance of economic benefits and economic costs. Thus, an increase (decrease) in profits means an increase (decrease) in net benefits to society. This is not a contentious issue in the CBA framework.				

B Benefits From Enhancement Of Marine Recreation				
	Benefit	**Indicator**	**Key Valuation Variables**	**Estimation Issues**

B1	**Benefits to sea anglers and divers:** • **Personal enjoyment** • **Improved mental and physical health of participants** **(increased flow of goods and services)**	Expansion of recreational sea angling.	• Increased number of anglers and divers • Increased frequency of participation • Number of activity days • WTP per activity day	• Good knowledge of angling activity levels, but not diving • Primary research on WTP is not feasible. • Values from elsewhere will need to be transferred to the inshore context • Possibly high values with large margins of error
B2	**Societal benefits from increased sea angling and diving:** • **Reductions in anti-social behaviour in some inshore communities.** • **Improved productivity of participants.** • **Reduced demands on health care budgets.** **(increased flow of goods and services)**	Expansion of recreational sea angling and diving	• Increased number of anglers and divers. • Increased frequency of participation • Number of activity days	• Primary research is not feasible • Values from elsewhere are not available, therefore non-quantifiable • None the less an important element of many public policies and high level Scottish Government objectives

B3	**Benefits to the scientific community from sea angling and diving** **(increased flow of goods and services)**	Development of methods for diver observations and use of rod and line to survey fish populations in inshore water	Confirmation of this role from Marine Scotland Science and the Academic Community	Non-quantifiable benefit

C. Benefits To Informal Visitors From Enhancement Of Coastal Visitor Experience.				
	Benefit	**Indicator**	**Key Valuation Variables**	**Estimation Issues**
	Benefit from more enjoyable coastal visits through marine wildlife observation, as well as higher and more diverse levels of marine activity (such as more diverse commercial fishing, more divers, more anglers, more charter vessels)	Increase in visitor satisfaction through, marine wildlife tourism and more vibrant coastal communities etc.	Increased number of visits and quality of visits increased number of visits	Primary research required

D. Benefits To The General Public				
	Benefit	**Indicator**	**Key Valuation Variables**	**Estimation Issues**

D1	**Non-user benefit that some of the general public obtain from simply knowing that inshore sea *angling / diving* is restored and protected. (GPNUV of the activity).** **(increased flow of goods and services)**	Number of non-anglers who are not indifferent to the amount of sea angling/diving activity in the inshore area	WTP of non-anglers/divers to restore sea angling/diving.	• Primary research is not feasible. • Values from elsewhere are not available, therefore non-quantifiable. • Possibly not significant. Indeed angling can be perceived as a cruel activity.
D2	**Non-user benefit that some of the general public obtain from simply knowing that future generations will be able to enjoy sea angling. (bequest value of the activity)** **(increased flow of goods and services)**	Number of individuals who are not indifferent to the sea angling/diving being available for future generations	WTP to restore sea angling/diving for the benefit of future generations.	If the GPNUV for the activity is not significant the bequest value will also not be significant
D3	**Insurance role of biodiversity (reduced risk because of enhanced biodiversity)** **(increased flow of goods and services)**	Number of risk-averse individuals	WTP to reduce the risk of ecosystem collapse	• Primary research on WTP is not feasible. • Values from elsewhere are not available, therefore non-quantifiable • Potentially large values with large margins of error

D4	**Benefits some obtain from knowing that the inshore ecosystem is restored and protected and can be appreciated by future generations (bequest value of inshore ecosystem).** **(increased flow of goods and services)**	Number of individuals who are not indifferent to inshore biodiversity being available for future generations	WTP to reduce the risk of ecosystem collapse and restore biodiversity for future generations.	• Primary research on WTP is not feasible. • Values from elsewhere are not available, therefore non-quantifiable • Potentially large values with large margins of error
D5	**Benefits some obtain from simply knowing that the inshore ecosystem is restored and protected (GPNUV of inshore ecosystem)** **(increased flow of goods and services)**	Number of individuals who are not indifferent to inshore biodiversity for its own sake	WTP to reduce the risk of ecosystem collapse and restore biodiversity for its own sake.	• Primary research on WTP is not feasible. • Values from elsewhere will need to be transferred to the inshore context. Estimates probably capture D3 and D4 • Possibly very high values with large margins of errors.

The NEV to society associated with the commercial sector approximate to changes in profits. More contentiously it can be argued that there is also benefit from generating jobs **if there is no other source of employment.** Homarus (2010), for example, added the wage bill on to the profits to provide a "value". In our view in some areas with high unemployment the opportunity cost of labour could be less than the wages of the fishermen. In the short term NEV of commercial fishing could be larger than simply the profit. Treasury guidelines do not provide for such adjustments. For this project, if appropriate, we will use a shadow wage rate.

The benefits associated with recreation, coastal visitors and the general (non-user) public are more complicated and diffuse and cannot generally be estimated using readily available market data. Indeed, their estimation is difficult. Despite, this they are obviously no less important than commercial fishermen's costs and revenue, and an economic evaluation that failed to address these would be in breach of UK (and US) guidelines on the conduct of economic evaluations. Their inclusion in this study here reflects standard practice. It is their exclusion which would be contentious.

The balance of costs and benefits will vary over time as stocks recover and business initiatives (and migration) bring down unemployment. Discounted Cash Flow techniques will be used to identify the Net Present Values. The discount rate we used was 3.5% and, in the main scenarios, the planning horizon was modest 20 years; though we also model the results using an infinite time horizon to fully reflect the potential for sustained and ongoing environmental benefits.

4.5 Benefits, Licensing and Latent Effort

It was previously explained that if 50 trawlers were replaced by an equivalent number of creelers, then the nephrop catch per unit of effort should increase along with the average length of Nephrops being landed. This is because compared with a creeler of the same length a Nephrop trawler has a higher annual catch and lands smaller Nephrops. It is therefore possible that, if 50 trawlers vacated an area, the area could accommodate an additional, say, 75 creel vessels without any reduction in the profitability of existing vessels. This means that the introduction of the 0-3 NM could result in increased employment in the catching sector. In addition, since there are more vessels than previously the fall in area's total value of Nephrops landings would not be as large, especially given the higher prices for creel caught Nephrops.

Whilst the additional vessels might be easily accommodated, the licensing system might not enable this. Since the number of licences with shellfish entitlement is fixed, the 25 additional vessels might not be forthcoming and the local benefit flow would be that much less. On the other hand, if 25 more vessels fish the area, there would be fewer vessels fishing elsewhere. Unless there was excessive effort elsewhere, the increase in the local flow of benefits would be at the expense of benefits elsewhere.

There is currently some slack in the system since some shellfishing entitlement is attached to vessels which are fished on a part-time basis. If catch per unit of effort does increase, and gear conflicts and territorial congestion are reduced, then a proportion of the part-time fleet may switch to full-time working. This might arise because the existing operators choose to increase their effort, or the increased value of their licence might persuade part-timers to sell licenses to potential full-time operators. The Table below presents the number of part time fishermen for each of Scotland's fisheries administrative ports.

Table Number of full and part-time fishermen by admin port[34]

Admin Port	Full	Part	Total	% PT
Shetland	233	205	438	**47**
Aberdeen	81	47	127	**37**
Orkney	257	121	379	**32**
Anstruther	116	48	164	**29**
Eyemouth	133	48	181	**26**
Buckie	166	49	215	**23**
Fraserburgh	657	134	791	**17**
Stornoway	323	64	403	**16**
Mallaig	263	41	337	**12**
Campbeltown	260	38	298	**13**
Ullapool	205	24	229	**10**
Ayr	512	54	566	**9**
Lochinver	20	2	23	**7**
Peterhead	372	28	400	**7**
Oban	240	8	248	**3**
Kinlochbervie	41	0	42	**0**
Wick/Scrabster	147	0	147	**0**
Grand total	4025	909	4987	**18**

The number of licenses with shellfish entitlement attached to vessels operating part-time is unknown. From the Table above, 18% of the catching sector works on a part-time basis. The Marine Analytical Unit of MS has examined this issue and has reported that the situation varies around the country. This variation is reflected in the above table. On the west coast, trawlers and static gear are often targeting the same species (Nephrops). Diverting trawlers away from near shore areas in the west would improve the profitability of static gear operating within 0-3NM. However, there are relatively few part-timers in the west.

On the east coast there is more latent capacity in the form of part-time effort. However, on the east coast, crabs and lobsters, which are not targeted by trawlers and dredgers, are relatively more important. In the east coast the diversion of trawling would not have such a beneficial impact on static gear fishery and the incentive for part-timers to convert is not as strong.

[34] Source: http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/InshoreFisheries/ifmac/ifmacmeetings/30012014

In conclusion, the benefit flow is constrained by the licensing system and the spatial mismatch between the location of latent effort and strong incentive effects to convert to full-time working. This issue is explicitly addressed in Section 23.

5 ECONOMIC IMPACT APPRAISAL OUTLINED

Economic Impact Appraisal revolves around answering the question: "What would happen (to household income and employment) in region 'X' if fishing was restricted in the fishing area" This involves identifying how the local expenditure of key groups would change and how these expenditure changes would impact on income and employment across the selected area. The principal key groups would be:

Increased Sea Angler and Visitor Expenditure

Change in Sales of Mobile Caught Fish principally Shellfish

Change in Sales of Static Caught Shellfish

The expenditure of sea anglers and visitors can create income and employment for others. Most apparent is the income and employment of businesses directly supplying services, such as charter vessels, temporary accommodation providers, tackle shops etc.

5.1 Direct, Indirect and Induced Effects

The income and employment that is directly dependent on expenditure is known as the **direct effect**.

Indirect effects can arise from the direct effect. For example, a Clyde charter operator may purchase vessel repair services in Greenock thus supporting the wages, profits and jobs of the local ship repair company. The repair company itself may purchase materials from local suppliers thereby generating a further round of indirect effects.

Induced effects can arise from the direct and indirect effects. This is because the direct effect and every round of indirect effects increases household incomes (in the form of wages, profits, rents and income from self-employment) which might be spent locally thereby supporting, say, local barbers.

The expansion/contraction of fishing effort will similarly have a direct effect on the suppliers to the fleet (chandlers, fuel merchants and, of course, fishermen) and subsequent direct and induced effects.

Similarly any expansion or contraction in the supply of fish or shellfish will have an impact on any downstream processors and on the suppliers of those processors.

The size of the indirect and induced effects varies directly with the size of the region and is captured by the multiplier derived from input-output tables. For Scotland as a whole we will use traditional multiplier analysis based on national statistics to identify the likely economic impact.

For coastal communities in each IFG area, input-output tables would need to be created to establish multipliers. Whilst this is just possible we know from previous experience that the uniqueness of small communities makes the results problematic. Instead we intend to use the BRES/ABS data zone analysis and information obtained from fishery officers and local information sources to identify key suppliers and processors and to directly estimate **"First Round"** effects in the local communities. By their nature these forecasts will be uncertain.

Although the fish processor research is not in the task list we believe it will significantly enhance the baseline information and is actually essential to understanding the impact of the options.

The typical “First Round” effect of expenditure by visitors and sea anglers in sub-regions is known from previous work by us and others. Whilst these sub-regions are larger than the IFG/Coastal regions used in this study, it is believed that the vast majority of spend by these groups will be very local. However second and subsequent round effects will be extremely small and will not be considered in the analysis.

An important consideration in Impact Analysis is **Substitution**. For visitors particularly, expenditure on one activity or in one place in the area can be rapidly replaced by expenditure on another activity or place. A day’s horse riding might be replaced by a day watching wildlife if that became available because of restrictions on fishing. The increase in economic activity might, in this case, be illusory.

At a Scottish level an increase in anglers in one area might simply be matched by a decrease elsewhere. In this case, for Scotland, the economic impact would be zero. Similarly if expenditure in the trawling sector in an IFG is balanced by an increase in expenditure on creeling then the economic impact is zero despite the loss of jobs in trawling.

The Economic Analysis will present the likely impacts within each of the IFGs and for Scotland as a whole for each of the options identified.

5.2 Sustainable Communities

Whilst fishing management tends to be dominated by questions of maximum sustainable yields for different species, the government also has a major role in maintaining and developing communities. For a number of these communities fishing may be the major or even only, source of employment.

As discussed in the introduction the independent report (Campbell (2010)) discusses how best to maintain and indeed grow these communities. The committee “*prevails on the Scottish Government to commission research on fisheries dependence and the data needs for describing and analysing FDA s, with a view to creating and maintaining a comprehensive national data base”.*

Social and business statistics newly published at data-zone level enable identification of the effects of downstream activities such as fish processing. These data are used to

a) Identify the economic impact on small fishing communities
b) Identify the level of dependence upon fishing
c) Compare the fishing sector in fishing communities with other sectors.

6 COMMERCIAL FISHERIES: DATA SOURCES AND MEASURES

A key stage in this study is establishing the benchmark information on zones 0-1 NM, 1-3 nm, 3-6 NM and 6-12 NM. This needs to done for each IFG plus Shetland. Ideally, estimates for catch, number of vessels by gear type, number of days by gear type would enable a comprehensive description of what is currently happening in these zones in each IFG. In addition estimates for the costs of gear conflict would be highly desirable.

The most important variable for the model is the value of catch for each zone in each IFG. A significant problem is that we do not have direct observations for catch by zone. There are however landings data and, even allowing for misreporting by fishermen and other errors, the belief within MS is that landings data are an accurate record of the fish coming ashore in each IFG area. Indeed, they can be checked against the records of registered buyers.

Although there are good landings data for each IFG, the landings data are not a good proxy for IFG catch. Even if it was a good proxy, there is still the problem of disaggregating the data to specific zones within each IFG (i.e. 0-1, 1-3 and 3-6 NM).

There are a number of reasons for the disparity between total landing in an IFG and catches in the IFG's water. For example, the landings in a "hypothetical home" IFG will include fish caught by:

- Home IFG's vessels fishing in neighbouring IFG waters.
- Home IFGs vessels fishing outside 6 miles.
- Neighbouring IFG vessels fishing outside 6 miles close to the home IFG's area.
- Neighbouring IFG vessels fishing neighbouring IFG's area but landing in the home IFG because of better port facilities, buyers, processing capacity.
- Nomadic vessels passing through the area.

Thus, the home IFG landing data could include a proportion of fish caught outside 6 miles or within 6 miles but in another IFG area. For the same reasons, a proportion of the recorded landings of other IFGs will include fish caught in the hypothetical home IFG. Thus IFG catch could be greater or less than recorded landings.

It has been necessary to use a range of data sources and procedure to compile the catch benchmarks. The method used depended on whether vessels were over 15 metres or 15 metres and under.

6.1 Fishing Activity and Catch by Vessels over 15 m

As described in Section 2, data from vessels over 15 m is collected by combining data from the Vessel Monitoring System (VMS) positioning system and an electronic log produced by a specified Electronic Reporting System (ERS).

VMS transmits a "ping" every two hours. This records the latitude and longitude of the vessel when the ping made. A key problem is identifying when a vessel is fishing as opposed to progressing to/from a fishing ground. By examining the distance covered between "pings" the VMS system provides an estimate of the speed of the vessel, and the speed of the vessel is largely determined by the activity it is undertaking. In port, the speed is zero and when travelling it is normally in excess of 5 knots. Thus any periods fishing can be identified by a vessel speed between 0 and 5 knots.

This approach is not perfect. A vessel proceeding carefully to and from a harbour may record a speed in that range and some trawls may be slightly faster than 5 knots. In coastal areas with strong tide flows, vessel steaming might occasionally be falsely identified as towing. Tests suggest that inaccuracies are limited, though the severity of the error will vary across geographical areas.

As described in the previous section, ERS provides details of the volume and value of catch landed. Vessel landings and VMS data can be linked through the vessel's identification details. In linking vessels' recorded landings to where it was caught, the approach taken by Marine Scotland is to allocate each vessel's total catch equally across every period's fishing. Thus if a vessel recorded 1500 kg over a week and there were 5 estimated "fishing" pings, each ping would be allocated a catch of 300 kg.

Marine Scotland allocates pings to ICES sub rectangles for further analysis at EU level. For the purposes of this study, it might have been possible to use this level of analysis. This would have required the matching of sub-rectangle to IFG's and also to zones (e.g. 0-1, 1-3 and 3-6 NM). This was rejected because the complex of sea lochs and zones within IFGs results in sub-rectangles overlapping land areas and IFGs, as well as zones within IFGs. Thus it was decided to allocate each ping to an IFG area using the ping's geographic co-ordinates and a GIS system.

6.1.1 VMS and IFG Zonal Catch Estimates for Vessels Over 15m

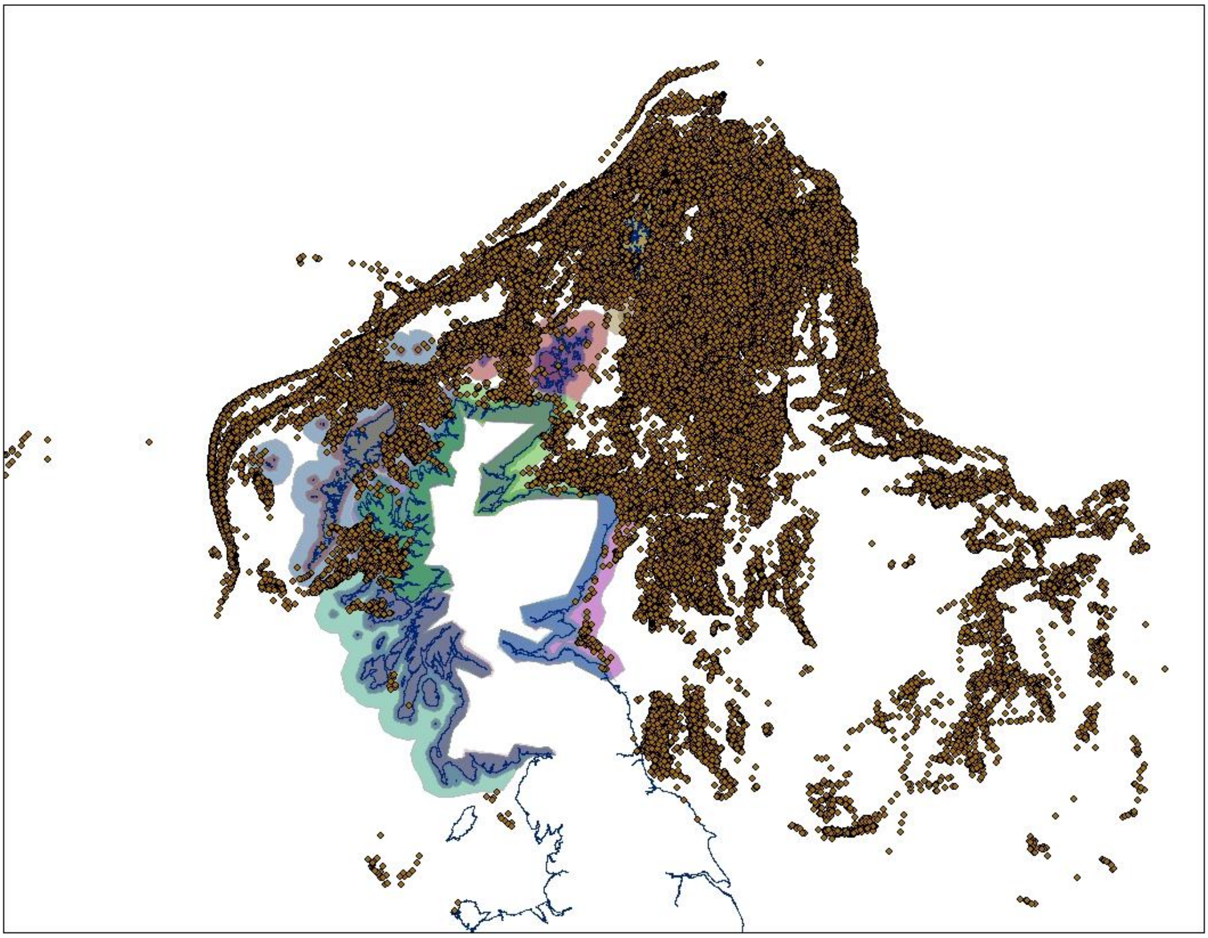
The GIS package utilised was Arc-GIS Desktop and the first task was to define the areas needed in the analysis. The Coastline was that defined by the Ordinance Survey (OS) for the Strategi map series. The Buffer Function was then used to define polygons (shape files) 1 NM, 3 NM, 6 NM and 12 NM from the shore. Using the polygon boundaries and the IFG boundaries, new polygons were created defining zones within IFGs (e.g. the 0-3 NM zone in the Clyde and West IFG). Once the polygons were created any ping could be associated with a zone using the Spatial Join function.

The VMS data were supplied by Marine Scotland as six Access (mdb) data files for each of 2010, 2011 and 2012 and three combined files for vessels from the Rest of the UK for the same years. Some simple reformatting was required to produce dbf files that could be used in Arc-GIS.

After adding the file to the Arc database, the latitude and longitude data was used to locate each ping on the map using the Add XY function[35]. The figure below is an example of the visual output available by using the Spatial Join function to link fishing pings with IFG areas. It shows the output for the over 15 m demersal fleet.

[35] An important step is to add the geographic co-ordinate information to be used; in this case the Mercator projection as defined by OS-GB 1990.

Fig 6.1.1 IFGs and Recorded Fishing Locations for > 15 m Demersal Trawlers, 2012



Finally, data points outside the 12 NM limit were excluded and the resulting selected data file exported as a dbase file. The table below provides summary data on the Pings

Table 6.1. Summary of VMS Data

	Number of VMS Pings				
	<1 NM	**<3 NM**	**<12 NM**	**Total**	**% of Pings**
Nephrops	22106 12.39%	44083 24.70%	96953 54.33%	178464 100.00%	44.09%
Demersal	5585 3.72%	8179 5.45%	23857 15.91%	149984 100.00%	37.05%
Pelagic	732 33.58%	945 43.35%	1286 58.99%	2180 100.00%	0.54%
Dredge	13,529 23.94%	22418 39.67%	34698 61.40%	56510 100.00%	13.96%
Pots	1207 9.28%	2299 17.67%	9201 70.71%	13013 100.00%	3.21%
Other	1000 21.52%	1894 40.77%	2786 59.97%	4646 100.00%	1.15%
Total	**44,159** **10.91%**	**79,818** **19.72%**	**168,781** **41.70%**	**404,797** **100.00%**	**100.00%**

After allocation and selection the resulting single species data files were exported as a dbf file which, as a first step, can be analysed in Excel. However combined files are necessary because vessels identified as say nephrop trawlers can occasionally catch queen scallops on a trip. Excel does not handle large files particularly well and its statistical tools for producing say multi-layer cross tabs are limited. Consequently the files were read into SPSS, combined and then analysed. The tables produced in SPSS were then transferred to Excel for production of the final tables.

6.1.1.1 Adjustment for Port Entry

As discussed earlier, a key element in the analysis are the assumptions that a) vessels travelling between 0 and 5 km/h are "fishing" and that b) the catch is equal at all recorded locations. Visual inspection of the "fishing pings" shows considerable fishing effort along the course vessels normally take on approaches to ports. The figure below illustrates over 15 m demersal trawlers approaching Scalloway and Lerwick steaming at less than 5 km/h but almost certainly not fishing. These incorrect fishing pings are most probably recording vessels steaming slowly as they approach ports.

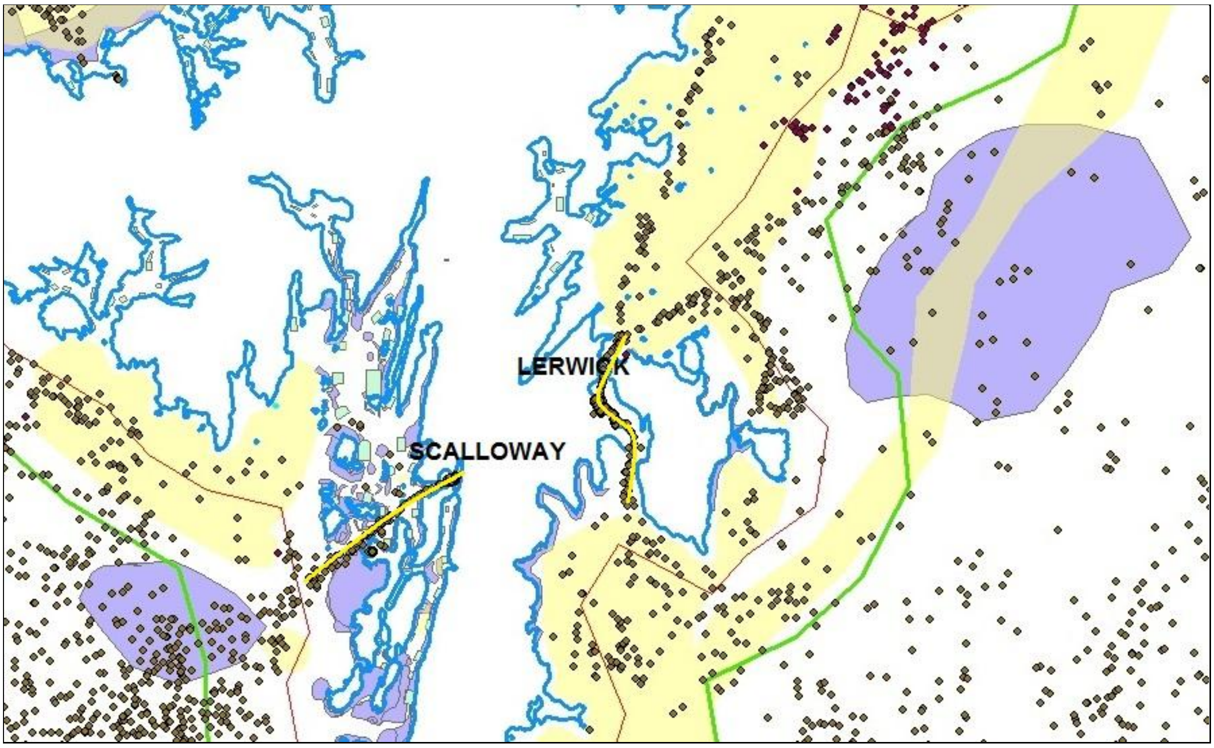


Fig 6.1.2 Pings from Demersal Vessels and Port Entry Routes

The result of misspecification of fishing pings is that the catch volume and value within the 1 mile zone will be over-estimated and outside the zone will be underestimated. To adjust for this problem the following procedure was adopted:

1. Each major port was examined to see if fishing pings were coinciding with routes normally followed by vessels steaming slowly whilst approaching port.
2. These approach routes were added to the map
3. All "fishing pings" on or close to (within 200 m) of the route were identified
4. The total catch value and volume for each species/gear type in each IFG of these selected pings was calculated and deducted from the estimated 1NM

catch values and volumes. Whilst all the catch value was removed from the 1 NM zone (the area most likely to have slow travel), only half the catch value and volume was deducted from the 3 NM zone and 75% from the 6 NM zone. In the absence of any other information, this was assumed to be reasonable. Finally the catch removed from the record had to be caught in some area. For this exercise it was assumed to have come from within the 12 NM/IFG zone although it was recognised that in the case of deep sea ports like Peterhead or Fraserburgh this will be an overestimate.

In conclusion, we are confident that for the over 15 m vessels the estimates on the location of effort and catch are sufficiently accurate for the requirements of this study.

6.2 Fishing Activity and Catch for Vessels Under 15m

Whilst VMS data provides data for vessels over 15 m there was no systematic collection of data on the location of the fishing effort or catch of the under 15 m segment of the inshore fleet

Fortunately, Marine Scotland Science's recently completed ScotMap project had addressed this problem by undertaking a one-off survey of inshore operators. The project asked them to draw their fishing activity as a polygon on an electronic map and provide data on the % contribution of this fishing area to gross vessel earnings, information on those earnings (average annual gross over the years 2007-2011) This data was then used to calculate a monetary value for each polygon. For each polygon the primary, and where relevant the secondary target, species was identified and the value of landings from each polygon was estimated based on information provided by fishermen. Fishermen who move between different grounds might draw more than one polygon.

6.2.1 Estimating IFG Zonal Fishing Effort for Vessels Under 15 m

In order to obtain the co-operation of the fishermen, as part of the Scotmap data agreement brokered by MS, strict conditions were imposed on the release of data. This effectively prevented any access to the raw data, apart from a limited number of staff at Marine Scotland Science (MSS) working on the Scotmap project. This meant that this study had no access.

In the absence of the raw data, the consultants provided MSS staff with a series of zonal boundaries for each IFG. For example zone 4_3 would be within 0-3 NM of the shore in IFG4. For each IFG area, MSS staff clipped the complete raw data to each distance zone (0-1 NM, 0-3 NM, and 3-6 NM) zone and provided a count of the number of vessels fishing within each zone.

Whilst the number of vessels is an indication of the location, intensity and type of effort in a distance zone, there are a number of problems. Individual operators might draw more than one polygon and report the catching of more than one species caught in each polygon. In addition, each polygon might also overlap the boundaries of this study's defined zones.

Thus a single vessel could appear in a number of zones. Unfortunately, without access to the raw data, we only know the number of vessels that appear in each zone. The number of days, or hours spent in each zone is unknown. Our only measure of effort is therefore the number of vessels counted in each zone, and this measure will double count some vessels. For example, the Scotmap survey had 1080 vessels responding. Summing the number of vessels identified in each of this study's zones, yields a total of 1461 vessels. This is an overestimation of 35.2% across the whole inshore area.

The overestimation will vary between IFG areas and gear types. The table below shows the implied overestimate associated with IFGs and gear types.

Table 6.2.1 Overestimation Associated with Vessel Counts across IFGs and Gear Types

	Trawls		**Dredge**	**Pots**		**Hand Dive**		**Lines**	
	N'rops	**D'rsal**	**Scallops**	**N'rops**	**Other Shellfish**	**Scallops**	**Other Shellfish**	**Pelagic**	**Total**
South West	41	0	12	70	99	13	3	1	239
North West	44	0	2	141	91	11	0	6	295
Outer Hebrides	33	0	2	68	145	9	0	1	258
MF&NC	21	14	3	1	130	2	0	68	239
Orkney	4	1	6	1	127	15	1	0	155
East Coast	55	20	3	5	270	0	1	125	479
Total Vessel Count	198	35	28	286	862	50	5	201	1665
No of Scotmap Vessels	120	28	21	252	805	39	5	154	1080
%Over Sample	65%	25%	33%	13%	7%	28%	0%	31%	54%

The table above for <15 m vessels is based on 1080 unique vessels in the Scotmap Survey. The vessel count of 1665 represents the number of vessels counted using each gear type in each IFG. The number of vessels counted across IFGs was 1424 (not reported in the table above). On this basis there would appear to be more vessel mobility between gear types than between IFGs.

For comparison, the table below gives a similar table based on VMS data for over 15 m. vessels.

Table 6.2.2 Number of Vessels over 15 m operating within 12 NM of shore by IFG and gear type

	D'rsal	N'rops	Pelagic. Trawl	Other Trawl	Dredge	Pots	*Total Vessel Count*	*Total VMS Vessels*	% Over Sample
South West	4	64	5	2	36	4	115	98	17.0%
North West	31	61	5	1	19	8	125	110	13.6%
Outer Hebrides	33	59	5	2	7	9	115	104	10.6%
MF&NC	74	63	2	19	16	5	179	141	27.0%
Orkney	48	4	8	1	5	5	71	67	6.0%
East Coast	99	95	9	22	23	0	248	202	22.8%
Shetland	99	18	23	7	2	0	149	131	13.7%
Total Vessel Count	388	364	57	54	108	31	1002	853	17.5%
Total VMS Vessels	141	170	28	33	52	16	440		
%Over Sample	175%	114%	103%	63%	107%	93%	127%		

As can clearly be seen larger vessels are much more mobile with vessels, on average, covering 2.5 zones. Identifying the location of over 15 m vessels is not problematic because the VMS data is based on pings which occur every 2 hours and these provide a reliable locator of fishing effort.

The table below shows estimates of the number of vessels in the 1, 3, 6 and 12 NM zones by IFG Area in 2011. The zones are concentric i.e. the vessels in the 12 NM limit include those in the 0-6, 0-3 and 0-1 NM limits.

Table 6.2.3 Number of Vessels < 15m within 1, 3, 6 and 12 mile limits by IFG

	South West	North West	Outer Hebrides	MF&NC	Orkney	East Coast	Total
1nm	192	237	213	213	145	415	1415
3nm	194	242	219	215	147	424	1441
6nm	194	249	220	215	147	421	1446
12nm	198	250	224	215	150	424	1461

Whilst there are additional boats in the larger areas the numbers are small; most vessels are found at some stage to be fishing within the 1 NM limit. The relative importance of fishing within 0-1 is evident.

6.2.2 Estimating Zonal Catch Value for Vessels Under 15 m

The aim of Scotmap was to map fishing activity and value associated with fishing by under 15 m vessels. It produced Raster maps showing the distribution of vessel activity and fishing value by species in Scotland. The figure below shows typical output from the project which is found at
http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/Themes/ScotMap

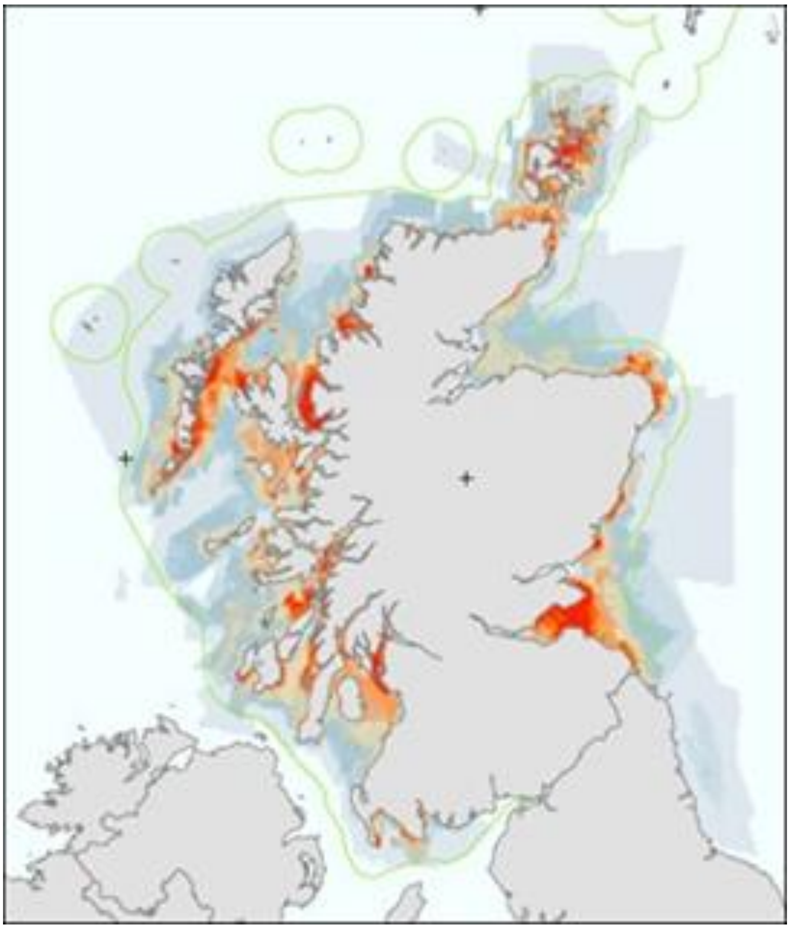


Fig 6.2.1 Example of Raster Map produced by ScotMap Project

These maps were generated by

1. Splitting the inshore area into very small rectangles.
2. Taking each polygon in turn and allocating the vessel to any of the small rectangles contained within it
3. Taking each polygon in turn and subdividing equally the value generated to each small rectangle found within the polygon.
4. Aggregating the number of vessels and the value in each of the small rectangles.
5. Producing a raster map by giving each value in the small polygon a colour e.g. 5 might be bright red, 3 a dark orange, 1 a light orange (see above Figure).

The process above means the Raster maps contain the aggregated information from the ScotMap project in a very dense format.

By splitting the raster into the IFG zonal polygons and summing the values in each of the small rectangles within the polygon it is possible to reverse the process and identify the value in each of this study's zones by species/gear-type.

Within Arc-GIS the "Zonal Statistics As Table" tool scans the raster values within any defined polygon and produces the sum of the raster values as one of the outputs. The table below shows the values generated by the procedure.

Table 6.2.1 Total Revenues estimated for each IFG by limit zone from ScotMap sample

	1 mile	3 mile	6 mile	12 mile
South West	£5,016,616	£8,050,246	£10,302,822	£10,809,416
North West	£4,257,352	£7,309,783	£8,817,997	£9,309,036
O. Hebrides	£2,439,342	£4,638,831	£5,930,194	£6,498,447
MF&NC	£1,223,678	£2,354,402	£3,340,052	£3,528,022
Orkney	£3,001,487	£4,280,057	£4,650,487	£4,868,764
East Coast	£1,944,109	£4,818,584	£6,296,235	£6,983,207
Scotland	£17,882,584	£31,451,904	£39,337,786	£41,996,893

6.2.3 Coverage and Non-Response Adjustment for Vessels Under 15m

The ScotMap project was based on information volunteered by fishermen. There could therefore be an element of error in both defining the fishing area and in assessing the revenue generated, but this was thought to minimal. A far greater problem is non-response. The table below shows the estimated survey coverage of vessels and revenue based on port of registration.

Table 6.2.2 Estimated Survey Coverage of Vessels and Revenue by Port

District Name	Vessel Coverage (i)	Average Landings 2010-11 Coverage (ii)
Aberdeen	63/81 (78%)	£ 4.02M /£ 4.39M (92%)
Anstruther	92/115 (80%)	£ 7.06M /£ 8.04M (88%)
Ayr	41/98 (42%)	£ 4.53M /£ 6.54M (69%)
Buckie	34/52 (65%)	£ 2M /£ 3.31M (60%)
Campbeltown	80/125 (64%)	£ 7.22M /£ 11.88M (61%)
Eyemouth	78/96 (81%)	£ 7.37M /£ 8.69M (85%)
Fraserburgh	77/96 (80%)	£ 2.33M /£ 4.35M (54%)
Kinlochbervie	11/20 (55%)	£ 0.56M /£ 1.05M (54%)
Lochinver	8/13 (62%)	£ 0.69M /£ 1.22M (57%)
Mallaig	19/39 (49%)	£ 1.11M /£ 2.38M (47%)
Oban	61/107 (57%)	£ 5.9M /£ 8.53M (69%)
Orkney	130/130 (100%)	£ 9.66M /£ 10.34M (93%)
Peterhead	41/45 (91%)	£ 1.42M /£ 1.51M (95%)
Portree	86/133 (65%)	£ 7.96M /£ 11.36M (70%)
Scrabster	50/75 (67%)	£ 2.53M /£ 3.28M (77%)
Stornoway	172/200 (86%)	£ 10.67M /£ 12.22M (87%)
Ullapool	47/85 (55%)	£ 3.67M /£ 5.48M (67%)
Total:	**1090/1510 (72%)**	**£ 78.71M /£ 104.56M (75%)**

During their assessment of the coverage, MSS staff had identified the reported catch associated with the non-responding vessels from the landings data. MSS staff were able to provide the catch by species/gear type and by home port for all vessels not in the sample. The IFG figures for non-reporting vessels were then estimated by aggregating the data for the ports within the IFG (with the exception of Fraserburgh which was aggregated into the Moray IFG). The split into zones was based on the recorded information for similar IFG/Gear type combinations. This was then simply added into the data set. The finalised data was then sent for validation by the fishing community.

6.2.4 Final Validation of Results

All the re-estimates were sent to every Fishery Office for final checking. Two small anomalies were identified relating to pelagic catches in the Moray Firth and North Coast and in the East Coast IFG. These reasons for these related to recording procedures rather than computational outcomes. Appropriate adjustments were made.

6.2.5 The Special Case of Shetland under 15 m vessels

Inshore fishing in Shetland operates under the ***Shetland Regulating Order Regulated Fishery Order 2012.*** The Order is managed by the Shetland Shellfish Management Organisation (SSMO) that regularly commissions studies of fish stocks and fishing activity around the islands.

One such study paralleled the ScotMap. Publications include Shape files identifying fishing grounds. An example is given in the figure below.

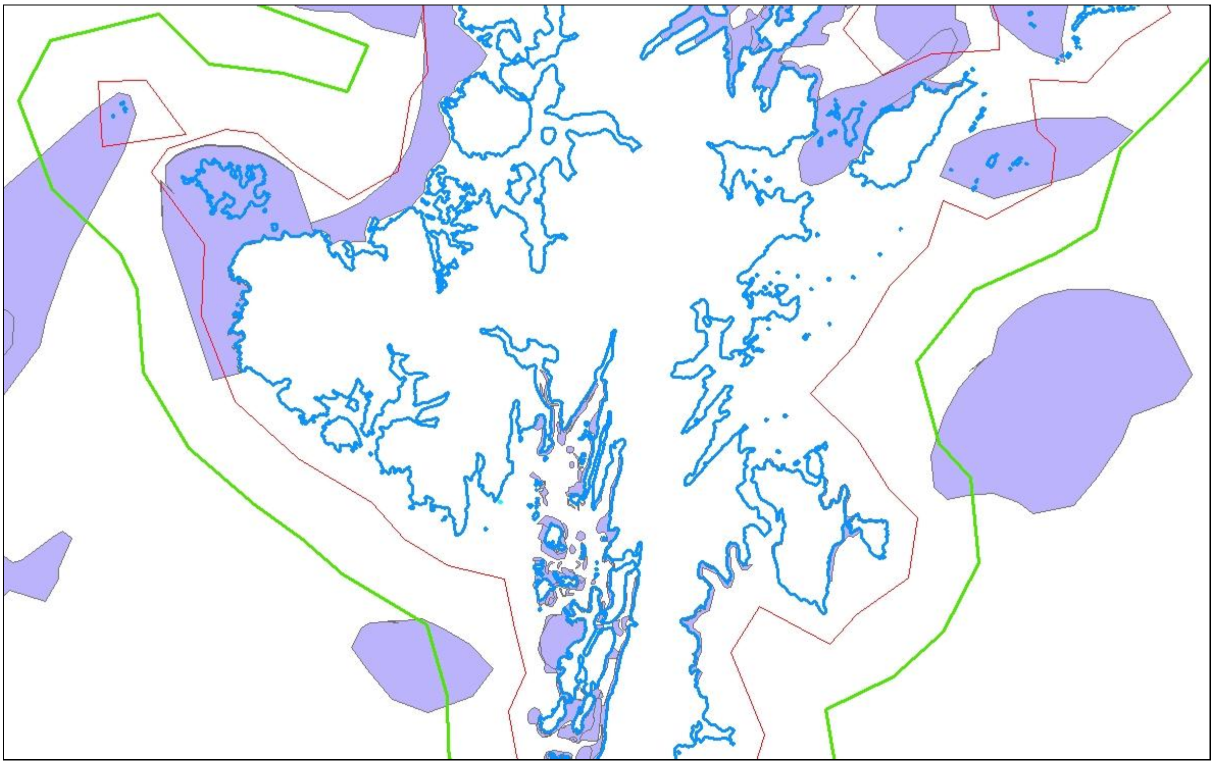


Fig 6.2.3 Identified Shellfish Fishing Areas, South Central Mainland and 1 & 3NM zones

Although rather crude it was assumed that catch in each zone was proportionate to the area fished. Less crudely the total catch equates to the landings. Thus for each of the species types the percentage of the area in each zone was calculated and multiplied by total catch to give final estimates of the amount caught within 1, 3 and 6 NM of the shore.

6.3 Modelling Effort for Under 15 m Vessels

Measuring fishing effort for each zone within each IFG effort is a complex calculation involving vessel numbers, the size and power of those vessels and the length of time they spend in each zone. The only variable which measured effort for the under-15m vessels was the vessel counts. We endeavoured to develop an effort variable (equivalent vessel unit) which captured the amount of effort vessels devoted to each zone within each IFG. As the project progressed it became clear that apportioning the total equivalent vessel units between zones within IFGs was only possible by assuming a perfect correlation between revenue and effort. In effect the impact of, for example, a 10% change in effort would be a 10% change in the revenue. There is nothing to be gained by a “bottom up” modelling of effort if this requires the assumption of a perfect correlation.

The problem however is that for the under 15m fleet, the conversion of trawlers to creelers or the transfer of licences from trawling to creeling is based on the number of vessels involved. Rather than try to calculate revenue/vessel from our data, which would have required the calculation of a vessel equivalent, the revenue per vessel obtained from Seafish’s Cost and Revenue Statistics was used. Estimates of the effort currently employed inshore are thus not used in the model.

7 ECONOMIC DEPENDENCY ON INSHORE FISHING

It has been suggested that in a number of villages inshore fishing is critical to the economy and that any restrictions might have serious outcomes for the health of that community. For example the Scottish Executive (2005) stated that “fishing is the economic mainstay of many of our most remote and fragile coastal communities bringing them wealth and social cohesion”.

Campbell et al (2010) examine the evidence using Travel to Work Areas (TTWA). They found that crude measures of fisheries dependence can be misleading. In Scotland only three out of 38 coastal Travel to Work Areas (TTWAs) show a level of employment dependence in excess of 10% (Fraserburgh 19.6%, Berwickshire 12.3%, and Uists and Barra 11.1%) and a further seven TTWAs over 5%. The measure of dependence is based on direct employment in fishing, fish processing and aquaculture. It excludes any multiplier to account for other local employment wholly or partly related to fishing activity (repair facilities; gear manufacture; box making; ice plants; transport firms *etc*.), let alone the proportion of local service sector jobs dependent on the local spending of incomes generated in the fisheries sector. Nor are there any regular, up to date, comparative data on value added revenues attributable to the local fisheries sector.

Basic data on direct employment, first hand sales value of landings and the fishing fleet are adequate. However the TTWAs are too large to examine the dependence of small communities and also missing is the array of social data on demographics, housing, education, health and social exclusion that can help to describe the varying economic and social circumstances in which fisheries dependence may occur.

Fortunately, such data exist in the small area statistics but the use of these presents a further range of problems associated with defining communities. These problems are discussed in the following section before application of the Scottish Neighbourhood Statistics (SNS) and the Business Register Employment Survey (BRES) to our defined fishing communities.

After this work was finished, Jones (2013) also completed an analysis for the Marine Analytical Unit of Marine Scotland of the Scottish Index of Multiple Deprivation (SIMD). This work is slightly different in that the data-zones around “Ports” were subjectively identified. Their rankings on the Index were then analysed. The results suggested that Fishing Communities were not significantly different from other Scottish communities with similar ranges of deprivation and affluence.

7.1 Definitions and Methodology

The basic unit utilised is the data-zone and there are 6,505 data-zones in Scotland. Each data-zone consists of around 250 households / 800 people, but may well be smaller if there is a strong argument for adhering to physical boundaries. For example, an island of 500 people may be treated as a single data zone.

Initially this research was to be confined to those data-zones whose centroids are within 2 km of the coast. This excluded inland processors and the jobs dependent upon them and could conceivably understate the impact in larger communities which have processing or engineering services located significantly more than 1 km away.

In practice the effect of using the centroid is to expand the buffer area to an average of 2 km from the coast. 1450 data-zone centroids were within the buffer.

For this study it was believed that data-zones in cities such as Aberdeen needed to be distinguished from villages such as Carradale and indeed from larger towns such as Stornoway. The OS Gazetteer identifies cities, towns and villages. Some of these may be misleading e.g. Bridge of Don is defined as a village rather than as part of the City of Aberdeen, but to enable checking and replication the OS definition was utilised. A few data-zones could not be related directly and were added directly.

After some experimentation it was found a generic analysis of all data-zones on the coast was unwieldy and misleading. It was unclear, for example, how towns like Helensburgh, Perth or Portobello were relevant to an analysis of fishing communities. Instead the focus was shifted to the home ports of the fishing fleet as defined in Scottish Sea Fisheries Statistics (2012).This identifies the administrative and home port for all licensed vessels. For boats registered in Scotland the number associated with each home port were identified. The complete list of home ports is given in Appendix 1. Although single boats may be critical to the welfare of individual families, particularly on isolated island communities, the data cannot support such detail. For this analysis, therefore, a fishing community is defined as any area where there are at least 5 licensed fishing vessels. This gave some 72 towns and villages for analysis.

These 72 ports were then mapped. This was normally straightforward but a few such as Central Mainland or West Mainland or South Lochs were ambiguous and a best guess was implemented based on administrative port and distance from other home ports. This information was then combined with GIS information from the SNS and BRES.

The procedure followed was then as follows

- Data-zones whose centroids were within 2 km of the coast were identified.
- The nearest port was allocated to each data zone centroid and the distance between calculated.
- All data zones where the distance was more than 2km were excluded. This still meant that in a city like Aberdeen there are 35 zones to consider.
- In some cases e.g. island clusters; there was no data zone centroid within 2km of the harbour. In these cases the closest data zone was associated with the port.
- In a few cases the data zone centroid was not within 2km of the coast. In these cases the data zone that includes the port was visually identified from the map.

Once the data-zones associated with each port have been identified it is easy to attach any data available at data-zone level.

7.2 The Socio-Economic Features of Fishing Communities

The SNS currently contains 1012 series at data-zone level. The Socio-Economic characteristics of communities are, however, neatly summarised in the construction of the Index of Multiple Deprivation. This ranks each zone from 1 to 6505 according to 9 criteria e.g. on the number of people seeking employment. The data zone with the highest unemployment rate is marked as 1. The Index of Multiple Deprivation combines these scores and then ranks them. For ease of inspection the scores have been grouped as follows.

Table 7.2.1 Deprivation Scores, Descriptions

Score	Description
1:1500	"very deprived"
1500:2800	"deprived"
2800:3600	"average"
3600:4900	"well provided"
4900:6505	"very well provided"

Appendix 2 shows the results. Inspection of Appendix 2 shows that there is no such thing as a typical fishing community. Some are well above the average, some well below. Some in the same geographic area such as Methil and St Andrews are markedly different in their socio-economic status. Where data-zones are part of a larger community such as Aberdeen the results can be misleading as these tend to be clustered in the poorer industrial areas close to the harbour.

In order to summarise, for each fishing port, a score of 1 was allocated to “very well provided” down to 5 for “deprived.” Appendix 3 presents the result for each port.

Analysis suggests that there is no correlation between socio-economic status, fleet size or geographical location (local authority). Two (St Andrews and Crail) are in the top 20% strata and two (Methil and Lybster) in the bottom 20% but the rest (68) are “normal”.

As a general rule fishing communities appear to have poorer transport links and poorer access to facilities than the norm. However, those with particularly poor links, typically have above average ranks in education, health and housing. The Table below presents the number of ports achieving a particular deprivation ranking for each criterion.

Table 7.2.2 Number of Ports by Deprivation Ranking for each Criterion.

	Very Well Provided	Well Provided	Average	Deprived	Very Deprived	Mean Score
Drive Time	8	20	2	5	37	**3.6**
Public Transport	4	19	11	5	33	**3.61**
Access Overall	7	21	4	5	35	**3.56**
Crime	29	10	8	22	3	**2.44**
Education	6	23	29	12	2	**2.74**
Employment	10	22	24	15	1	**2.65**
Health	13	21	15	20	3	**2.71**
Housing	7	18	20	20	7	**3.03**
Income	6	26	23	16	1	**2.72**
Multiple Index	2	21	24	23	2	**3.03**

Given an expected mean of 2.5 it would appear that fishing communities tend to be around or just below average on most measures but significantly worse off in terms of access.

7.3 Unemployment

The measure of Unemployment used here is the Claimant Count as of October 2013. This tends to under-estimate the actual level of unemployment as it does not measure under-employment, fictitious self-employment and non-registration (or exclusion). On the other hand it does include those who might be undertaking unregistered casual work. Table x gives the results.

Table 7.3. Claimant Count for Coastal Communities

Community	Claimants	Rate	Community	Claimants	Rate
SCOTLAND	144257	4.4%	ALL FISHING	6031	4.1%
ABERDEEN	735	3.6%	LOCHINVER	10	3.0%
ANSTRUTHER	67	2.9%	LUING	7	1.3%
ARBROATH	304	6.0%	LYBSTER	27	7.0%
ARISAIG	15	3.0%	MACDUFF	164	3.5%
AYR	659	6.6%	MALLAIG	12	2.5%
BALLANTRAE	22	5.6%	METHIL	518	7.2%
BENBECULA	21	4.4%	MONTROSE	263	4.0%
BERNERA	16	4.3%	OBAN	140	3.5%
BROADFORD	34	3.0%	PETERHEAD	323	4.0%
BUCKIE	198	4.6%	PITTENWEEM	15	1.4%
BUTE	191	6.2%	PORTREE	50	3.5%
CAMPBELTOWN	141	5.0%	PORTSOY	29	3.0%
CARRADALE	13	2.9%	ROSEHEARTY	19	2.4%
CASTLEBAY	17	5.1%	SANDAY	14	2.6%
CENTRAL SHETLAND	7	1.1%	SCALLOWAY	10	2.0%
CRAIL	24	2.3%	SCALPAY	13	2.4%
DRUMMORE	15	3.7%	SCRABSTER	61	3.6%
DUNROSSNESS	7	1.2%	SOUTH HARRIS	28	5.0%
DUNVEGAN	13	2.6%	SOUTH LOCHS	11	2.4%
EYEMOUTH	99	5.2%	SOUTH RONALDSAY	5	1.1%
FORT WILLIAM	134	3.6%	SOUTH UIST/ERISKAY	3	1.0%
FRASERBURGH	206	4.0%	ST ANDREWS	32	0.5%
GARDENSTOWN	3	0.8%	STORNOWAY	158	4.1%
GIRVAN	233	6.0%	STROMNESS	23	2.1%
GOURDON	18	1.3%	TARBERT	24	2.8%
GRIMSAY	17	3.3%	TINGWALL	5	1.1%
HOY	9	1.4%	TOBERMORY	18	2.7%
ISLAY	14	2.7%	TORRIDON	13	2.8%
JOHN O'GROATS	8	1.8%	TROON	201	4.8%
JOHNSHAVEN	20	3.8%	ULLAPOOL	19	2.2%
KINLOCHBERVIE	6	2.0%	WEST MAINLAND	0	0.0%
KIRKCUDBRIGHT	85	3.9%	WESTRAY	7	1.4%
KIRKWALL	49	1.6%	WHALSAY	0	0.0%

Community	Claimants	Rate	Community	Claimants	Rate
KYLE	27	6.9%	**WHITEHILLS**	14	2.1%
LERWICK	98	2.2%	**WICK**	240	6.6%
LOCH SCRIDAIN	10	2.5%	**YELL**	20	4.1%

The results again suggest that fishing communities around Scotland are not developing in any specific way. Some towns with a declining industrial heritage such as Methil and Campbeltown have high levels of unemployment as do some of the remote rural villages such as Barra and South Harris. However these are contrasted by high levels of employment in oil towns like Aberdeen and in remote areas like South Uist and South Ronaldsay. The rates in Ayr, Ballantrae, Bute and Girvan may be related to the economic situation in the west of Scotland in general and to early voluntary retirement/release rather than any specific decline in fishing. In the next section we examine the industrial structure of the fishing communities.

7.4 Community Dependence on the Fishing Sector

The BRES publishes employee and employment estimates at detailed geographical and industrial levels. It collects comprehensive employment information from businesses in England, Scotland and Wales representing the majority of the GB economy. BRES is regarded as the definitive source of official government employee and employment statistics by industry. Employment is obtained by adding the number of working owners to the number of employees employed by a business where working owners include sole traders, sole proprietors and partners who receive drawings and/or a share of profits, but are not paid via PAYE.

In terms of data, the survey sample of approximately 80,000 businesses is weighted up to represent the GB economy covering all sectors. One of the strengths of BRES is that estimates are provided at detailed geographical and industrial levels (down to a lower super output geography at a 5-digit Standard Industrial Classification (SIC)). No other Office of National Statistics employment survey output provides such information at these low levels and this enables a detailed analysis of employment at low level geographies and industries.

It should be noted BRES is a sample survey and produces estimated employment figures. These estimates are of a good quality at higher levels of geography (for example region). The quality of the estimates deteriorates as the geographies get smaller and this should be taken into account when considering the quality of sub-national estimates.

Agriculture is not collected or published at DZ level in the survey and consequently estimates of employment identified as Agriculture, Forestry and Fishing in practice only relate to Forestry and Fishing. Even then it appears that the coverage of employment in Fishing is spasmodic. Whilst the larger deep sea vessels operating from Peterhead, Buckie and Fraserburgh are included, fishermen working on small trawlers and creel boats should have but have not been identified.

Table 7.4.1 BRES Employment Data

District	Regularly Employed	Irregularly Employed	Crofters	Total	BRES
Aberdeen	78	34	-	**112**	18
Anstruther	114	51	-	**165**	12
Buckie	136	48	-	**184**	170
Eyemouth	116	50	-	**166**	19
Fraserburgh	643	154	-	**797**	548
Peterhead	347	31	-	**378**	315
Scrabster	111	-	-	**111**	26
Total East Coast	**1,545**	**368**	**-**	**1,913**	1108
Orkney	235	119	-	**354**	48
Shetland	231	201	-	**432**	211
Stornoway	298	56	17	**371**	50
Total Islands	**764**	**376**	**17**	**1,157**	**309**
Ayr	507	74	-	**581**	109
Campbeltown	279	44	-	**323**	29
Kinlochbervie	39	-	1	**40**	38
Lochinver	19	2	2	**23**	1
Mallaig	92	7	-	**99**	64
Oban	231	-	-	**231**	28
Portree	152	34	34	**220**	31
Ullapool	124	36	-	**160**	3
Total West Coast	**1,443**	**197**	**37**	**1,677**	**303**
All districts	**3,752**	**941**	**54**	**4,747**	**1,720**

Despite the limitations relating to numbers of fishermen, data on the static industries, fish processing, net making and repair and boat repair should be accurate.

The Table below compares the employment in these fishing industries with employment in the tourist industries.

Table 7.4.2 Employment in Tourism and Fishing Compared

	Fishing Industries					Tourist Industries				
	Marine Fishing	Processing	Ropes and Nets	Boat Repair	All	Accomm.	Catering	Sport & Recreation	All	Difference
SCOTLAND	0.1%	0.3%	0.0%	0.3%	**0.7%**	2.4%	4.6%	1.7%	**8.6%**	7.9%
ALL FISHING	1.1%	2.0%	0.0%	0.3%	**3.4%**	4.0%	6.2%	2.1%	**12.2%**	8.8%
Aberdeen	0.0%	1.0%	0.0%	0.1%	**1.1%**	2.6%	8.8%	1.8%	**13.3%**	12.2%
Anstruther	0.8%	0.2%	0.0%	1.2%	**2.2%**	8.1%	14.7%	1.3%	**24.1%**	21.9%
Arbroath	0.0%	0.0%	0.0%	0.0%	**0.0%**	0.6%	6.2%	1.0%	**7.9%**	7.8%
Arisaig	0.4%	0.0%	0.0%	0.0%	**0.4%**	25.4%	4.5%	0.0%	**29.9%**	29.5%
Ayr	0.0%	0.0%	0.0%	0.0%	**0.0%**	5.3%	7.0%	2.1%	**14.5%**	14.5%
Ballantrae	0.0%	0.0%	0.0%	0.0%	**0.0%**	20.2%	1.6%	0.0%	**21.9%**	21.9%
Benbecula	0.0%	0.0%	0.0%	0.0%	**0.0%**	1.7%	6.1%	0.7%	**8.5%**	8.5%
Bernera	14.0%	0.7%	0.0%	0.0%	**14.7%**	6.3%	0.7%	0.0%	**7.0%**	-7.7%
Broadford	1.6%	0.0%	0.0%	0.0%	**1.6%**	14.7%	5.0%	0.4%	**20.2%**	18.6%
Buckie	6.2%	7.7%	0.0%	0.3%	**14.2%**	2.2%	4.1%	3.7%	**10.1%**	-4.2%
Bute	0.2%	0.0%	0.0%	0.0%	**0.2%**	2.9%	2.9%	2.5%	**8.3%**	8.2%
Campbeltown	0.6%	0.0%	0.0%	0.0%	**0.7%**	3.4%	2.3%	4.5%	**10.2%**	9.5%
Carradale	3.9%	0.0%	0.0%	0.0%	**3.9%**	9.3%	0.0%	0.8%	**10.1%**	6.2%
Castlebay	1.9%	0.0%	0.0%	0.0%	**1.9%**	15.4%	2.7%	0.4%	**18.5%**	16.6%
Central Shetland	0.2%	0.0%	0.0%	0.0%	**0.2%**	13.1%	12.5%	3.9%	**29.6%**	29.4%
Crail	0.0%	0.0%	0.0%	0.0%	**0.0%**	27.7%	4.0%	12.1%	**43.8%**	43.8%
Drummore	0.0%	0.0%	0.0%	0.0%	**0.0%**	10.4%	11.9%	0.0%	**22.4%**	22.4%
Dunrossness	0.7%	0.0%	0.0%	0.0%	**0.7%**	9.3%	0.0%	0.4%	**9.7%**	9.0%
Dunvegan	0.0%	0.0%	0.0%	0.0%	**0.0%**	12.7%	16.4%	0.7%	**29.9%**	29.9%
Eyemouth	2.2%	12.0%	0.0%	0.0%	**14.2%**	1.1%	6.6%	2.2%	**9.9%**	-4.3%
Fort William	0.1%	0.0%	0.0%	0.0%	**0.1%**	9.6%	8.6%	1.8%	**20.0%**	19.9%
Fraserburgh	7.2%	18.9%	0.4%	0.4%	**26.9%**	0.0%	3.2%	1.7%	**5.0%**	-21.9%
Gardenstown	60.3%	0.0%	0.0%	0.0%	**60.3%**	0.0%	2.6%	0.0%	**2.6%**	-57.7%
Girvan	0.2%	0.0%	0.0%	0.0%	**0.2%**	0.7%	8.1%	0.8%	**9.6%**	9.3%
Gourdon	0.0%	0.0%	0.0%	0.0%	**0.0%**	4.1%	6.3%	0.0%	**10.3%**	10.3%
Grimsay	2.3%	0.4%	0.0%	0.0%	**2.7%**	29.1%	0.0%	0.0%	**29.1%**	26.4%
Hoy	1.8%	0.0%	0.0%	0.0%	**1.8%**	0.4%	5.5%	2.6%	**8.5%**	6.6%
Islay	0.0%	0.0%	0.0%	0.0%	**0.0%**	5.8%	0.9%	6.3%	**13.0%**	13.0%
John O'groats	0.0%	0.0%	0.0%	0.0%	**0.0%**	10.6%	0.0%	0.0%	**10.6%**	10.6%
Johnshaven	5.0%	0.0%	0.0%	0.0%	**5.0%**	6.9%	1.3%	0.0%	**8.2%**	3.1%
Kinlochbervie	15.7%	0.0%	0.0%	0.0%	**15.7%**	5.7%	0.0%	2.9%	**8.6%**	-7.1%
Kirkcudbright	0.8%	14.3%	0.0%	0.0%	**15.1%**	3.5%	1.9%	3.0%	**8.4%**	-6.7%
Kirkwall	0.5%	0.0%	0.0%	0.0%	**0.5%**	4.1%	3.0%	1.9%	**9.0%**	8.5%
Kyle	1.8%	0.0%	0.0%	0.5%	**2.3%**	4.8%	8.6%	1.8%	**15.2%**	12.9%
Lerwick	2.4%	3.4%	0.0%	0.9%	**6.7%**	2.1%	4.9%	2.7%	**9.7%**	3.0%
Loch Scridain	3.1%	0.0%	0.0%	0.0%	**3.1%**	33.7%	8.2%	0.0%	**41.8%**	38.8%
Lochinver	0.4%	0.0%	0.0%	0.0%	**0.4%**	19.8%	5.8%	5.1%	**30.7%**	30.4%

	Fishing Industries					Tourist Industries				
	Marine Fishing	Processing	Ropes and Nets	Boat Repair	All	Accomm.	Catering	Sport & Recreation	All	Difference
Luing	0.8%	0.0%	0.0%	0.0%	**0.8%**	0.0%	4.0%	2.4%	**6.3%**	5.6%
Lybster	1.5%	0.0%	0.0%	0.0%	**1.5%**	3.7%	0.0%	0.0%	**3.7%**	2.2%
Macduff	1.6%	0.0%	0.3%	3.4%	**5.4%**	1.1%	2.5%	2.1%	**5.7%**	0.3%
Mallaig	15.2%	7.3%	0.0%	0.0%	**22.5%**	4.8%	10.4%	0.0%	**15.2%**	-7.3%
Methil	0.0%	0.0%	0.0%	2.7%	**2.7%**	0.6%	2.0%	4.0%	**6.6%**	3.9%
Montrose	0.1%	0.0%	0.0%	0.0%	**0.1%**	3.3%	6.8%	3.1%	**13.3%**	13.2%
Oban	0.5%	0.0%	0.0%	0.0%	**0.5%**	8.4%	5.1%	1.8%	**15.3%**	14.8%
Peterhead	4.4%	5.2%	0.1%	0.2%	**10.0%**	2.7%	4.0%	1.5%	**8.2%**	-1.8%
Pittenweem	2.5%	0.0%	0.0%	0.0%	**2.5%**	0.0%	14.7%	0.5%	**15.2%**	12.7%
Portree	0.4%	0.0%	0.0%	0.0%	**0.4%**	11.5%	4.3%	0.7%	**16.5%**	16.1%
Portsoy	0.8%	8.2%	0.0%	0.0%	**9.0%**	3.8%	6.0%	0.0%	**9.9%**	0.8%
Rosehearty	6.1%	0.0%	0.0%	6.1%	**12.3%**	9.6%	1.8%	5.3%	**16.7%**	4.4%
Sanday	1.3%	0.0%	0.0%	0.0%	**1.3%**	6.0%	0.0%	0.0%	**6.0%**	4.6%
Scalloway	0.0%	13.2%	0.0%	0.2%	**13.4%**	4.7%	1.4%	0.0%	**6.1%**	-7.3%
Scalpay	0.9%	0.0%	0.0%	1.5%	**2.4%**	15.4%	1.5%	0.0%	**16.9%**	14.5%
Scrabster	0.2%	0.0%	0.0%	0.0%	**0.2%**	10.6%	0.3%	0.0%	**10.9%**	10.7%
South Harris	0.0%	0.0%	0.0%	0.0%	**0.0%**	9.3%	3.9%	0.0%	**13.2%**	13.2%
South Lochs	4.1%	0.0%	0.0%	0.0%	**4.1%**	4.7%	6.8%	0.0%	**11.5%**	7.4%
South Ronaldsay	1.3%	0.0%	0.0%	0.0%	**1.3%**	12.6%	24.5%	0.0%	**37.1%**	35.8%
South Uist/Eriskay	14.0%	2.3%	0.0%	0.0%	**16.3%**	53.5%	0.0%	0.0%	**53.5%**	37.2%
St Andrews	0.0%	0.0%	0.0%	0.0%	**0.0%**	6.1%	10.3%	4.2%	**20.7%**	20.7%
Stornoway	0.1%	1.6%	0.0%	0.0%	**1.7%**	2.9%	3.0%	0.6%	**6.6%**	4.8%
Stromness	0.1%	1.9%	0.0%	1.4%	**3.4%**	6.7%	4.9%	3.5%	**15.1%**	11.7%
Tarbert	3.2%	5.0%	0.0%	0.0%	**8.2%**	3.2%	9.4%	0.0%	**12.6%**	4.4%
Tingwall	0.5%	0.0%	2.8%	0.0%	**3.3%**	0.5%	0.5%	7.5%	**8.5%**	5.2%
Tobermory	1.3%	0.9%	0.0%	0.0%	**2.2%**	16.8%	4.6%	0.2%	**21.6%**	19.4%
Torridon	1.7%	0.0%	0.0%	0.0%	**1.7%**	37.3%	3.0%	6.0%	**46.3%**	44.7%
Troon	4.3%	0.0%	0.0%	0.3%	**4.7%**	5.3%	9.9%	3.5%	**18.7%**	14.0%
Ullapool	0.4%	0.0%	0.0%	0.0%	**0.4%**	17.0%	9.6%	2.2%	**28.8%**	28.4%
West Mainland	4.3%	0.0%	0.0%	0.0%	**4.3%**	0.0%	0.0%	0.0%	**0.0%**	-4.3%
Westray	4.1%	2.1%	0.0%	0.0%	**6.2%**	5.8%	0.0%	0.8%	**6.6%**	0.4%
Whalsay	16.9%	18.2%	0.0%	0.0%	**35.1%**	0.0%	0.0%	1.3%	**1.3%**	-33.8%
Whitehills	12.7%	30.5%	0.0%	0.0%	**43.2%**	0.0%	5.1%	0.0%	**5.1%**	-38.1%
Wick	0.8%	0.0%	0.0%	0.0%	**0.8%**	2.2%	1.9%	0.3%	**4.3%**	3.6%
Yell	0.0%	0.0%	0.0%	0.0%	**0.0%**	4.2%	0.0%	4.6%	**8.8%**	8.8%

The communities where employment in fishing related industries exceeds 20% are marked in yellow. With the exception of Gardenstown, all these communities have processing plants. In general, employment in tourist industries substantially exceeds that in fishing related industries. This is illustrated by the final column of the table.

Where tourism employment does not exceed fishing sector employment is marked in red type. Where this exceeds 10% (marked by a yellow background) it could be argued that there was economic fragility. However Whalsay, Whitehills and Gardenstown all have low or very low unemployment; only Fraserburgh might be classified as a fragile fish based economy.

In summary, it would appear to be difficult to argue that fishing communities face exceptional problems and are unhealthily dependent upon a sustained supply of fish. Clearly difficulties would arise if vessels left the industry because of a steep rise in costs or exceptional restrictions but these would appear to be no more extreme than problems regularly faced by their urban compatriots.

If it became clear that a policy would lead to redundancy in the fishing sector but an overall rise in welfare for the people of Scotland there is nothing exceptional within the communities that would justify an exceptional response.

8 THE BASELINE: SCOTTISH FISHERIES[36]

8.1 Overview

In 2012, Scottish based vessels landed sea fish and shellfish into UK and abroad with a value of £466 million. This was a 9% decrease in value in real terms compared to 2011. There were 2,046 active Scottish based vessels in 2012, the lowest recorded number of vessels and 49 less than in the previous year. These vessels employed a total of 4,747 fishermen, the lowest recorded number and a decline of five per cent from 2011.

In 2012, Scottish vessels landed £166 million of pelagic species, accounting for 36% of the value of all Scottish vessel landings. Demersal species represented 31% of the value of landings and shellfish 34% of landings. Mackerel is the most valuable species to the Scottish fishing industry. It accounted for 28% of the total value of Scottish landings in 2012 and 79 per cent of the value of pelagic landings.

Landings abroad (£112 m accounted for 24% per cent of all landings by Scottish vessels. Of the quantity landed abroad 86 % was pelagic; 12% were demersal and 2% were shellfish. In 2012, there were 331,000 tonnes of sea fish and shellfish landed into Scotland by Scottish and non-Scottish vessels with a value of £419 million. This is a decrease of 14% in the value of landings from 2011.

[36] All data in this Section is sourced from Scottish Sea Fisheries Statistics 2012, Published by the Scottish Government, September 2013

8.2 The Scottish Fleet:

Table 8.2.Scottish based vessels by gear and length (2012)

Main fishing method	10m & under	>10 - 12	>12 - 15	>15 - 24	>24 -40	Over40	Total
Demersal single trawl	15	7	4	73	46	2	**147**
Demersal pair trawl	-	-	-	9	9	-	**18**
Seine net	-	-	-	13	11	1	**25**
Lines	-	-	-	-	13	2	**15**
Demersal gill nets	4	-	-	-	3	-	**7**
Demersal twin/mult trawl	-	-	-	9	7	-	**16**
Beam trawl	-	-	-	-	3	1	**4**
Other demersal	-	-	-	1	1	-	**2**
Demersal total	**19**	**7**	**4**	**105**	**93**	**6**	**234**
Purse seine	-	-	-	-	-	4	**4**
Pelagic trawl	-	-	-	-	-	20	**20**
Pelagic total	**-**	**-**	**-**	**-**	**-**	**24**	**24**
Creel fishing	1,266	88	14	8	-	-	**1,376**
Nephrops trawl	80	41	41	86	3	-	**251**
Mechanical dredging	17	6	16	37	12	1	**89**
Suction dredging	1	1	-	-	-	-	**2**
Shell fishing by hand	65	4	1	-	-	-	**70**
Shellfish total	**1,429**	**140**	**72**	**131**	**15**	**1**	**1,788**
Total	**1,448**	**147**	**76**	**236**	**108**	**31**	**2,046**

The table above summarises the Scottish Fleet of 2,046 vessels as reported in the Scottish Sea Fisheries Statistics. The relative importance in terms of numbers of under 10 m inshore vessels is apparent (1,448 vessels) and under 10 m using creels (1,266 vessels). In 2012, the number of > 10m vessels was 598, a loss of 27 vessels from 2011. The >10 m demersal sector consisted of 215 vessels, a decrease of 14 vessels, while the >10m shellfish sector reduced by 13 vessels to 359 vessels. The number of vessels in the > 10m pelagic sector was unchanged at 24 vessels. There were 1,448 vessels in the ten metre and under fleet, which represents a decrease of 22 vessels since 2011.

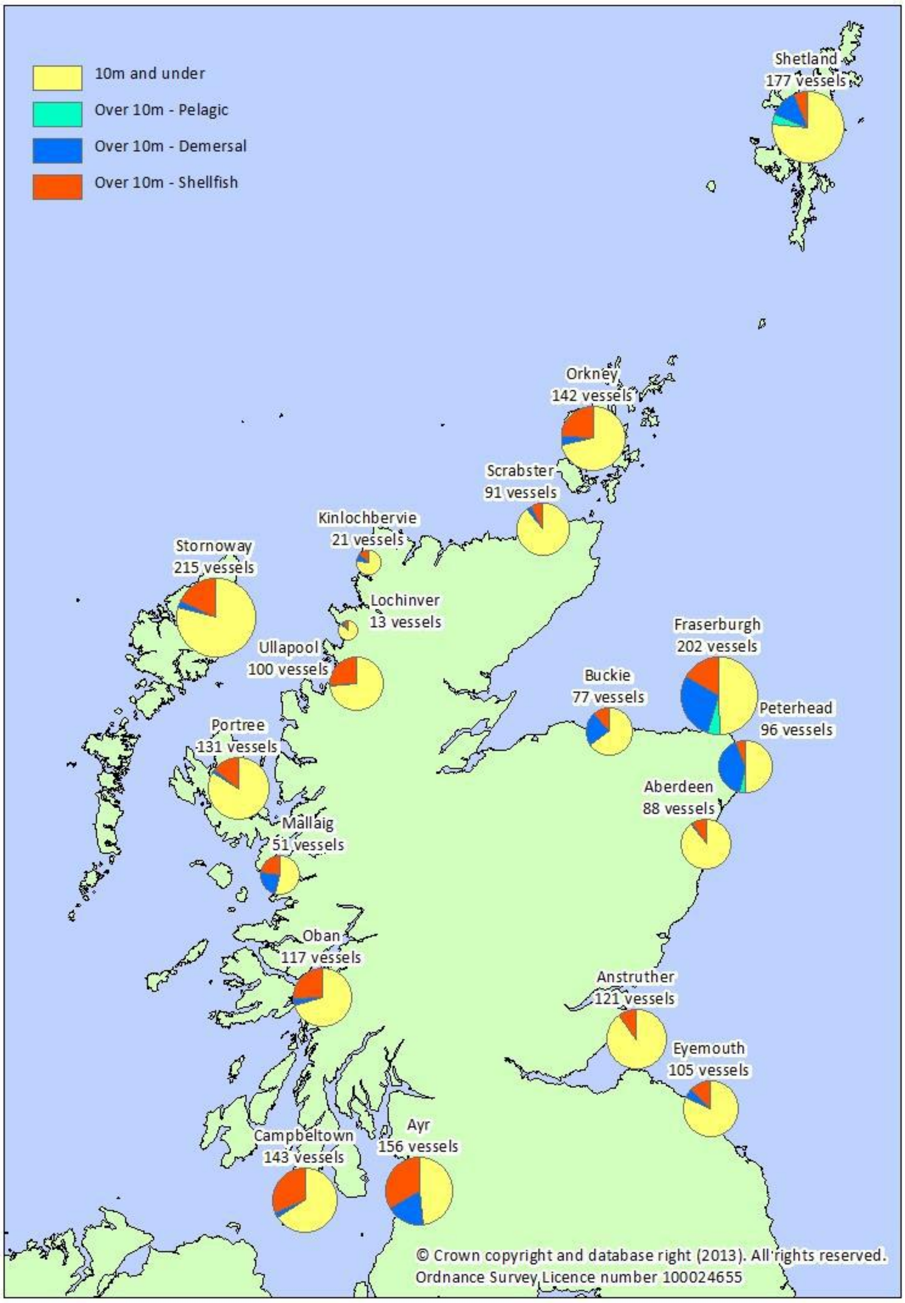


Fig ***8.2. Scottish Fleet by District by Vessel Size by Species***

The figure above highlights the distribution of the Scottish fleet by district by vessel size by species category. In terms of vessel numbers, Stornoway was the district with the largest number of vessels under its responsibility. Three quarters of the 215 Stornoway vessels were in the ten metre and under category. Apart from Fraserburgh, Ayr and Peterhead where there are broadly similar numbers of 10m and under vessels and over 10m vessels, most districts have far more ten metre and under vessels than over 10m.

8.3 Employment in the Catching Sector

From the table below were 4,747 people employed on Scottish based vessels. Of these 3752 were regularly employed with 941 being part-time or irregularly employed. It is noted that the Fraserburgh district office and the port itself are within the East Coast IFG, though the other seven associated ports of the Fraserburgh Office are almost entirely within the Moray Firth and North Coast IFG.

It is probably more sensible to assign the employment associated with the Fraserburgh district to MF&NC. With Fraserburgh located within the MF&NC IFG, then the South West IFG contains the administrative bases whose boats employ the most people, followed by MF&NC and the East Coast.

Table 8.3. Nos. Employed on Scottish based vessels, by district, by notional IFG: 2012

IFG	District	Regularly Employed	Irregularly Employed	Crofters	Total
South West	Ayr	507	74	-	581
	Campbeltown	279	44	-	323
	Oban	231	-	-	231
	Total	**1017**	**118**	**-**	**1135**
North West	Kinlochbervie	39	-	1	40
	Lochinver	19	2	2	23
	Mallaig	92	7	-	99
	Portree	152	34	34	220
	Ullapool	124	36	-	160
	Total	**426**	**79**	**37**	**542**
Outer Hebrides	**Stornoway**	**298**	**56**	**17**	**371**
.	Buckie	136	48	-	184
	Scrabster	111	-	-	111
	Fraserburgh	643	154	-	797
	Total	**1017**	**202**	**-**	**1092**
Orkney	**Orkney**	**235**	**119**	**-**	**354**
East Coast	Aberdeen	78	34	-	112
	Anstruther	114	51	-	165
	Eyemouth	116	50	-	166
	Peterhead	347	31	-	378
	Total	**655**	**166**	**-**	**821**
Shetland	**Shetland**	**231**	**201**	**-**	**432**
All Scotland	**Total**	**3752**	**941**	**54**	**4747**

8.4 Scottish Landings

The Table below presents the landing by Scottish vessels in Scottish ports. For the purposes of this table, Fraserburgh has been allocated to the MF&NC IFG.

The dominance of Peterhead in the East IFG is readily apparent, though the vast majority of the Peterhead catch will caught by large vessels fishing outside the 6 NM IFG area. Indeed, Peterhead is one of the smaller districts in terms vessel numbers with the Peterhead Fishery Office responsible for only 96 vessels. Neither is Peterhead the most important district in terms of employment on fishing vessels.

With respect catches within the East Coast IFG, the catch of Peterhead vessels might not be particularly significant.

Table 8.4.1 Landings by Scottish Vessels by Landing District by Notional IFG Area 2012[37]

IFG	District	Value (£ '000)
South West	Ayr	12,693
	Campbeltown	12,879
	Oban	8380
	Total	**33,952**
North West	Kinlochbervie	13,538
	Lochinver	6,307
	Mallaig	12,063
	Portree	7,901
	Ullapool	11,895
	Total	**51,704**
Outer Hebrides	**Stornoway**	**10,756**
MF&NC	Buckie	3,136
	Scrabster	20,298
	Fraserburgh	35,459
	Total	**58,893**
Orkney	**Orkney**	**6,491**
East Coast	Aberdeen	4,215
	Anstruther	4,514
	Eyemouth	6,187
	Peterhead	109,947
	Total	**124,863**
Shetland	**Shetland**	**44,604**
All Scotland	**Total**	**331,263**

The table below presents the landings by all Scottish and non-Scottish vessels by the main species groups by district by notional IFG.

The three largest individual districts in Scotland in terms of landings were; Peterhead (East Coast IFG), Shetland and Fraserburgh (MF&NC IFG). These three districts accounted for 57% in value of all landings into Scotland. One hundred and fifty two thousand tonnes, worth £142 m, were landed into Peterhead of which 49% were pelagic species. Landings into Shetland were valued at £59m, pelagic species accounted for 57 per cent of this value, whilst demersal species accounted for 36% and shellfish species for 7%. The third biggest district, Fraserburgh, was dominated by shellfish landings, representing over half the value of the landings.

Landings into the South West IFG districts, the Outer Hebrides IFG and Orkney were dominated by shellfish, while demersal landing dominate landings into the North West IFG districts. Shellfish is more important in most East Coast districts with the notable exception of Peterhead. The relative importance of the major species groups is quite varied across the MF&NC districts.

[37] Derived from Table 1.2 **"**Number of voyages and the quantity and value of landings by Scottish vessels by landing district: 2008 to 2012" Scottish Sea Fisheries Statistics 2012, published September 2013

Table 8.4.2 Value of all landings by main species groups by district by notional IFG area (2012)[38]

IFG	District	Total demersal	Total pelagic	Total shellfish	Total landings (£'000)
South West	Ayr	£6	£15	£13,915	£13,936
	Campbeltown	£17	£97	£15,961	£16,075
	Oban	£30	£1	£8,787	£8,818
	Total	**£53**	**£113**	**£38,663**	**£38,829**
North West	Kinlochbervie	£11,344	£10	£2,578	£13,932
	Lochinver	£28,859	£0	£3,082	£31,940
	Mallaig	£2,543	£372	£9,883	£12,798
	Portree	£11	£4	£7,931	£7,946
	Ullapool	£8,366	£48	£6,473	£14,887
	Total	**£51,123**	**£434**	**£29,947**	**£81,503**
Outer Hebrides	**Stornoway**	**£161**	**£0**	**£10,605**	**£10,766**
MF&NC	Buckie	£115	£34	£3,012	£3,161
	Scrabster	£18,730	£4	£6,546	£25,279
	Fraserburgh	£6,126	£10,907	£19,537	£36,570
	Total	**£24,971**	**£10,945**	**£29,095**	**£65,010**
Orkney	**Orkney**	**£52**	**£20**	**£6,418**	**£6,491**
East Coast	Aberdeen	£77	£58	£4,193	£4,328
	Anstruther	£2	£34	£4,501	£4,537
	Eyemouth	£297	£46	£6,582	£6,925
	Peterhead	£61,932	£69,504	£10,205	£141,641
	Total	**£62,308**	**£69,642**	**£25,481**	**£157,431**
Shetland	**Shetland**	**£21,536**	**£33,632**	**£3,955**	**£59,124**
All Scotland	**Total**	**£160,204**	**£114,786**	**£144,164**	**£419,154**

8.5 Scottish Inshore Fisheries

The official statistics do not present data for landings from each of the IFG areas (i.e. within 6 NM of the shore). The data that exist (see above) do not provide any meaningful insight into what is happening within 6 nm. It has therefore been necessary to estimate landings from catches in the different sea areas based on VMS and Scotmap data. The procedures used were described in Section 6.

Our baseline catch estimates for the entire Scottish Inshore Fisheries area for 2011 are presented below. These are the summation of the estimates for each of the IFG areas, the results of which are presented in later sections.

[38] Derived from Table 1.7 Quantity and value of all landings into Scotland by district and main species: 2008 to 2012, Scottish Sea Fisheries Statistics 2012, published September 2013.

8.6 Scotland: Baseline Inshore Fishery 2011 Catch Estimates

8.6.1 Scotland Zone 0-1 nm

Table 8.6.1 Scotland: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

SCOTLAND 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£229,485	£0	£0	£0	£0	£229,485
Nephrops Trawl	Val	£0	£0	£4,758,325	£0	£0	£4,758,325
Pelagic Lines	Val	£0	£202,036	£0	£0	£0	£202,036
Dredge	Val	£0	£0	£0	£2,027,957	£0	£2,027,957
Pots	Val	£0	£0	£8,394,516	£0	£12,320,115	£20,714,631
Hand Dive	Val	£0	£0	£0	£2,211,087	£136,046	£2,347,134
Total	**Val**	£229,485	£202,036	£13,152,842	£4,239,045	£12,456,161	£30,279,568

Table 8.6.2 Scotland: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

SCOTLAND 1nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£1,760,238	£2,068	£300,954	£0	£0	£72,921	£2,136,181
Trawl	Vol	1,111	2	91	0	0	17	1,222
Nephrops	Val	£105,701	£155	£3,546,211	£112	£25,386	£8,514	£3,686,078
Trawl	Vol	76	0	1,281	0	57	3	1,416
Pelagic	Val	£0	£2,166,659	£0	£0	£0	£0	£2,166,659
Trawl	Vol	0	1,840	0	0	0	0	1,840
Other	Val	£3,327	£63,944	£5,776	£0	£0	£310,939	£383,985
Trawl	Vol	3	127	2	0	0	55	187
Dredge	Val	£118	£258	£0	£2,275,146	£48,734	£2,105	£2,326,362
	Vol	0	0	0	1,171	122	0	1,294
Pots	Val	£1,245	£0	£43,404	£319	£0	£336,724	£381,692
	Vol	1	0	7	0	0	196	205
Total	**Val**	£1,870,629	£2,233,083	£3,896,344	£2,275,577	£74,120	£731,203	£11,080,957
	Vol	1,192	1,970	1,381	1,171	179	271	6,164

Table 8.6.3 Scotland: Catch Value by Gear Type by all Vessels in 0-1 NM zone

SCOTLAND 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£1,989,723	£2,068	£300,954	£0	£72,921	£2,365,666
Nephrops Trawl	Val	£105,701	£155	£8,304,536	£25,497	£8,514	£8,444,403
Pelagic Trawl	Val	£0	£2,166,659	£0	£0	£0	£2,166,659
Pelagic Lines	Val	£0	£202,036	£0	£0	£0	£202,036
Other Trawl	Val	£3,327	£63,944	£5,776	£0	£310,939	£383,985
Dredge	Val	£118	£258	£0	£4,351,837	£2,105	£4,354,319
Pots	Val	£1,245	£0	£8,437,920	£319	£12,656,839	£21,096,323
Hand Dive	Val	£0	£0	£0	£2,211,087	£136,046	£2,347,134
Total	**Val**	**£2,100,114**	**£2,435,119**	**£17,049,186**	**£6,588,742**	**£13,187,364**	**£41,360,524**

8.6.2 Scotland Zone 0-3 nm

Table 8.6.4 Scotland: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

SCOTLAND 3NM		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£553,833	£0	£0	£0	£0	£553,833
Nephrops Trawl	Val	£0	£0	£10,444,086	£0	£0	£10,444,086
Pelagic Lines	Val	£0	£430,775	£0	£0	£0	£430,775
Dredge	Val	£0	£0	£0	£3,669,255	£0	£3,669,255
Pots	Val	£0	£0	£13,973,793	£0	£18,947,476	£32,921,269
Hand Dive	Val	£0	£0	£0	£2,818,896	£219,346	£3,038,242
Total	**Val**	£553,833	£430,775	£24,417,879	£6,488,151	£19,166,822	£51,057,460

Table 8.6.5 Scotland: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

SCOTLAND 3NM		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£3,614,583	£3,392	£670,359	£0	£0	£210,790	£4,499,124
Trawl	Vol	2,217	3	202	0	0	47	2,470
Nephrops	Val	£166,114	£552	£7,772,306	£335	£31,028	£14,889	£7,985,223
Trawl	Vol	122	0	2,895	0	70	4	3,092
Pelagic	Val	£0	£9,933,972	£0	£0	£0	£0	£9,933,972
Trawl	Vol	0	7,520	0	0	0	0	7,520
Other	Val	£8,343	£105,765	£14,463	£0	£0	£916,937	£1,045,508
Trawl	Vol	7	175	5	0	0	171	358
Dredge	Val	£2,407	£469	£0	£4,149,709	£141,861	£4,605	£4,299,051
	Vol	1	0	0	2,114	359	1	2,475
Pots	Val	£1,245	£0	£75,439	£461	£0	£561,615	£638,761
	Vol	1	0	13	0	0	357	372
Total	**Val**	£3,792,692	£10,044,150	£8,532,568	£4,150,505	£172,889	£1,708,836	£28,401,640
	Vol	2,350	7,699	3,116	2,114	428	580	16,287

Table 8.6.6 Scotland: Catch Value by Gear Type by all Vessels in 0-3 NM zone

SCOTLAND 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£4,168,417	£3,392	£670,359	£0	£210,790	£5,052,958
Nephrops Trawl	Val	£166,114	£552	£18,216,393	£31,362	£14,889	£18,429,309
Pelagic Trawl	Val	£0	£9,933,972	£0	£0	£0	£9,933,972
Pelagic Lines	Val	£0	£430,775	£0	£0	£0	£430,775
Other Trawl	Val	£8,343	£105,765	£14,463	£0	£916,937	£1,045,508
Dredge	Val	£2,407	£469	£0	£7,960,825	£4,605	£7,968,306
Pots	Val	£1,245	£0	£14,049,232	£461	£19,509,091	£33,560,029
Hand Dive	Val	£0	£0	£0	£2,818,896	£219,346	£3,038,242
Total	**Val**	**£4,346,526**	**£10,474,926**	**£32,950,447**	**£10,811,544**	**£20,875,657**	**£79,459,100**

8.6.3 Scotland Zone 0-6 nm

Table 8.6.7 Scotland: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

SCOTLAND 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£958,378	£0	£0	£0	£0	£958,378
Nephrops Trawl	Val	£0	£0	£15,148,674	£0	£0	£15,148,674
Pelagic Lines	Val	£0	£555,290	£0	£0	£0	£555,290
Dredge	Val	£0	£0	£0	£4,628,240	£0	£4,628,240
Pots	Val	£0	£0	£17,215,308	£0	£23,403,156	£40,618,464
Hand Dive	Val	£0	£0	£0	£3,044,609	£236,253	£3,280,861
Total	**Val**	£958,378	£555,290	£32,363,982	£7,672,848	£23,639,408	£65,189,907

Table 8.6.8 Scotland: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

SCOTLAND 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£5,707,750	£4,088	£883,679	£0	£0	£258,695	£6,854,212
Trawl	Vol	5,015	8	525	0	0	93	5,641
Nephrops	Val	£281,009	£1,716	£11,734,948	£335	£33,908	£25,290	£12,077,205
Trawl	Vol	210	1	4,435	0	76	7	4,731
Pelagic	Val	£38,616	£24,682,419	£0	£0	£0	£0	£24,721,036
Trawl	Vol	0	18,540	0	0	0	0	18,540
Other	Val	£10,856	£424,281	£16,957	£0	£0	£1,194,926	£1,647,021
Trawl	Vol	10	401	6	0	0	224	641
Dredge	Val	£3,101	£727	£0	£5,241,124	£239,661	£6,411	£5,491,024
	Vol	2	1	0	2,675	609	1	3,288
Pots	Val	£1,245	£0	£100,734	£461	£0	£997,479	£1,099,919
	Vol	1	0	11	0	0	288	301
Total	**Val**	£6,042,576	£25,113,232	£12,736,319	£5,241,920	£273,569	£2,482,801	£51,890,417
	Vol	5,238	18,952	4,977	2,676	685	613	33,142

Table 8.6.9 Scotland: Catch Value by Gear Type by all Vessels in 0-6 NM zone

SCOTLAND 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£6,666,128	£4,088	£883,679	£0	£258,695	£7,812,590
Nephrops Trawl	Val	£281,009	£1,716	£26,883,622	£34,242	£25,290	£27,225,879
Pelagic Trawl	Val	£38,616	£24,682,419	£0	£0	£0	£24,721,036
Pelagic Lines	Val	£0	£555,290	£0	£0	£0	£555,290
Other Trawl	Val	£10,856	£424,281	£16,957	£0	£1,194,926	£1,647,021
Dredge	Val	£3,101	£727	£0	£10,109,025	£6,411	£10,119,264
Pots	Val	£1,245	£0	£17,316,041	£461	£24,400,635	£41,718,383
Hand Dive	Val	£0	£0	£0	£3,044,609	£236,253	£3,280,861
Total	**Val**	**£7,000,955**	**£25,668,522**	**£45,100,300**	**£13,188,337**	**£26,122,210**	**£117,080,324**

8.6.4 Scotland Zone 0-12 nm

Table 8.6.10 Scotland: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

SCOTLAND 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£1,021,875	£0	£0	£0	£0	£1,021,875
Nephrops Trawl	Val	£0	£0	£16,791,536	£0	£0	£16,791,536
Pelagic Lines	Val	£0	£597,203	£0	£0	£0	£597,203
Dredge	Val	£0	£0	£0	£4,884,217	£0	£4,884,217
Pots	Val	£0	£0	£17,607,960	£0	£24,837,207	£42,445,168
Hand Dive	Val	£0	£0	£0	£3,044,609	£236,253	£3,280,861
Total	**Val**	£1,021,875	£597,203	£34,399,496	£7,928,826	£25,073,460	£69,020,859

Table 8.6.11 Scotland: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

SCOTLAND 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£13,816,407	£5,927	£1,317,273	£0	£0	£403,931	£15,543,537
Trawl	Vol	8,184	6	390	0	0	98	8,677
Nephrops	Val	£727,204	£2,076	£17,177,054	£335	£134,278	£59,333	£18,100,280
Trawl	Vol	548	2	6,200	0	298	18	7,065
Pelagic	Val	£0	£52,218,478	£0	£0	£0	£0	£52,218,478
Trawl	Vol	0	39,618	0	0	0	0	39,618
Other	Val	£17,602	£1,228,480	£17,580	£0	£0	£1,434,097	£2,697,759
Trawl	Vol	16	1,174	6	0	0	271	1,466
Dredge	Val	£8,159	£727	£0	£6,508,959	£1,260,367	£6,443	£7,784,655
	Vol	5	1	0	3,295	3,159	1	6,460
Pots	Val	£7,197	£517,581	£102,443	£461	£0	£2,336,662	£2,964,344
	Vol	7	976	18	0	0	1,751	2,753
Total	**Val**	£14,576,569	£53,973,269	£18,614,350	£6,509,755	£1,394,645	£4,240,466	£99,309,053
	Vol	8,758	41,776	6,614	3,295	3,457	2,139	66,039

Table 8.6.12 Scotland: Catch Value by Gear Type by all Vessels in 0-12 NM zone

SCOTLAND 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£14,838,282	£5,927	£1,317,273	£0	£403,931	£16,565,412
Nephrops Trawl	Val	£727,204	£2,076	£33,968,590	£134,613	£59,333	£34,891,816
Pelagic Trawl	Val	£0	£52,218,478	£0	£0	£0	£52,218,478
Pelagic Lines	Val	£0	£597,203	£0	£0	£0	£597,203
Other Trawl	Val	£17,602	£1,228,480	£17,580	£0	£1,434,097	£2,697,759
Dredge	Val	£8,159	£727	£0	£12,653,543	£6,443	£12,668,872
Pots	Val	£7,197	£517,581	£17,710,403	£461	£27,173,869	£45,409,511
Hand Dive	Val	£0	£0	£0	£3,044,609	£236,253	£3,280,861
Total	**Val**	**£15,598,443**	**£54,570,471**	**£53,013,846**	**£15,833,226**	**£29,313,926**	**£168,329,912**

8.6.5 Scotland Summary Tables

Table 8.6.13 Scotland: Catch Value by Gear From Shore to Zones Outer Limits

Scotland	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£2,365,666	5.7%	£5,052,958	6.4%	£7,812,590	6.7%	£16,565,412	9.8%
Nephrops Trawl	£8,444,403	20.4%	£18,429,309	23.2%	£27,225,879	23.3%	£34,891,816	20.7%
Pelagic Trawl	£2,166,659	5.2%	£9,933,972	12.5%	£24,721,036	21.1%	£52,218,478	31.0%
Pelagic Lines	£202,036	0.5%	£430,775	0.5%	£555,290	0.5%	£597,203	0.4%
Other Trawl	£383,985	0.9%	£1,045,508	1.3%	£1,647,021	1.4%	£2,697,759	1.6%
Dredge	£4,354,319	10.5%	£7,968,306	10.0%	£10,119,264	8.6%	£12,668,872	7.5%
Pots	£21,096,323	51.0%	£33,560,029	42.2%	£41,718,383	35.6%	£45,409,511	27.0%
Hand Dive	£2,347,134	5.7%	£3,038,242	3.8%	£3,280,861	2.8%	£3,280,861	1.9%
Total	£41,360,524	100.0%	£79,459,100	100.0%	£117,080,324	100.0%	£168,329,912	100.0%
%	24.6%		47.2%		69.6%		100.0%	

Table 8.6.14 C Scotland: Catch Value by Gear Type For Each Zone

Scotland	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£2,365,666	5.7%	£2,687,292	7.1%	£2,759,633	7.3%	£8,752,822	17.1%
Nephrops Trawl	£8,444,403	20.4%	£9,984,906	26.2%	£8,796,570	23.4%	£7,665,937	15.0%
Pelagic Trawl	£2,166,659	5.2%	£7,767,313	20.4%	£14,787,064	39.3%	£27,497,442	53.7%
Pelagic Lines	£202,036	0.5%	£228,740	0.6%	£124,515	0.3%	£41,913	0.1%
Other Trawl	£383,985	0.9%	£661,523	1.7%	£601,512	1.6%	£1,050,738	2.1%
Dredge	£4,354,319	10.5%	£3,613,987	9.5%	£2,150,957	5.7%	£2,549,608	5.0%
Pots	£21,096,323	51.0%	£12,463,706	32.7%	£8,158,354	21.7%	£3,691,128	7.2%
Hand Dive	£2,347,134	5.7%	£691,108	1.8%	£242,619	0.6%	£0	0.0%
Total	£41,360,524	100.0%	£38,098,575	100.0%	£37,621,224	100.0%	£51,249,588	100.0%

Table 8.6.15 Scotland: Catch Value by Gear Type From Shore to Zones Outer Limits

Scotland	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£21,096,323	51.0%	£33,560,029	42.2%	£41,718,383	35.6%	£45,409,511	27.0%
Mobile	£17,715,032	42.8%	£42,430,054	53.4%	£71,525,790	61.1%	£119,042,337	70.7%
Other	£2,549,169	6.2%	£3,469,017	4.4%	£3,836,151	3.3%	£3,878,064	2.3%
Total	£41,360,524	100.0%	£79,459,100	100.0%	£117,080,324	100.0%	£168,329,912	100.0%

Table 8.6.16 Scotland: Catch Value by Vessel Size From Shore to Zones Outer Limits

Scotland	1nm	%	3nm	%	6nm	%	12nm	%
Small	£30,279,568	73.2%	£51,057,460	64.3%	£65,189,907	55.7%	£69,020,859	41.0%
Large	£11,080,957	26.8%	£28,401,640	35.7%	£51,890,417	44.3%	£99,309,053	59.0%
Total	£41,360,524	100.0%	£79,459,100	100.0%	£117,080,324	100.0%	£168,329,912	100.0%

Table 8.6. 17 Scotland: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

Scotland	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£4,535,233	11.0%	£14,821,451	18.7%	£32,669,476	27.9%	£70,168,915	41.7%
Shellfish	£36,825,292	89.0%	£64,637,649	81.3%	£84,410,847	72.1%	£98,160,997	58.3%
Total	£41,360,524	100.0%	£79,459,100	100.0%	£117,080,324	100.0%	£168,329,912	100.0%

The following sections provide the detailed catch estimates for each of the IFG areas.

Collectively, these results provide a comprehensive and very detailed picture of Scottish inshore fish catches by each gear type within 0-1, 0-3, 0-6 and 0-12 nm from the shore.

The primary focus of this study is the 0-1 and 0-3 NM zones. The summary results for these two zones have been brought forward and are presented in the Table below.

Table 8.6.18 Catch Value by IFG within 1 and 3NM (£'000s)

		Demersal Trawl	N'ps Trawl	Pelagic Trawl	Pelagic Lines	Other Trawl	Dredge	Pots	Hand Dive	Total
South West	**1nm**	£16	£3,827	£77	£5	£2	£1,795	£5,782	£963	£12,465
	3nm	£34	£7,983	£83	£9	£5	£3,264	£8,783	£1,212	£21,372
North West	**1nm**	£500	£1,716	£30	£12	£2	£390	£5,497	£292	£8,440
	3nm	£843	£4,080	£39	£17	£6	£676	£9,039	£360	£15,059
Outer Hebrides	**1nm**	£36	£589	£1	£1	£1	£296	£2,826	£236	£3,986
	3nm	£66	£1,180	£265	£2	£2	£490	£5,381	£358	£7,745
MF&NC	**1nm**	£262	£1,030	£0	£94	£257	£115	£1,692	£64	£3,513
	3nm	£871	£2,111	£14	£162	£612	£518	£2,272	£102	£6,662
Orkney	**1nm**	£14	£121	£0	£0	£1	£73	£2,576	£734	£3,519
	3nm	£42	£182	£0	£0	£0	£213	£2,712	£879	£4,029
East Coast	**1nm**	£634	£1,160	£0	£85	£110	£56	£1,771	£59	£3,875
	3nm	£845	£2,875	£0	£211	£370	£187	£3,937	£127	£8,553
Shetland	**1nm**	£903	£3	£2,059	£4	£11	£1,631	£952	£0	£5,563
	3nm	£2,352	£19	£9,534	£30	£49	£2,620	£1,436	£0	£16,040
Scotland	**1nm**	£2,365 5.7%	£8,446 20.4%	£2,167 5.2%	£201 0.5%	£384 0.9%	£4,356 10.5%	£21,096 51.0%	£2,348 5.7%	£41,361 100.0%
	3nm	£5,053 6.4%	£18,430 23.2%	£9,935 12.5%	£431 0.5%	£1,044 1.3%	£7,968 10.0%	£33,560 42.2%	£3,038 3.8%	£79,460 100.0%

It is estimated that landings worth £41.2 m are taken within 0-1 NM of the shore by Scottish vessels. Within 0-3 NM of the shore, £79.5m is caught by Scottish vessels of which £33.6m is taken by pots.

The total recorded landing by all Scottish vessels into Scottish ports in 2011 was £331.3m[39]. The baseline estimates of this study suggest that £41.2m (12.4%) of this value was caught 0-1NM from the shore and, £79.5m (24%) within 0-3NM of the shore. The comparable percentages for 0-6NM and 0-12NM are 35.3% and 50.8%, respectively.

It would appear that within 1NM of the shore, pots are responsible for over 50% of the catch by value, with Nephrop trawls and dredges taking 20% and 10% respectively. Beyond 1NM a smaller percentage is taken by pots. In the 0-3NM zone the share of the catch taken by pots falls to 42%. The share of the catch taken by Nephrop trawls rises to 23% and pelagic trawls become more significant (12.5%) but only because of the amount of pelagic activity around Shetland.

We were aware of only one other estimate of inshore catches. Homarus (2010) in a study for the Scottish Government estimated the value of inshore landings for 0-6 NM in 2009. These estimates are presented in the table below.

[39] See Table 8.4.1.

Table 8.6.19 Homarus Estimates of Inshore Catches (£'000)2009

Species Group	Catch Value 0-6nm	Landings Value All Scotland
Total Demersal	1,011	150,171
Total Pelagic	346	151,582
Total Shellfish	76,289	135,985
Total	77,646	437,711

Homarus were not explicit about how these estimates generated. Though they do comment that MS Compliance at the time thought the total might be closer to £60m. The Homarus estimate has been widely used as a descriptor of all Scotland's inshore fisheries.

It is clear that there is a substantial difference between Homarus and our estimated total of £117.1m caught within 0-6nm. Indeed, notwithstanding the different years our estimate is almost double what MS Compliance believed.

It is possible that Marine Scotland have been under appreciating the importance of the 0-6 NM zone, which prior to Scotmap and VMS was perfectly understandable, or this study has overestimated inshore catches. It is interesting to note that £52 m of our estimate is from VMS data for the over 15m fleet which confers a level of credibility. The remaining £65.2m is derived from Scotmap.

Another possibility is that the Homarus estimates excluded Shetland, whose catch within 0-6NM we estimate to be £32.8m (See Section 15). The addition of our Shetland estimate would raise the Homarus estimate to £110.4m which is within the margins of error.

On the basis of this study, we estimate that £117.1m worth of fish and shellfish is caught by Scottish vessels within 0-6mn of the Scottish shore, or £84.3m if you exclude Shetland.

9 THE BASELINE: SOUTH WEST IFG (IFG 1)

9.1 Introduction to Area

The South West IFG includes the old Clyde IFG, the southern half of the former Mull and the Small Isles IFG and the Solway IFG. As shown in the figure below its borders cover the west coasts of Argyll and Bute L.A. and Dumfries &Galloway L.A. and, in the Clyde Estuary, South Ayrshire L.A. , North Ayrshire and Arran L.A., Inverclyde L.A., Renfrew L.A. and West Dumbarton L.A. and Glasgow City L.A.

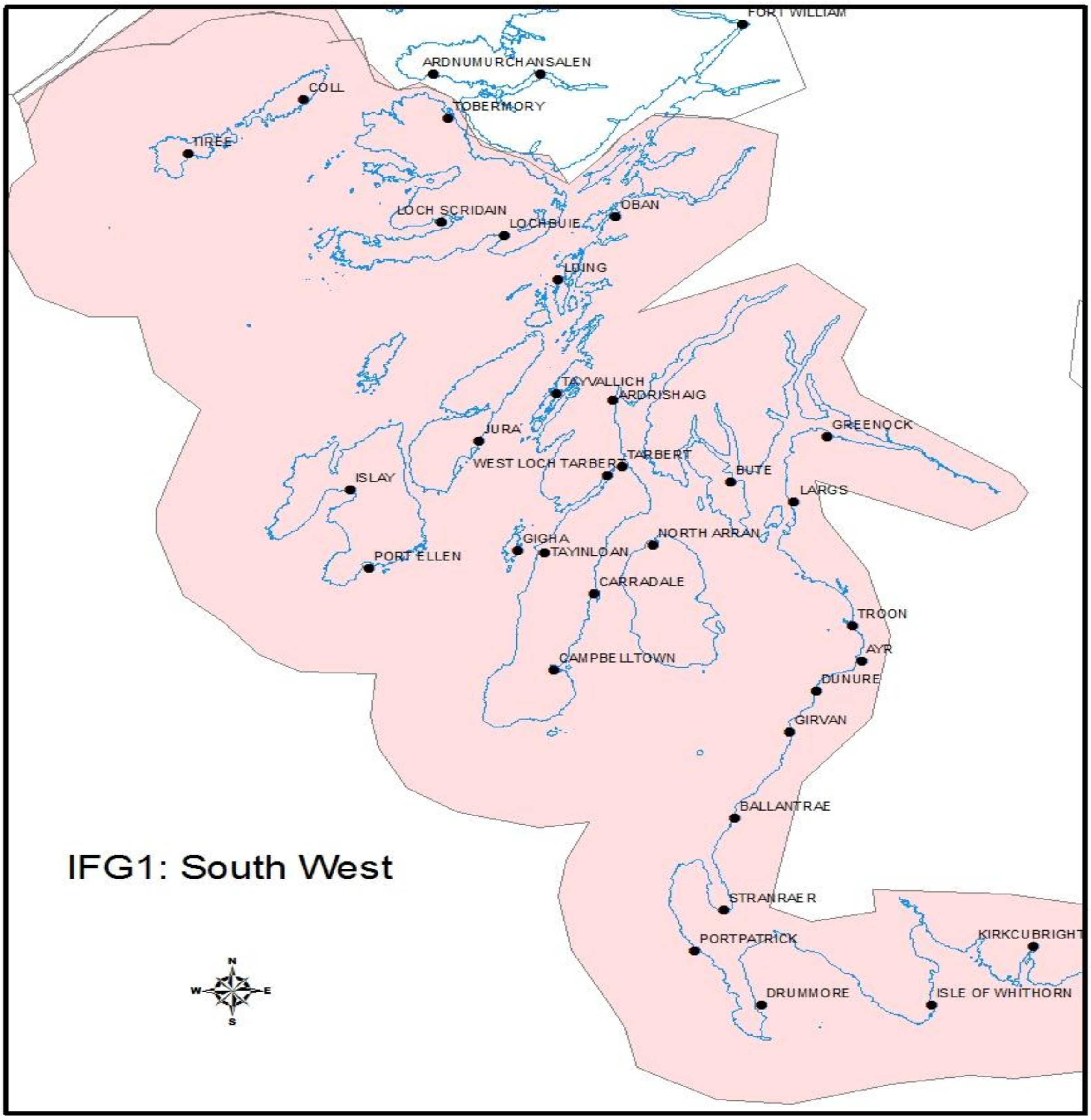


Figure 9.1 South West Map

Section 20.3 of this report estimated the (notional) populations of the IFG areas by allocating data zones to the nearest IFG. The population of the South West IFG was estimated to be 2,258,654 which is 45% of the Scottish population. The South West and East IFG together account for a notional 92% of the entire Scottish Population. The proximity to large centres of population would suggest that actual and potential flows of benefits and costs to recreational users of the inshore environment, as well as general public could be large relative to the equivalent flows associated with commercial fisheries.

Sea angling, which was at one time extremely popular, has diminished markedly particularly in the Clyde system, largely because of the absence of mature finfish to catch. Sea angling is however still very important to the economy of the Solway Coast and is highly regarded outside of the Clyde system, particularly around Mull, the Sound of Jura and Loch Etive. Several charter boats operate in the IFG waters from the regions ports, and much sea angling takes place from the shore. Areas of highest activity are generally those most accessible and nearest to the urban areas in the region.

The IFG region is of particular interest to scuba divers due to its diverse rocky habitats and clear waters offering sheltered conditions. Several charter vessel operators offer diving trips and there is also significant independent diving activity. Again because of the proximity to urban areas, the Clyde is an important centre for sub aqua as well as sailing and sea kayaking. Marine wildlife watching is an important attraction for the area with numerous operators of wildlife tours and vessels across the region. Marine species of particular note for supporting this sector in the region are whales, dolphins, puffins, sea eagles and seals.

There are three fishery districts; Campbeltown, Ayr and Oban; important second level ports and a number of small fishing villages covering *inter alia* the many islands of the area. The table below presents the ports administered by each Fishery District

Table 9.1. South West IFG Fishery Offices and Administered Ports

Ayr (FO*)	**Campbeltown (FO*)**	**Oban (FO*)**
Annan	Ardrishaig	Coll
Ayr	Arran	Fort William
Ballantrae	Bruichladdich	Loch Buie (Mull)
Cumbraes	Bute	Loch Scridain (Mull)
Drummore	Campbeltown	Luing
Dunure	Carradale	Oban
Girvan	Colonsay	Tiree
Kirkcudbright	Crinan	Tobermory
Largs	Gigha	
Greenock	Islay	
Maidens	Jura	
Portpatrick	Port Askaig	
Stranraer	Port Ellen	
Troon	Tarbert	
Saltcoats	Tayinloan	
Whithorn	Tayvallich	
	West Loch Tarbert	

The IFG region is a nationally important fishing ground to the mobile gear Nephrops fleet. In addition there is some seasonal visiting effort from the east coast. The nephrop trawler fleet in the IFG use either single or twin rig trawls targeting Nephrops throughout the year. Outside the Clyde, the main fishing grounds are in more open waters, though particularly during periods of poor weather inshore grounds can be can be important for income generation in more sheltered conditions. Around half of all Nephrops are exported overseas, either fresh or frozen. The main export markets are Spain, France and Italy.

The creel fishing fleet in the region target Nephrops, brown crab, velvet crab and lobster, depending on habitat types. Many vessels opportunistically prosecute different fisheries on a seasonal basis dependent upon availability, whilst others may specialise in one particular fishery. Whilst it is possible to make a fairly clear delineation of targeted Nephrops fishing, due to specific gear types, it is more difficult to do so with the mixed crab and lobster fisheries where it is often difficult to separate any target component. Seasonal variations between crabs and lobsters are an added complication

Whilst a majority of region's creelers are small under 10 m vessels working day trips, there are larger vessels operating static gear within the region. The creel fleet is not necessarily centred on large ports and harbours in the same way as the mobile gear fleet and small vessels operate may throughout the region from many isolated locations. Creel vessels can operate from moorings, and may land catches ashore via a tender if pier/quay facilities are absent.

Lobster is fished with creels year round on hard ground, although peak periods of demand for this premium product include Christmas and Easter. The velvet crab fishery is targeted by smaller inshore vessels on shallow hard grounds close to shore. In addition to landings from the targeted fishery a significant amount may be landed as by catch from the crab and lobster fishery

A significant component of the scallop fishing effort comes from the nomadic scalloping fleet of larger vessels of up to 30 m length, some of which are based in the region, and which work waters around the UK on a cyclical basis. In addition there are smaller resident vessels targeting the scallop fishery year round, as well as some seasonal effort from some vessels seasonally switching from the Nephrops trawl fishery. Scallops are also exploited by hand with scuba diving equipment with the scallops being sold live as a premium product.

9.2 Active Vessels by District and Gear Type

Table 9.2. South West Active Vessels by District and Gear Type

			Ayr	Campbeltown	Oban	Total
10 m & under		**Nephrop Trawls**	12	6	4	22
		Creel fishing	52	80	70	202
		Other	11	8	8	27
		Total	**75**	**94**	**82**	**251**
Over 10 m	**Pelagic**	**Purse seine**	-	-	-	
		Pelagic trawl	-	-	-	
		Other	-	-	-	
		Total	**-**	**-**	**-**	
	Demersal	**Trawl**	8	4	5	17
		Seine	-	-	-	
		Lines	14	-	-	14
		Other	7	-	-	7
		Total	**29**	**4**	**5**	**38**
	Shellfish	**Nephrop trawls**	18	28	7	53
		Creel fishing	3	8	13	24
		Other	31	9	10	50
		Total	**52**	**45**	**30**	127
	Total Over 10 m		**81**	**49**	**35**	165
Total All Vessels			**156**	**143**	**117**	**416**

Source: *Scottish Sea Fisheries Statistics 2012*, Table 2.5

The 10m and under segment is dominated by creels. Shellfish vessels account for 77% of the over 10m fleet with nephrop trawls making up 47% of the over 10m shellfish segment.

9.3 South West Employment by District

Table 9.3. South West IFG Catching Sector Employment

District	Regularly Employed	Irregularly Employed	Total
Ayr	507	74	581
Campbeltown	279	44	323
Oban	231	-	231
Total	**1017**	**118**	**1135**

Of all the IFGs, the South West area has the greatest number catching jobs. The absence of part-time or irregular work in the catching sector in Oban is unusual. For most other fishery districts across Scotland, 10-30% of all catching jobs were irregular or part-time.

9.4 South West IFG Landings

Table 9.4. South West IFG Landings (£'000) by District by All Vessels and Scottish Vessels

	All Vessels				Scottish Vessels
District	**Total demersal**	**Total pelagic**	**Total shellfish**	**Total landings**	**Total Landings**
Ayr	£6	£15	£13,915	£13,936	£12,693
Campbeltown	£17	£97	£15,961	£16,075	£12,879
Oban	£30	£1	£8,787	£8,818	£8,380
Total	**£53**	**£113**	**£38,663**	**£38,829**	**£33,952**

A relatively small proportion of landings are by non-Scottish vessels. Most of these will be from Northern Ireland or English vessels landing Nephrops and scallops to Scottish ports administered by Campbeltown and Ayr Districts. Demersal and pelagic landings are now insignificant and the above data highlights how the inshore fishery has changed significantly since the early 1980s

9.5 MPA's and Legislation & Regulations specific to the IFG Area

There are six MPAs within the IFG area. In the table below we have estimated the area of both the 0-1NM and 0-3NM that would be covered by an MPA site. For the South West IFG there are 6 relevant IFGs

Table 9.5.1 IFG 1: MPAs in the South West IFG in 0-1 NM and 0-3NM zone

MPA	**Area (KM) within 0-1 NM**	**Area (KM) within 0-3 NM**
South Arran	106.9	281.4
Clyde Sea Sill	66.0	174.0
Loch Creran	12.0	12.0
Upper Loch Fyne and Loch Goil	86.0	86.0
Loch Sween	37.2	37.2
Loch Sunart to the Sound of Jura	472.8	620.0
Total	780.9	1210.6

The area has a number of prohibitions including a complete ban on fishing in Lamlash Bay and constraints on fishing activity due to the EU Cod Recovery Plan and operations associated with naval bases in the Clyde system.

Measure	Explanatory Notes
Maximum length of a fishing vessel	There is a size limit for fishing boats in the Clyde. Prohibition of fishing for any species of sea fish (except herring, mackerel and sprats) from a fishing boat with an overall length not greater than 70ft/21.34 meters
Limited number of fishing days at sea	This regulation effectively limits vessels targeting *Nephrops* with 80-99 mm mesh size to 25 days at sea per month within the Clyde Area. Since 2003 Annex XVII of Regulation (EC) No. 2341/2002, which establishes fishing effort and additional conditions for monitoring, inspection and surveillance for the recovery of certain cod stocks.
Mesh sizes for *Nephrops*	Nets for *Nephrops* fishing must have a stretched mesh size of not less than 80 mm (80 mm for twin rig). 80 mm within whole of West of Scotland cod recovery zone.
Ban on using mobile fishing gear during the weekend	The weekend ban on mobile gear was introduced in 1986. Prohibition of use of mobile or active gear from midnight on Friday until midnight on Sunday from January 1st to December 31st in each year.
Prohibition of all fishing.	Prohibition of all fishing for sea fish in an area of Lamlash Bay, Arran.
Protection for undersized *Nephrops*	Prohibition of landing and selling *Nephrops* with a carapace of less than 20 mm (Annex 12 on 850- 98). Prohibition of landing and selling *Nephrops* tails of <37 mm length (Annex 12 on 850-98).
Protection for herring stocks	1 Jan to 30 April all Clyde closed to herring fishing north of a line from Mull of Kintyre to Corsewall Point. The target species needs to represent at least 50% of the catch. Herring by-catch, maximum 50 kg per boat.
Scallops	Limit on number of scallop dredges that can be towed. Only eight scallop dredges may be towed each side of a fishing vessel, i.e. a total of 16 are towed.
Cod box	The 'cod box' was a temporary measure introduced 1st March to 30th April 2001 designed to protect cod at spawning time. The 'cod box' is now a National Order on an annual basis. Minimum 35% of *Nephrops* target in catch.
Ballantrae Banks	The Ballantrae Banks to protect herring spawning grounds. Ballantrae Banks, being the area of waters bounded by a line drawn from a point on the mainland at 55°04'.9 North latitude and 5°01'.6 West longitude (Downan Point) to a point at 5°04'.9 North latitude and 5°06 West longitude; thence to a point 55°09'04 North latitude and 5°06' West longitude; and thence to a point on the mainland at 55°08'.3 North latitude and 4°59'.7 West longitude (Bennane Head). Prohibition of use of mobile or active gear from 1st February to 30th April in each year. Also Ballantrae Banks.
Loch Ryan	Loch Ryan, within a straight line drawn from a point on the mainland at 55°01'.1 North latitude and 5°05'.8 West longitude (Miieur Point) to a point on the mainland at 55°00'.65 North latitude and 05°03'.2 West longitude (Garry Point). Prohibition of mobile or active gear from January1st December 31st in each year except dredging for mussels and oysters.

Queens Harbour & Gare Loch	Queens Harbour. Restricted access to Loch Long, Loch Long and Gare Loch. A permit has to be sought from the Queens Harbour Master. The Gare Loch, within a straight line a straight line drawn from a point on the mainland at 55°59'.26 North latitude and 4*46'.01 West longitude (Rosneath Point) to a point on the mainland at 55*58'.31 North latitude and 4°42'.25 West longitude (Ardmore Head) Prohibition of use of mobile or active gear from 1st January to 31st December in each year.
Naval use of the seabed	Various areas of the seabed are used by the Navy/MOD. Fishing activity is restricted or excluded from these areas, i.e. Queens Harbour – Lochs Long, Goil, Gare Loch and part of eastern Loch Fyne.

The baseline catch estimates are presented below.

9.6 South West Baseline Catch Estimates (IFG 1)

9.6.1 South West Zone 0-1 nm

Table 9.6.2 IFG 1: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

SOUTH WEST 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£3,432	£0	£0	£0	£0	£3,432
Nephrops Trawl	Val	£0	£0	£1,984,773	£0	£0	£1,984,773
Pelagic Lines	Val	£0	£4,908	£0	£0	£0	£4,908
Dredge	Val	£0	£0	£0	£251,840	£0	£251,840
Pots	Val	£0	£0	£3,222,844	£0	£2,549,887	£5,772,731
Hand Dive	Val	£0	£0	£0	£888,723	£73,938	£962,661
Total	**Val**	**£3,432**	**£4,908**	**£5,207,617**	**£1,140,563**	**£2,623,825**	**£8,980,345**

Table 9.6.3 IFG 1: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

SOUTH WEST 1NM			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£10	£0	£12,954	£0	£0	£0	£12,964
Trawl		Vol	0	0	4	0	0	0	4
Nephrops		Val	£7,482	£0	£1,808,802	£0	£25,386	£330	£1,842,000
Trawl		Vol	6	0	715	0	57	0	777
Pelagic		Val	£0	£76,674	£0	£0	£0	£0	£76,674
Trawl		Vol	0	223	0	0	0	0	223
Other		Val	£0	£0	£1,580	£0	£0	£0	£1,580
Trawl		Vol	0	0	1	0	0	0	1
Dredge		Val	£48	£0	£0	£1,493,885	£48,734	£0	£1,542,667
	0	Vol	0	0	0	769	122	0	891
Pots		Val	£18	£0	£8,742	£0	£0	£153	£8,913
	0	Vol	0	0	2	0	0	0	2
Total		**Val**	£7,558	£76,674	£1,832,078	£1,493,885	£74,120	£483	£3,484,797
	0	**Vol**	6	223	721	769	179	0	1,899

Table 9.6.4 IFG 1: Catch Value by Gear Type by all Vessels in 0-1 NM zone

SOUTH WEST 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£3,442	£0	£12,954	£0	£0	£16,396
Nephrops Trawl	Val	£7,482	£0	£3,793,575	£25,386	£330	£3,826,773
Pelagic Trawl	Val	£0	£76,674	£0	£0	£0	£76,674
Pelagic Lines	Val	£0	£4,908	£0	£0	£0	£4,908
Other Trawl	Val	£0	£0	£1,580	£0	£0	£1,580
Dredge	Val	£48	£0	£0	£1,794,459	£0	£1,794,507
Pots	Val	£18	£0	£3,231,586	£0	£2,550,040	£5,781,644
Hand Dive	Val	£0	£0	£0	£888,723	£73,938	£962,661
Total	**Val**	**£10,990**	**£81,581**	**£7,039,695**	**£2,708,568**	**£2,624,308**	**£12,465,142**

9.6.2 South West Zone 0-3 nm

Table 9.6.5 IFG 1: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

SOUTH WEST 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£5,508	£0	£0	£0	£0	£5,508
Nephrops Trawl	Val	£0	£0	£3,832,133	£0	£0	£3,832,133
Pelagic Lines	Val	£0	£8,659	£0	£0	£0	£8,659
Dredge	Val	£0	£0	£0	£587,939	£0	£587,939
Pots	Val	£0	£0	£4,730,752	£0	£4,034,353	£8,765,106
Hand Dive	Val	£0	£0	£0	£1,124,285	£87,277	£1,211,562
Total	**Val**	**£5,508**	**£8,659**	**£8,562,886**	**£1,712,224**	**£4,121,630**	**£14,410,907**

Table 9.6.6 IFG 1: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

SOUTH WEST 3NM			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£153	£0	£27,991	£0	£0	£0	£28,144
Trawl		Vol	0	0	8	0	0	0	8
Nephrops		Val	£19,467	£0	£4,099,125	£0	£31,028	£1,010	£4,150,629
Trawl		Vol	15	0	1,667	0	70	0	1,752
Pelagic		Val	£0	£82,842	£0	£0	£0	£0	£82,842
Trawl		Vol	0	238	0	0	0	0	238
Other		Val	£0	£0	£5,428	£0	£0	£0	£5,428
Trawl		Vol	0	0	3	0	0	0	3
Dredge		Val	£49	£0	£0	£2,534,477	£141,861	£0	£2,676,387
	0	Vol	0	0	0	1,290	359	0	1,648
Pots		Val	£18	£0	£14,204	£0	£0	£3,608	£17,830
	0	Vol	0	0	4	0	0	3	8
Total		**Val**	£19,686	£82,842	£4,146,749	£2,534,477	£172,889	£4,618	£6,961,260
	0	**Vol**	15	238	1,682	1,290	428	4	3,657

Table 9.6.7 IFG 1: Catch Value by Gear Type by all Vessels in 0-3 NM zone

SOUTH WEST 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£5,660	£0	£27,991	£0	£0	£33,652
Nephrops Trawl	Val	£19,467	£0	£7,931,258	£31,028	£1,010	£7,982,763
Pelagic Trawl	Val	£0	£82,842	£0	£0	£0	£82,842
Pelagic Lines	Val	£0	£8,659	£0	£0	£0	£8,659
Other Trawl	Val	£0	£0	£5,428	£0	£0	£5,428
Dredge	Val	£49	£0	£0	£3,264,277	£0	£3,264,326
Pots	Val	£18	£0	£4,744,957	£0	£4,037,961	£8,782,936
Hand Dive	Val	£0	£0	£0	£1,124,285	£87,277	£1,211,562
Total	**Val**	**£25,194**	**£91,501**	**£12,709,635**	**£4,419,590**	**£4,126,248**	**£21,372,167**

9.6.3 South West Zone 0-6 nm

Table 9.6.8 IFG 1: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

SOUTH WEST 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£7,049	£0	£0	£0	£0	£7,049
Nephrops Trawl	Val	£0	£0	£5,403,829	£0	£0	£5,403,829
Pelagic Lines	Val	£0	£10,576	£0	£0	£0	£10,576
Dredge	Val	£0	£0	£0	£836,415	£0	£836,415
Pots	Val	£0	£0	£5,718,099	£0	£5,116,642	£10,834,741
Hand Dive	Val	£0	£0	£0	£1,259,792	£90,887	£1,350,679
Total	**Val**	**£7,049**	**£10,576**	**£11,121,928**	**£2,096,208**	**£5,207,529**	**£18,443,289**

Table 9.6.9 IFG 1: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

SOUTH WEST 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£230	£0	£41,064	£0	£0	£0	£41,294
Trawl	Vol	0	0	12	0	0	0	12
Nephrops	Val	£37,501	£0	£6,013,675	£0	£33,908	£1,620	£6,086,704
Trawl	Vol	28	0	2,518	0	76	1	2,623
Pelagic	Val	£0	£85,729	£0	£0	£0	£0	£85,729
Trawl	Vol	0	244	0	0	0	0	244
Other	Val	£0	£0	£7,016	£0	£0	£0	£7,016
Trawl	Vol	0	0	3	0	0	0	3
Dredge	Val	£49	£0	£0	£2,818,513	£239,661	£0	£3,058,223
0	Vol	0	0	0	1,431	609	0	2,041
Pots	Val	£18	£0	£17,270	£0	£0	£20,750	£38,038
0	Vol	0	0	6	0	0	18	23
Total	**Val**	£37,799	£85,729	£6,079,024	£2,818,513	£273,569	£22,370	£9,317,004
0	**Vol**	29	244	2,539	1,431	685	18	4,947

Table 9.6.10 IFG 1: Catch Value by Gear Type by all Vessels in 0-6 NM zone

SOUTH WEST 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val		£0	£41,064	£0	£0	£48,343
Nephrops Trawl	Val	£37,501	£0	£11,417,504	£33,908	£1,620	£11,490,533
Pelagic Trawl	Val	£0	£85,729	£0	£0	£0	£85,729
Pelagic Lines	Val	£0	£10,576	£0	£0	£0	£10,576
Other Trawl	Val	£0	£0	£7,016	£0	£0	£7,016
Dredge	Val	£49	£0	£0	£3,894,589	£0	£3,894,639
Pots	Val	£18	£0	£5,735,368	£0	£5,137,392	£10,872,778
Hand Dive	Val	£0	£0	£0	£1,259,792	£90,887	£1,350,679
Total	**Val**	**£44,847**	**£96,305**	**£17,200,952**	**£5,188,290**	**£5,229,899**	**£27,760,292**

9.6.4 South West Zone 0-12 nm

Table 9.6.11 IFG 1: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

SOUTH WEST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val		£0	£0	£0	£0	£7,395
Nephrops Trawl	Val	£0	£0	£5,678,325	£0	£0	£5,678,325
Pelagic Lines	Val	£0	£10,872	£0	£0	£0	£10,872
Dredge	Val	£0	£0	£0	£934,656	£0	£934,656
Pots	Val	£0	£0	£5,715,357	£0	£5,360,698	£11,076,055
Hand Dive	Val	£0	£0	£0	£1,259,792	£90,887	£1,350,679
Total	**Val**	**£7,395**	**£10,872**	**£11,393,682**	**£2,194,449**	**£5,451,585**	**£19,057,982**

Table 9.6.12 IFG 1: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

SOUTH WEST 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£565	£0	£98,701	£0	£0	£0	£99,265
Trawl	Vol	0	0	29	0	0	0	29
Nephrops	Val	£107,157	£0	£6,887,836	£0	£134,278	£3,506	£7,132,777
Trawl	Vol	79	0	2,834	0	298	1	3,213
Pelagic	Val	£0	£86,602	£0	£0	£0	£0	£86,602
Trawl	Vol	0	247	0	0	0	0	247
Other	Val	£0	£0	£7,016	£0	£0	£0	£7,016
Trawl	Vol	0	0	3	0	0	0	3
Dredge	Val	£199	£0	£0	£3,033,275	£1,260,367	£0	£4,293,841
0	Vol	0	0	0	1,541	3,159	0	4,700
Pots	Val	£18	£0	£18,357	£0	£0	£185,240	£203,614
0	Vol	0	0	6	0	0	156	162
Total	**Val**	£107,938	£86,602	£7,011,909	£3,033,275	£1,394,645	£188,745	£11,823,115
0	**Vol**	80	247	2,873	1,541	3,457	157	8,355

Table 9.6.13 IFG 1: Catch Value by Gear Type by all Vessels in 0-12 NM zone

SOUTH WEST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£7,960	£0	£98,701	£0	£0	£106,661
Nephrops Trawl	Val	£107,157	£0	£12,566,161	£134,278	£3,506	£12,811,102
Pelagic Trawl	Val	£0	£86,602	£0	£0	£0	£86,602
Pelagic Lines	Val	£0	£10,872	£0	£0	£0	£10,872
Other Trawl	Val	£0	£0	£7,016	£0	£0	£7,016
Dredge	Val	£199	£0	£0	£5,228,298	£0	£5,228,497
Pots	Val	£18	£0	£5,733,713	£0	£5,545,937	£11,279,669
Hand Dive	Val	£0	£0	£0	£1,259,792	£90,887	£1,350,679
Total	**Val**	**£115,334**	**£97,474**	**£18,405,591**	**£6,622,369**	**£5,640,330**	**£30,881,097**

9.6.5 South West Summary Tables

Table 9.6.14 IFG 1: Catch Value by Gear From Shore to Zones Outer Limits

S. WEST	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£16,396	0.1%	£33,652	0.2%	£48,343	0.2%	£106,661	0.3%
Nephrops Trawl	£3,826,773	30.7%	£7,982,763	37.4%	£11,490,533	41.4%	£12,811,102	41.5%
Pelagic Trawl	£76,674	0.6%	£82,842	0.4%	£85,729	0.3%	£86,602	0.3%
Pelagic Lines	£4,908	0.0%	£8,659	0.0%	£10,576	0.0%	£10,872	0.0%
Other Trawl	£1,580	0.0%	£5,428	0.0%	£7,016	0.0%	£7,016	0.0%
Dredge	£1,794,507	14.4%	£3,264,326	15.3%	£3,894,639	14.0%	£5,228,497	16.9%
Pots	£5,781,644	46.4%	£8,782,936	41.1%	£10,872,778	39.2%	£11,279,669	36.5%
Hand Dive	£962,661	7.7%	£1,211,562	5.7%	£1,350,679	4.9%	£1,350,679	4.4%
Total	£12,465,142	100.0%	£21,372,167	100.0%	£27,760,292	100.0%	£30,881,097	100.0%
%	40.4%		69.2%		89.9%		100.0%	

Table 9.15 IFG 1: Catch Value by Gear Type For Each Zone

S. WEST	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£16,396	0.1%	£17,256	0.2%	£14,691	0.2%	£58,318	1.9%
Nephrops Trawl	£3,826,773	30.7%	£4,155,990	46.7%	£3,507,770	54.9%	£1,320,569	42.3%
Pelagic Trawl	£76,674	0.6%	£6,168	0.1%	£2,887	0.0%	£874	0.0%
Pelagic Lines	£4,908	0.0%	£3,752	0.0%	£1,917	0.0%	£295	0.0%
Other Trawl	£1,580	0.0%	£3,848	0.0%	£1,588	0.0%	£0	0.0%
Dredge	£1,794,507	14.4%	£1,469,819	16.5%	£630,313	9.9%	£1,333,858	42.7%
Pots	£5,781,644	46.4%	£3,001,292	33.7%	£2,089,843	32.7%	£406,891	13.0%
Hand Dive	£962,661	7.7%	£248,901	2.8%	£139,117	2.2%	£0	0.0%
Total	£12,465,142	100.0%	£8,907,025	100.0%	£6,388,125	100.0%	£3,120,805	100.0%

Table 9.6.16 IFG 1: Catch Value by Gear Type From Shore to Zones Outer Limits

	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£5,781,644	46.4%	£8,782,936	41.1%	£10,872,778	39.2%	£11,279,669	36.5%
Mobile	£5,715,929	45.9%	£11,369,010	53.2%	£15,526,259	55.9%	£18,239,877	59.1%
Other	£967,569	7.8%	£1,220,221	5.7%	£1,361,255	4.9%	£1,361,551	4.4%
Total	£12,465,142	100.0%	£21,372,167	100.0%	£27,760,292	100.0%	£30,881,097	100.0%

Table 9.6.17 IFG 1: Catch Value by Vessel Size From Shore to Zones Outer Limits

	1nm	%	3nm	%	6nm	%	12nm	%
Small	£8,980,345	72.0%	£14,410,907	67.4%	£18,443,289	66.4%	£19,057,982	61.7%
Large	£3,484,797	28.0%	£6,961,260	32.6%	£9,317,004	33.6%	£11,823,115	38.3%
Total	£12,465,142	100.0%	£21,372,167	100.0%	£27,760,292	100.0%	£30,881,097	100.0%

Table 9.6.18 IFG 1: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

S. WEST	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£92,572	0.7%	£116,695	0.5%	£141,152	0.5%	£212,808	0.7%
Shellfish	£12,372,570	99.3%	£21,255,472	99.5%	£27,619,140	99.5%	£30,668,290	99.3%
Total	£12,465,142	100.0%	£21,372,167	100.0%	£27,760,292	100.0%	£30,881,097	100.0%

From the above tables it is estimated that in 2011 the value of the landing from the IFG area (i.e. 0-6nm) by Scottish vessels was £27.76 m of which 44.9% is caught within 1 NM and 77% within 0-3 nm. Given the topography it is not surprising that relatively little is caught within 3-6nm. A large proportion of the sea area is within lochs or narrow channels (<6 NM) between land masses

A total of £12.47m was caught in the 0-1 NM zone, the comparable figure for the 1-3 NM zone was £8.91 m

Within both the 0-1 and 0-3 NM, mobile gears take a larger share of the catch than static gears and 15 m and under vessels catch significantly more than the over 15 m vessels.

10 THE BASELINE: NORTH WEST IFG (IFG 2)

10.1 Introduction to Area

The current North West IFG comprises the original North West IFG plus part of the former Small Isle and Mull IFG north of the sound of Mull.).

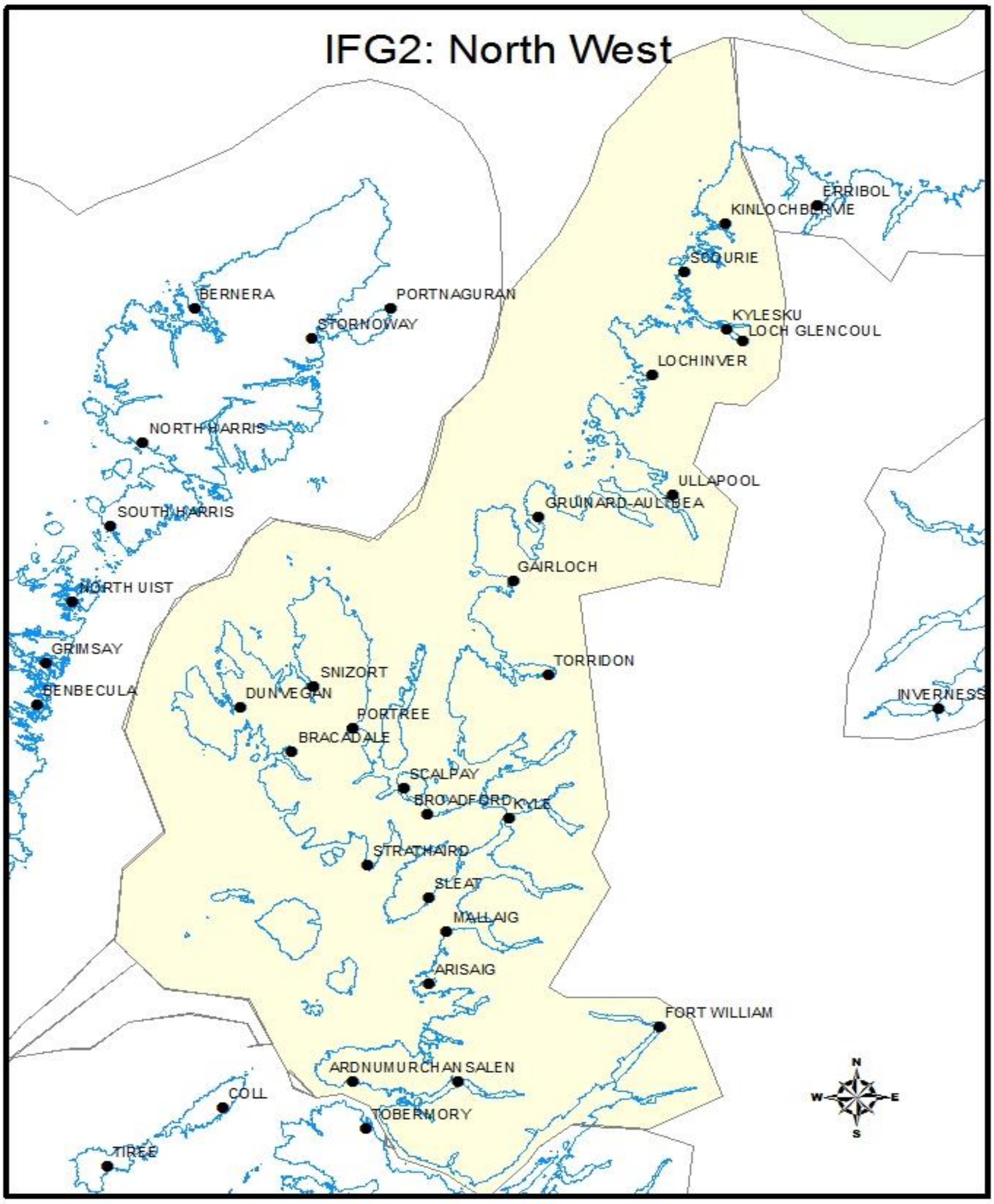


Fig 10.1. North West IFG Area

The NW IFG area covers the coastal areas of Wester Ross, a small part of West Sutherland in the north, Skye and Lochaber and Knoydart, Arisaig and Ardnamurchan.

The area is sparsely populated, the major communities being Ullapool, Lochinver, Gairloch Portree and Mallaig. Section 20.3 of this report estimated the (notional) populations of the IFG areas by allocating data zones to the nearest IFG. The population of the North West IFG was estimated to be 40,850 which is 0.80% of the Scottish population. It is also relatively remote from the big centres of population and therefore only likely to attract the more specialist and committed sea anglers and divers who are willing to take longer trips. Because of the small population, Option Values and GPNUVs will be smaller.

Many of the small towns and villages in the area rely heavily on the locally based fishing fleet of relatively small boats and the associated industries. This dependency is analysed in Section 7. This coast is heavily indented by deep sea lochs which are highly variable in character.

In the Kinlochbervie district in the north the main inshore fishery centres on lobster, with smaller landings of Nephrops and velvet crab. Around Lochinver and Ullapool the inshore activity is dominated by Nephrops creeling. In common with practice in other IFG areas, Nephrops from the creel sector are landed live mainly for live export to European markets

The Portree area has the highest concentration of inshore fishing activity and is the most diverse. There is also a significant lobster fishery within the area with vessels also taking by catches of brown crab, velvet and green crab. There is also a small scale scallop fishery at times during the year which is prosecuted by visiting dredges and local.

Marine Scotland has a significant presence in the NW IFG area. There are 5 District Fishery Offices covering the main landing centres of Kinlochbervie, Lochinver, Ullapool Portree and Mallaig.

Table 10.1. North West IFG Fishery Offices and Their Administered Ports

Kinlochbervie (FO*)	Lochinver (FO*)	Mallaig (FO*)	Portree (FO*)	Ullapool (FO*)
Eriboll Kinlochbervie Scourie	Culkein Drumbeg Kylesku r Lochinver	Ardnamurchan Arisaig Corpach Glenuig Mallaig Salen	Bracadale Broadford Dunvegan Kyle Portree Sleat Snizort Strathai Torridon	Achiltibuie Aultbea Gairloch Ull

10.2 North West Active Vessels by District and Gear Type

The Table below summarises the North West fleet. The total fleet administered by the above districts was 316 vessels in 2012. Of these, 238 of these vessels were 10 m and under. Not unexpectedly, creel vessels dominate the 10 m and under segment.

Table 10.2. North West Active Vessels by District and Gear Type

			Mallaig	Portree	Ullapool	Lochinver	Kinlochbervie	Total
10m & under		Nephrop Trawls	1	6	5	-	2	**14**
		Creel fishing	24	102	61	11	13	**211**
		Other	3	2	7	-	1	**13**
		Total	**28**	**110**	**73**	**11**	**16**	**238**
Over 10 m	Pelagic	Purse seine	-	-	-	-	-	-
		Pelagic trawl	-	-	-	-	-	-
		Other	-	-	-	-	-	-
		Total	**-**	**-**	**-**	**-**	**-**	**-**
	Demersal	Trawl	9	2	1	1	2	**15**
		Seine	2	-	1	-	-	**3**
		Lines	-	-	-	-	-	-
		Other	-	-	-	-	-	-
		Total	**11**	**2**	**2**	**1**	**2**	**18**
	Shellfish	Nephrop trawls	10	10	12	-	2	**34**
		Creel fishing	1	9	10	1	1	**22**
		Other	1	-	3	-	-	**4**
		Total	**12**	**19**	**25**	**1**	**3**	**60**
	Total Over 10 m		**23**	**21**	**27**	**2**	**5**	**78**
Total All Vessels			**51**	**131**	**100**	**13**	**21**	**316**

Source: Scottish Sea Fisheries Statistics, 2012 (Table 2.5)

10.3 North West Employment by District

Table 10.3. North West IFG Catching Sector Employment

District	Regularly Employed	Irregularly Employed	Crofters	Total
Kinlochbervie	39	-	1	40
Lochinver	19	2	2	23
Mallaig	92	7	-	99
Portree	152	34	34	220
Ullapool	124	36	-	160
Total	**426**	**79**	**37**	**542**

Source *Scottish Sea Fisheries Statistics 2012*

This area has the highest proportion of crofters working in fishing. Indeed, there is only one other Fishery District which reports any crofters catching fish for a living (Stornoway)

10.4 North West Landings

Table 10.4. North West Landings (£'000) by District by All Vessels and Scottish Vessels

	All Vessels				Scottish Vessels
District	**Total demersal**	**Total pelagic**	**Total shellfish**	**Total landings**	**Total Landings**
Kinlochbervie	£11,344	£10	£2,578	£13,932	£13,538
Lochinver	£28,859	£0	£3,082	£31,940	£6,307
Mallaig	£2,543	£372	£9,883	£12,798	£12,063
Portree	£11	£4	£7,931	£7,946	£7,901
Ullapool	£8,366	£48	£6,473	£14,887	£11,895
Total	**£51,123**	**£434**	**£29,947**	**£81,503**	£51,704

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

There is a substantial difference between total landings and the landing by Scottish vessels. This is explained by demersal landings by non-Scottish foreign vessels at Lochinver. Pelagic landings are insignificant.

10.5 MPAs and Legislation & Regulations specific to the IFG Area

There are five MPAs within the IFG area. In the table below we have estimated the area of both the 0-1NM and 0-3NM that would be covered by an MPA site.

Table 10.5.1 IFG 1: MPAs in the North West IFG in 0-1 NM and 0-3NM zones

MPA	Area (KM) within 0-1 NM	Area (KM) within 0-3 NM
Lochs Duich, Long and Alsh	35.7	35.7
Loch Sunart	46.9	46.9
Wester Ross	323.2	487.0
Loch Sunart to the Sound of Jura	135.1	139.4
Small Isles	173.1	557.7
Total	713.9	1266.6

Specific Legislation and Regulations:

AREA	CLOSURE	TIME
North of Rona	Creels	All Year
Loch Torridon and the Northern Inner Sound	Mobile or Active Gear	All Year
Southern Inner Sound	Mobile or Active Gear	1 October – 31 March
Loch Gairloch	Mobile or Active Gear	All Year
Enard Bay	Mobile or Active Gear	1 October – 31 March
Eddrachilis Bay	Mobile or Active Gear	1 October – 31 March
Loch Laxford	Mobile or Active Gear	1 October – 31 March
Rubh na Fearn to Inner Sound	Dredging (but not suction dredging)	1 April – 30 September

The next section reports the catch value estimates derived through our manipulation of VMS and Scotmap data

10.6 North West Baseline Catch Estimates (IFG 2)

10.6.1 North West Zone 0-1 nm

Table 10.6.1 IFG 2: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

NORTH WEST 1NM		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£908,603	£0	£0	£908,603
Pelagic Lines	Val	£0	£11,756	£0	£0	£0	£11,756
Dredge	Val	£0	£0	£0	£24,229	£0	£24,229
Pots	Val	£0	£0	£4,169,059	£0	£1,303,053	£5,472,112
Hand Dive	Val	£0	£0	£0	£291,617	£0	£291,617
Total	**Val**	**£0**	**£11,756**	**£5,077,662**	**£315,846**	**£1,303,053**	**£6,708,317**

Table 10.6.2 IFG 2: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

NORTH WEST 1NM		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£245,998	£397	£245,114	£0	£0	£8,956	£500,466
Trawl	Vol	161	1	75	0	0	3	240
Nephrops	Val	£17,064	£24	£789,139	£0	£0	£823	£807,050
Trawl	Vol	12	0	253	0	0	0	265
Pelagic	Val	£0	£30,371	£0	£0	£0	£0	£30,371
Trawl	Vol	0	134	0	0	0	0	134
Other	Val	£0	£0	£2,370	£0	£0	£0	£2,370
Trawl	Vol	0	0	1	0	0	0	1
Dredge	Val	£0	£0	£0	£366,127	£0	£0	£366,127
0	Vol	0	0	0	186	0	0	186
Pots	Val	£0	£0	£307	£0	£0	£24,808	£25,115
0	Vol	0	0	0	0	0	16	16
Total	**Val**	£263,063	£30,792	£1,036,931	£366,127	£0	£34,587	£1,731,500
0	**Vol**	172	135	329	186	0	19	842

Table 10.6.3 IFG 2: Catch Value by Gear Type by all Vessels in 0-1 NM zone

NORTH WEST 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£245,998	£397	£245,114	£0	£8,956	£500,466
Nephrops Trawl	Val	£17,064	£24	£1,697,742	£0	£823	£1,715,653
Pelagic Trawl	Val	£0	£30,371	£0	£0	£0	£30,371
Pelagic Lines	Val	£0	£11,756	£0	£0	£0	£11,756
Other Trawl	Val	£0	£0	£2,370	£0	£0	£2,370
Dredge	Val	£0	£0	£0	£390,357	£0	£390,357
Pots	Val	£0	£0	£4,169,367	£0	£1,327,860	£5,497,227
Hand Dive	Val	£0	£0	£0	£291,617	£0	£291,617
Total	**Val**	**£263,063**	**£42,548**	**£6,114,593**	**£681,973**	**£1,337,640**	**£8,439,816**

10.6.2 North West Zone 0-3 nm

Table 10.6.4 IFG 2: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

NORTH WEST 3NM		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£2,061,308	£0	£0	£2,061,308
Pelagic Lines	Val	£0	£16,582	£0	£0	£0	£16,582
Dredge	Val	£0	£0	£0	£81,234	£0	£81,234
Pots	Val	£0	£0	£7,155,524	£0	£1,843,662	£8,999,185
Hand Dive	Val	£0	£0	£0	£359,727	£0	£359,727
Total	**Val**	**£0**	**£16,582**	**£9,216,832**	**£440,962**	**£1,843,662**	**£11,518,037**

Table 10.6.5 IFG 2: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

NORTH WEST 3NM			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£274,172	£514	£558,437	£0	£0	£10,156	£843,280
Trawl		Vol	178	1	172	0	0	3	354
Nephrops		Val	£27,666	£53	£1,989,607	£0	£0	£1,196	£2,018,521
Trawl		Vol	20	0	655	0	0	0	676
Pelagic		Val	£0	£38,616	£0	£0	£0	£0	£38,616
Trawl		Vol	0	170	0	0	0	0	170
Other		Val	£0	£0	£6,285	£0	£0	£0	£6,285
Trawl		Vol	0	0	2	0	0	0	2
Dredge		Val	£0	£0	£0	£594,536	£0	£0	£594,536
	0	Vol	0	0	0	302	0	0	302
Pots		Val	£0	£0	£338	£0	£0	£39,488	£39,827
	0	Vol	0	0	0	0	0	24	24
Total		**Val**	£301,837	£39,184	£2,554,667	£594,536	£0	£50,840	£3,541,065
	0	**Vol**	198	171	829	302	0	28	1,528

Table 10.6.5 IFG 2: Catch Value by Gear Type by all Vessels in 0-3 NM zone

NORTH WEST 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£274,172	£514	£558,437	£0	£10,156	£843,280
Nephrops Trawl	Val	£27,666	£53	£4,050,915	£0	£1,196	£4,079,830
Pelagic Trawl	Val	£0	£38,616	£0	£0	£0	£38,616
Pelagic Lines	Val	£0	£16,582	£0	£0	£0	£16,582
Other Trawl	Val	£0	£0	£6,285	£0	£0	£6,285
Dredge	Val	£0	£0	£0	£675,770	£0	£675,770
Pots	Val	£0	£0	£7,155,862	£0	£1,883,150	£9,039,012
Hand Dive	Val	£0	£0	£0	£359,727	£0	£359,727
Total	**Val**	**£301,837**	**£55,766**	**£11,771,499**	**£1,035,497**	**£1,894,502**	**£15,059,102**

10.6.3 North West Zone 0-6 nm

Table 10.6.7 IFG 2: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

NORTH WEST 6NM		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£2,733,183	£0	£0	£2,733,183
Pelagic Lines	Val	£0	£17,455	£0	£0	£0	£17,455
Dredge	Val	£0	£0	£0	£107,656	£0	£107,656
Pots	Val	£0	£0	£8,402,514	£0	£2,226,886	£10,629,400
Hand Dive	Val	£0	£0	£0	£403,740	£9,099	£412,839
Total	**Val**	**£0**	**£17,455**	**£11,135,696**	**£511,396**	**£2,235,985**	**£13,900,532**

Table 10.6.1 IFG 8: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

NORTH WEST 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£299,267	£514	£699,591	£0	£0	£12,904	£1,012,276
Trawl	Vol	191	1	215	0	0	4	411
Nephrops	Val	£47,607	£201	£2,874,404	£0	£0	£1,810	£2,924,021
Trawl	Vol	35	0	939	0	0	1	976
Pelagic	Val	£38,616	£0	£0	£0	£0	£0	£38,616
Trawl	Vol	0	170	0	0	0	0	170
Other	Val	£0	£0	£6,285	£0	£0	£0	£6,285
Trawl	Vol	0	0	2	0	0	0	2
Dredge	Val	£0	£0	£0	£710,494	£0	£0	£710,494
0	Vol	0	0	0	366	0	0	366
Pots	Val	£0	£0	£338	£0	£0	£43,029	£43,367
0	Vol	0	0	0	0	0	27	27
Total	**Val**	£385,490	£715	£3,580,617	£710,494	£0	£57,743	£4,735,059
0	**Vol**	227	172	1,156	366	0	32	1,951

Table 10.6.9 IFG 2: Catch Value by Gear Type by all Vessels in 0-6 NM zone

NORTH WEST 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£299,267	£514	£699,591	£0	£12,904	£1,012,276
Nephrops Trawl	Val	£47,607	£201	£5,607,586	£0	£1,810	£5,657,204
Pelagic Trawl	Val	£38,616	£0	£0	£0	£0	£38,616
Pelagic Lines	Val	£0	£17,455	£0	£0	£0	£17,455
Other Trawl	Val	£0	£0	£6,285	£0	£0	£6,285
Dredge	Val	£0	£0	£0	£818,150	£0	£818,150
Pots	Val	£0	£0	£8,402,852	£0	£2,269,914	£10,672,766
Hand Dive	Val	£0	£0	£0	£403,740	£9,099	£412,839
Total	**Val**	**£385,490**	**£18,170**	**£14,716,314**	**£1,221,890**	**£2,293,728**	**£18,635,591**

10.6.4 North West Zone 0-12 nm

Table 10.6.10 IFG 2: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

NORTH WEST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£3,290,759	£0	£0	£3,290,759
Pelagic Lines	Val	£0	£18,254	£0	£0	£0	£18,254
Dredge	Val	£0	£0	£0	£134,632	£0	£134,632
Pots	Val	£0	£0	£8,585,370	£0	£2,344,831	£10,930,201
Hand Dive	Val	£0	£0	£0	£403,740	£9,099	£412,839
Total	**Val**	**£0**	**£18,254**	**£11,876,129**	**£538,372**	**£2,353,930**	**£14,786,685**

Table 10.6.11 IFG 2: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

NORTH WEST 12nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£315,034	£514	£856,371	£0	£0	£13,527	£1,185,445
Trawl		Vol	200	1	265	0	0	4	470
Nephrops		Val	£71,116	£425	£4,049,072	£0	£0	£3,049	£4,123,662
Trawl		Vol	55	1	1,310	0	0	1	1,367
Pelagic		Val	£0	£115,748	£0	£0	£0	£0	£115,748
Trawl		Vol	0	316	0	0	0	0	316
Other		Val	£0	£0	£6,285	£0	£0	£0	£6,285
Trawl		Vol	0	0	2	0	0	0	2
Dredge		Val	£0	£0	£0	£723,649	£0	£0	£723,649
	0	Vol	0	0	0	371	0	0	371
Pots		Val	£0	£0	£338	£0	£0	£145,980	£146,318
	0	Vol	0	0	0	0	0	95	95
Total		**Val**	£386,149	£116,688	£4,912,066	£723,649	£0	£162,555	£6,301,108
	0	**Vol**	254	317	1,577	371	0	101	2,621

Table 10.6.12 IFG 2: Catch Value by Gear Type by all Vessels in 0-12 NM zone

NORTH WEST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£315,034	£514	£856,371	£0	£13,527	£1,185,445
Nephrops Trawl	Val	£71,116	£425	£7,339,831	£0	£3,049	£7,414,421
Pelagic Trawl	Val	£0	£115,748	£0	£0	£0	£115,748
Pelagic Lines	Val	£0	£18,254	£0	£0	£0	£18,254
Other Trawl	Val	£0	£0	£6,285	£0	£0	£6,285
Dredge	Val	£0	£0	£0	£858,281	£0	£858,281
Pots	Val	£0	£0	£8,585,708	£0	£2,490,811	£11,076,519
Hand Dive	Val	£0	£0	£0	£403,740	£9,099	£412,839
Total	**Val**	**£386,149**	**£134,942**	**£16,788,195**	**£1,262,021**	**£2,516,485**	**£21,087,793**

10.6.5 North West Summary Tables

Table 10.6.13 IFG 2: Catch Value by Gear Type From Shore to Zones Outer Limits

NORTH WEST	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£500,466	5.9%	£843,280	5.6%	£1,012,276	5.4%	£1,185,445	5.6%
Nephrops Trawl	£1,715,653	20.3%	£4,079,830	27.1%	£5,657,204	30.4%	£7,414,421	35.2%
Pelagic Trawl	£30,371	0.4%	£38,616	0.3%	£38,616	0.2%	£115,748	0.5%
Pelagic Lines	£11,756	0.1%	£16,582	0.1%	£17,455	0.1%	£18,254	0.1%
Other Trawl	£2,370	0.0%	£6,285	0.0%	£6,285	0.0%	£6,285	0.0%
Dredge	£390,357	4.6%	£675,770	4.5%	£818,150	4.4%	£858,281	4.1%
Pots	£5,497,227	65.1%	£9,039,012	60.0%	£10,672,766	57.3%	£11,076,519	52.5%
Hand Dive	£291,617	3.5%	£359,727	2.4%	£412,839	2.2%	£412,839	2.0%
Total	£8,439,816	100.0%	£15,059,102	100.0%	£18,635,591	100.0%	£21,087,793	100.0%
%	40.0%		71.4%		88.4%		100.0%	

Table 10.6.14 IFG 2: Catch Value by Gear Type For Each Zone

NORTH WEST	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£500,466	5.9%	£342,814	5.2%	£168,997	4.7%	£173,169	7.1%
Nephrops Trawl	£1,715,653	20.3%	£2,364,177	35.7%	£1,577,374	44.1%	£1,757,217	71.7%
Pelagic Trawl	£30,371	0.4%	£8,245	0.1%	£0	0.0%	£77,132	3.1%
Pelagic Lines	£11,756	0.1%	£4,826	0.1%	£873	0.0%	£799	0.0%
Other Trawl	£2,370	0.0%	£3,915	0.1%	£0	0.0%	£0	0.0%
Dredge	£390,357	4.6%	£285,414	4.3%	£142,380	4.0%	£40,131	1.6%
Pots	£5,497,227	65.1%	£3,541,785	53.5%	£1,633,754	45.7%	£403,753	16.5%
Hand Dive	£291,617	3.5%	£68,110	1.0%	£53,112	1.5%	£0	0.0%
Total	£8,439,816	100.0%	£6,619,286	100.0%	£3,576,489	100.0%	£2,452,202	100.0%

Table 10.6.15 IFG 2: Catch Value by Gear Type From Shore to Zones Outer Limits

NORTH WEST	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£5,497,227	65.1%	£9,039,012	60.0%	£10,672,766	57.3%	£11,076,519	52.5%
Mobile	£2,639,217	31.3%	£5,643,781	37.5%	£7,532,531	40.4%	£9,580,180	45.4%
Other	£303,373	3.6%	£376,309	2.5%	£430,294	2.3%	£431,093	2.0%
Total	£8,439,816	100.0%	£15,059,102	100.0%	£18,635,591	100.0%	£21,087,793	100.0%

Table 10.6.16 IFG 2: Catch Value by Vessel Size From Shore to Zones Outer Limits

NORTH WEST	1nm	%	3nm	%	6nm	%	12nm	%
Small	£6,708,317	79.5%	£11,518,037	76.5%	£13,900,532	74.6%	£14,786,685	70.1%
Large	£1,731,500	20.5%	£3,541,065	23.5%	£4,735,059	25.4%	£6,301,108	29.9%
Total	£8,439,816	100.0%	£15,059,102	100.0%	£18,635,591	100.0%	£21,087,793	100.0%

Table 10.6.17 IFG 2: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

NORTH WEST	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£305,610	3.6%	£357,603	2.4%	£789,865	4.2%	£1,023,929	4.9%
Shellfish	£8,134,206	96.4%	£14,701,499	97.6%	£17,845,726	95.8%	£20,063,864	95.1%
Total	£8,439,816	100.0%	£15,059,102	100.0%	£18,635,591	100.0%	£21,087,793	100.0%

From the above tables, it is estimated that value of landings in 2011 in the IFG water (i.e. 0-6 nm) by Scottish vessels is £18,6 m of which 45.2% is caught within 1NM and 80% within 0-3nm. The relatively small contribution of 3 – 6 NM is a very similar profile to the South West IFG area's catch. The is probably explained by the similar coastal topography of large lochs indenting the coast and offshore islands lying close to or within 3 NM, which results in a smaller proportion of the IFG territory lying within 3-6NM from the coast.

The big difference between the South West and North West is that in the NW of the 15 m and under vessels and static gears take the biggest proportion of the catch by value.

11 THE BASELINE: OUTER HEBRIDES (IFG 3)

11.1 Introduction to Area

The area covered by the OH IFG is an area in the Minches and Sea of the Hebrides bordering with the North West IFG in the North and with Mull and the Small Isles IFG in the South plus the area to the West of the Hebrides following the 6 NM IFG boundary and a 6 NM radius around St Kilda, Flannan Isles, North Rona and Sula Sgeir (see map below).

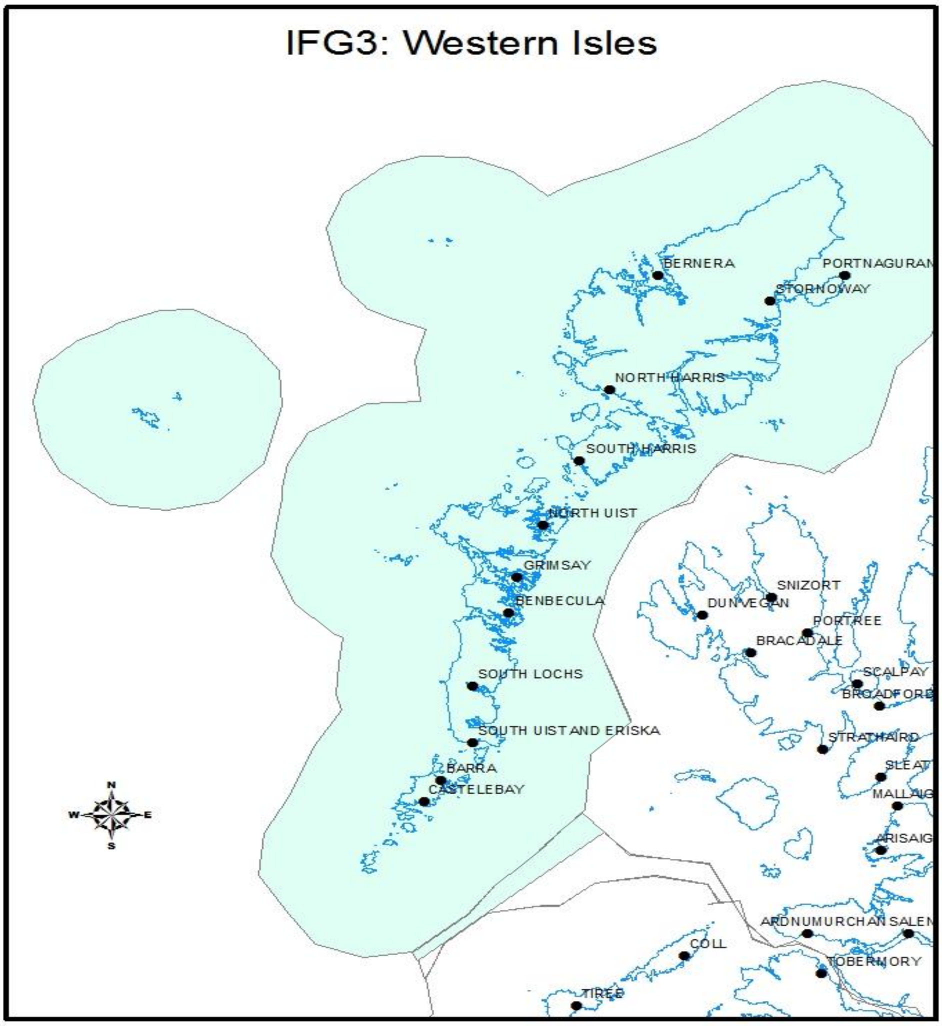


Figure 11.1. Outer Hebrides IFG Area

The population is around 26,500 and accounts for only 0.5% of the Scottish population. Marine recreational and general public values will be correspondingly smaller than in the more populated IFGs.

The Stornoway Fishery District administers the following ports: Barra, Benbecula, Bernera, (Lewis), Berneray (N Uist), Grimsay, Lochs, North Harris North Uist, Portnaguran, Ness, Scalpay, South Harris, South Uist, Eriskay, Stornoway.

Pelagic and white fish fisheries used to be important but presently very little effort is directed at these fisheries. In common with the South West and North West IFG areas, fishing for shellfish is now the primary activity and accounts for virtually all landings by value into Western Isles ports. In the Minches, the main species targeted are Nephrops, scallops, crab and lobster. The inshore sea areas to the west and north provide the main grounds for lobster, brown crab and crawfish.

The majority of the locally based inshore fleet is now under 10 m in length. Over the past decade, trawling effort has decreased whilst the creeling sector has been increasing to the extent that creel caught Nephrops account for over a third of all shellfish landings. Nomadic trawlers targeting Nephrops tend to land their catch in mainland ports.

In descending order of landings values, Nephrops, lobster, scallops, brown crab, velvet crab are the key shellfish species.

The main processors are; Scottish Seafoods Ltd in Lewis and Harris employing around 50 people processing for the UK scampi market, Kallin Shellfish Ltd, in the Uists, employing 14 people processing scallops and brown crab, and Barratlantic Ltd, on Barra employing around 40 processing Nephrops scallops and white fish species.

There are a number of buyers specialising in live shellfish and offering live storage facilities. On Barra, Aurora Shellfish and Sandray Shellfish buy live shellfish buyers for shipping to the continental market. In the Uists, the live shell fish buyers are Kilbride Shellfish, North Uist Fish Marketing, W Stewart Live Fish, W MacDonald Shellfish, Live Langoustine, Sutherland Game and Scot West. In Lewis and Harris, the buyers are Hebridean Marine, Sandray Shellfish, Keltic Seafare, Sutherland Game and Scot West.

11.2 Outer Hebrides Active Vessels by District and Gear Type

Table 11.2. Outer Hebrides; Active Vessels by District and Gear Type

10m and Under		**Nephrop Trawls**	-
		Creel fishing	165
		Other	4
		Total	**169**
Over 10m	**Pelagic**	**Purse seine**	-
		Pelagic trawl	1
		Other	-
		Total	**1**
	Demersal	**Trawl**	6
		Seine	-
		Lines	-
		Other	-
		Total	**6**
	Shellfish	***Nephrop trawls***	14
		Creel fishing	21
		Other	4
		Total	**39**
	Total Over10 m		**46**
Total All Vessels			**215**

Source *Scottish Sea Fisheries Statistics 2012*, Table 2.5

The fleet has a very similar profile to the North West IFG with a preponderance of small creel vessels.

11.3 Outer Hebrides Employment

Table 11.3. Outer Hebrides Catching Sector Employment

	Regularly Employed	Irregularly Employed	Crofters	Total
Outer Hebrides	**298**	**56**	**17**	**371**

Source *Scottish Sea Fisheries Statistics 2012*

11.4 Outer Hebrides Landings

Table 11.4. Outer Hebrides IFG Landings by All Vessels and Scottish Vessels

All Vessels				Scottish Vessels
Total demersal	**Total pelagic**	**Total shellfish**	**Total landings (£'000)**	**Total Landings (£'000)**
£161	**£0**	**£10,605**	**£10,766**	**£10,756**

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

Virtually all landings are by Scottish vessels. Like the South West area, the Outer Hebrides area would appear to support almost exclusively shellfish fisheries. Whist the North West has some similarities, it lands a significant value of demersal fish caught by Scottish and non-Scottish vessels but caught outside the IFG area

11.5 MPAs, Legislation & Regulations specific to the IFG Area

There are two MPAs within the IFG area. In the table below we have estimated the area of both the 0-1NM and 0-3NM that would be covered by an MPA site.

Table 10.5.1 IFG 1: MPAs in the Outer Hebrides North West IFG in 0-1 NM and 0-3NM zones

MPA	Area (KM) within 0-1 NM	Area (KM) within 0-3 NM
Eye Peninsula to Butt of Lewis		375.1
Monach Isles	0.1	63.7
Total		438.8

Specific Legislation and Regulations:

Area	Prohibition
Lochmaddy to Stuley Island to Barra Head and Gurney Point	Mobile gear prohibitions 1 March – 31 October Scallop dredging permitted 1 March – 31 April and 24 August – 31 October Sandeel fishing permitted 1 March - 31 October in Stuley Island – Barra Head area
Sound of Harris	Mobile gear prohibitions 1 March – 30 September, scallop dredging permitted during that period
Broad Bay	All year prohibition on mobile gear to protect juvenile plaice
Loch Roag	All year prohibition on mobile gear
Flannan Isles	Prohibition of creel fishing 1 November – 31 March
West of Barra – Scarp Island	Prohibition of creel fishing 1 November – 31 March
Bragar to Dell - West of Lewis	Prohibition of creel fishing 1 July – 30 September

An area off Harris has been identified as grounds suitable for trawlers and a local agreement on access has been reached between both static and mobile gear sectors. Trawlers must give prior notification to static gear operators before they intend to commence fishing in the area, so that static gear can be shifted to allow access for the trawlers. Trawl activity in the area is usually on a seasonal basis.

An area between Chicken Head and Cellar Head has a high concentration of brown crab creels from 1 November until 31 March. Scallop dredgers also dredge in the area on a limited basis during this period and an agreed code has been developed to accommodate

The next section reports the catch estimates derived through our manipulation of VMS and Scotmap data

11.6 The Outer Hebrides Baseline Catch Estimates (IFG 3)

11.6.1 Outer Hebrides Zone 0-1 nm

Table 11.6.1 IFG 3: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

OUTER HEBRIDES 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£46,029	£0	£0	£46,029
Pelagic Lines	Val	£0	£1,465	£0	£0	£0	£1,465
Dredge	Val	£0	£0	£0	£99,650	£0	£99,650
Pots	Val	£0	£0	£981,877	£0	£1,609,564	£2,591,441
Hand Dive	Val	£0	£0	£0	£235,828	£0	£235,828
Total	**Val**	**£0**	**£1,465**	**£1,027,906**	**£335,478**	**£1,609,564**	**£2,974,413**

Table 11.6.2 IFG 3: Catch Value and Volume by Gear Type by Vessels Over 15 m in 0-1 NM zone

OUTER HEBRIDES 1NM			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£11,992	£0	£23,965	£0	£0	£185	£36,142
Trawl		Vol	8	0	8	0	0	0	16
Nephrops		Val	£22,002	£4	£520,081	£0	£0	£888	£542,975
Trawl		Vol	20	0	180	0	0	0	200
Pelagic		Val	£0	£755	£0	£0	£0	£0	£755
Trawl		Vol	0	1	0	0	0	0	1
Other		Val	£0	£0	£1,263	£0	£0	£0	£1,263
Trawl		Vol	0	0	0	0	0	0	0
Dredge		Val	£70	£0	£0	£195,872	£0	£0	£195,942
	0	Vol	0	0	0	97	0	0	97
Pots		Val	£0	£0	£34,355	£0	£0	£200,498	£234,853
	0	Vol	0	0	5	0	0	125	130
Total		**Val**	£34,064	£759	£579,664	£195,872	£0	£201,572	£1,011,930
	0	**Vol**	27	1	193	97	0	126	444

Table 11.6.3 IFG 3: Catch Value by Gear Type by all Vessels in 0-1 NM zone

OUTER HEBRIDES 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£11,992	£0	£23,965	£0	£185	£36,142
Nephrops Trawl	Val	£22,002	£4	£566,110	£0	£888	£589,004
Pelagic Trawl	Val	£0	£755	£0	£0	£0	£755
Pelagic Lines	Val	£0	£1,465	£0	£0	£0	£1,465
Other Trawl	Val	£0	£0	£1,263	£0	£0	£1,263
Dredge	Val	£70	£0	£0	£295,522	£0	£295,592
Pots	Val	£0	£0	£1,016,232	£0	£1,810,062	£2,826,294
Hand Dive	Val	£0	£0	£0	£235,828	£0	£235,828
Total	**Val**	**£34,064**	**£2,224**	**£1,607,569**	**£531,350**	**£1,811,135**	**£3,986,343**

11.6.2 Outer Hebrides Zone 0-3 nm

Table 11.6.4.IFG 3: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

OUTER HEBRIDES 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£148,857	£0	£0	£148,857
Pelagic Lines	Val	£0	£2,093	£0	£0	£0	£2,093
Dredge	Val	£0	£0	£0	£231,452	£0	£231,452
Pots	Val	£0	£0	£2,045,633	£0	£2,949,532	£4,995,165
Hand Dive	Val	£0	£0	£0	£358,291	£0	£358,291
Total	**Val**	**£0**	**£2,093**	**£2,194,490**	**£589,743**	**£2,949,532**	**£5,735,858**

Table 11.6.5 IFG 3: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

OUTER HEBRIDES 3nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£22,207	£0	£43,240	£0	£0	£853	£66,300
Trawl		Vol	12	0	14	0	0	0	26
Nephrops		Val	£34,517	£4	£995,170	£0	£0	£1,297	£1,030,988
Trawl		Vol	31	0	353	0	0	1	385
Pelagic		Val	£0	£264,965	£0	£0	£0	£0	£264,965
Trawl		Vol	0	497	0	0	0	0	497
Other		Val	£0	£0	£1,992	£0	£0	£0	£1,992
Trawl		Vol	0	0	0	0	0	0	0
Dredge		Val	£225	£0	£0	£258,007	£0	£0	£258,233
	0	Vol	0	0	0	126	0	0	126
Pots		Val	£0	£0	£60,897	£0	£0	£325,369	£386,266
	0	Vol	0	0	9	0	0	221	230
Total		**Val**	£56,949	£264,969	£1,101,299	£258,007	£0	£327,520	£2,008,744
	0	**Vol**	43	497	376	126	0	222	1,265

Table 11.6.6 IFG 3: Catch Value by Gear Type by all Vessels in 0-3 NM zone

OUTER HEBRIDES 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£22,207	£0	£43,240	£0	£853	£66,300
Nephrops Trawl	Val	£34,517	£4	£1,144,026	£0	£1,297	£1,179,844
Pelagic Trawl	Val	£0	£264,965	£0	£0	£0	£264,965
Pelagic Lines	Val	£0	£2,093	£0	£0	£0	£2,093
Other Trawl	Val	£0	£0	£1,992	£0	£0	£1,992
Dredge	Val	£225	£0	£0	£489,459	£0	£489,684
Pots	Val	£0	£0	£2,106,530	£0	£3,274,901	£5,381,431
Hand Dive	Val	£0	£0	£0	£358,291	£0	£358,291
Total	**Val**	**£56,949**	**£267,063**	**£3,295,788**	**£847,750**	**£3,277,051**	**£7,744,602**

11.6.3 Outer Hebrides Zone 0-6 nm

Table 11.6.7 IFG 3: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

OUTER HEBRIDES 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£362,224	£0	£0	£362,224
Pelagic Lines	Val	£0	£2,093	£0	£0	£0	£2,093
Dredge	Val	£0	£0	£0	£245,396	£0	£245,396
Pots	Val	£0	£0	£3,041,073	£0	£3,303,359	£6,344,432
Hand Dive	Val	£0	£0	£0	£420,614	£0	£420,614
Total	**Val**	**£0**	**£2,093**	**£3,403,296**	**£666,010**	**£3,303,359**	**£7,374,758**

Table 11.6.8 IFG 3: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

OUTER HEBRIDES 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£29,531	£0	£60,701	£0	£0	£1,155	£91,387
Trawl	Vol	16	0	20	0	0	0	36
Nephrops	Val	£53,805	£17	£1,538,272	£0	£0	£1,719	£1,593,814
Trawl	Vol	47	0	552	0	0	1	599
Pelagic	Val	£0	£402,437	£0	£0	£0	£0	£402,437
Trawl	Vol	0	762	0	0	0	0	762
Other	Val	£0	£0	£2,674	£0	£0	£0	£2,674
Trawl	Vol	0	0	0	0	0	0	0
Dredge	Val	£225	£0	£0	£352,095	£0	£0	£352,321
0	Vol	0	0	0	177	0	0	177
Pots	Val	£0	£0	£83,126	£0	£0	£599,862	£682,988
0	Vol	0	0	6	0	0	18	23
Total	**Val**	£83,562	£402,454	£1,684,773	£352,095	£0	£602,736	£3,125,621
0	**Vol**	63	762	577	177	0	19	1,598

Table 11.6.9 IFG 3: Catch Value by Gear Type by all Vessels in 0-6 NM zone

Outer Hebrides 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£29,531	£0	£60,701	£0	£1,155	£91,387
Nephrops Trawl	Val	£53,805	£17	£1,900,496	£0	£1,719	£1,956,037
Pelagic Trawl	Val	£0	£402,437	£0	£0	£0	£402,437
Pelagic Lines	Val	£0	£2,093	£0	£0	£0	£2,093
Other Trawl	Val	£0	£0	£2,674	£0	£0	£2,674
Dredge	Val	£225	£0	£0	£597,491	£0	£597,716
Pots	Val	£0	£0	£3,124,199	£0	£3,903,221	£7,027,420
Hand Dive	Val	£0	£0	£0	£420,614	£0	£420,614
Total	**Val**	**£83,562**	**£404,547**	**£5,088,069**	**£1,018,105**	**£3,906,096**	**£10,500,379**

11.6.4 Outer Hebrides Zone 0-12 nm

Table 11.6.10 IFG 3: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

OUTER HEBRIDES 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£0	£0	£0	£0	£0	£0
Nephrops Trawl	Val	£0	£0	£607,882	£0	£0	£607,882
Pelagic Lines	Val	£0	£2,183	£0	£0	£0	£2,183
Dredge	Val	£0	£0	£0	£303,635	£0	£303,635
Pots	Val	£0	£0	£3,253,872	£0	£3,592,220	£6,846,092
Hand Dive	Val	£0	£0	£0	£420,614	£0	£420,614
Total	**Val**	**£0**	**£2,183**	**£3,861,754**	**£724,248**	**£3,592,220**	**£8,180,406**

Table 11.6.11 IFG 3: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

OUTER HEBRIDES 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£232,549	£0	£156,929	£0	£0	£9,908	£399,386
Trawl	Vol	145	0	50	0	0	3	198
Nephrops	Val	£183,527	£25	£3,032,448	£0	£0	£2,976	£3,218,977
Trawl	Vol	141	0	998	0	0	1	1,140
Pelagic	Val	£0	£517,581	£0	£0	£0	£0	£517,581
Trawl	Vol	0	976	0	0	0	0	976
Other	Val	£0	£0	£2,859	£0	£0	£0	£2,859
Trawl	Vol	0	0	0	0	0	0	0
Dredge	Val	£225	£0	£0	£351,883	£0	£0	£352,108
0	Vol	0	0	0	179	0	0	179
Pots	Val	£0	£0	£83,748	£0	£0	£1,246,992	£1,330,741
0	Vol	0	0	12	0	0	951	963
Total	**Val**	£416,301	£517,606	£3,275,984	£351,883	£0	£1,259,877	£5,821,651
0	**Vol**	285	976	1,061	179	0	956	3,457

Table 11.6.12 IFG 3: Catch Value by Gear Type by all Vessels in 0-12 NM zone

OUTER HEBRIDES 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£232,549	£0	£156,929	£0	£9,908	£399,386
Nephrops Trawl	Val	£183,527	£25	£3,640,331	£0	£2,976	£3,826,859
Pelagic Trawl	Val	£0	£517,581	£0	£0	£0	£517,581
Pelagic Lines	Val	£0	£2,183	£0	£0	£0	£2,183
Other Trawl	Val	£0	£0	£2,859	£0	£0	£2,859
Dredge	Val	£225	£0	£0	£655,517	£0	£655,743
Pots	Val	£0	£0	£3,337,620	£0	£4,839,212	£8,176,832
Hand Dive	Val	£0	£0	£0	£420,614	£0	£420,614
Total	**Val**	**£416,301**	**£519,789**	**£7,137,738**	**£1,076,131**	**£4,852,097**	**£14,002,056**

Outer Hebrides Summary Tables

Table 11.6.13 IFG 3: Catch Value by Gear Type From Shore to Zones Outer Limits

OUTER HEBRIDES	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£36,142	0.9%	£66,300	0.9%	£91,387	0.9%	£399,386	2.9%
Nephrops Trawl	£589,004	14.8%	£1,179,844	15.2%	£1,956,037	18.6%	£3,826,859	27.3%
Pelagic Trawl	£755	0.0%	£264,965	3.4%	£402,437	3.8%	£517,581	3.7%
Pelagic Lines	£1,465	0.0%	£2,093	0.0%	£2,093	0.0%	£2,183	0.0%
Other Trawl	£1,263	0.0%	£1,992	0.0%	£2,674	0.0%	£2,859	0.0%
Dredge	£295,592	7.4%	£489,684	6.3%	£597,716	5.7%	£655,743	4.7%
Pots	£2,826,294	70.9%	£5,381,431	69.5%	£7,027,420	66.9%	£8,176,832	58.4%
Hand Dive	£235,828	5.9%	£358,291	4.6%	£420,614	4.0%	£420,614	3.0%
Total	£3,986,343	100.0%	£7,744,602	100.0%	£10,500,379	100.0%	£14,002,056	100.0%
%	28.5%		55.3%		75.0%		100.0%	

Table 11.6.14 IFG 3: Catch Value by Gear Type For Each Zone

OUTER HEBRIDES	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£36,142	0.9%	£30,158	0.8%	£25,087	0.9%	£307,999	8.8%
Nephrops Trawl	£589,004	14.8%	£590,840	15.7%	£776,193	28.2%	£1,870,821	53.4%
Pelagic Trawl	£755	0.0%	£264,210	7.0%	£137,472	5.0%	£115,144	3.3%
Pelagic Lines	£1,465	0.0%	£628	0.0%	£0	0.0%	£90	0.0%
Other Trawl	£1,263	0.0%	£729	0.0%	£682	0.0%	£185	0.0%
Dredge	£295,592	7.4%	£194,092	5.2%	£108,032	3.9%	£58,026	1.7%
Pots	£2,826,294	70.9%	£2,555,137	68.0%	£1,645,989	59.7%	£1,149,413	32.8%
Hand Dive	£235,828	5.9%	£122,463	3.3%	£62,322	2.3%	£0	0.0%
Total	£3,986,343	100.0%	£3,758,259	100.0%	£2,755,777	100.0%	£3,501,677	100.0%

Table 11.6.15 IFG 3: Catch Value by Type From Shore to Zones Outer Limits

OUTER HEBRIDES	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£2,826,294	70.9%	£5,381,431	69.5%	£7,027,420	66.9%	£8,176,832	58.4%
Mobile	£922,756	23.1%	£2,002,786	25.9%	£3,050,252	29.0%	£5,402,427	38.6%
Other	£237,293	6.0%	£360,385	4.7%	£422,707	4.0%	£422,797	3.0%
Total	£3,986,343	100.0%	£7,744,602	100.0%	£10,500,379	100.0%	£14,002,056	100.0%

Table 11.6.16 IFG 3: Catch Value by Vessel Size From Shore to Zones Outer Limits

OUTER HEBRIDES	1nm	%	3nm	%	6nm	%	12nm	%
Small	£2,974,413	74.6%	£5,735,858	74.1%	£7,374,758	70.2%	£8,180,406	58.4%
Large	£1,011,930	25.4%	£2,008,744	25.9%	£3,125,621	29.8%	£5,821,651	41.6%
Total	£3,986,343	100.0%	£7,744,602	100.0%	£10,500,379	100.0%	£14,002,056	100.0%

Table 11.6.17 IFG 3: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

OUTER HEBRIDES	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£36,288	0.9%	£324,012	4.2%	£488,109	4.6%	£936,090	6.7%
Shellfish	£3,950,055	99.1%	£7,420,590	95.8%	£10,012,270	95.4%	£13,065,966	93.3%
Total	£3,986,343	100.0%	£7,744,602	100.0%	£10,500,379	100.0%	£14,002,056	100.0%

From the above tables, it is estimated that the value of landings taken from the IFG water in 2011 (i.e. 0-6 NM) by Scottish vessels is £10.5 m of which 37.9% is caught within 1 NM and 74% within 0-3 nm. This is similar to the proportions estimated for the South West and North West

A total of £3.99 m was caught in the 0-1NM zone, the comparable figure for the 1-3 NM zone was £3.76m

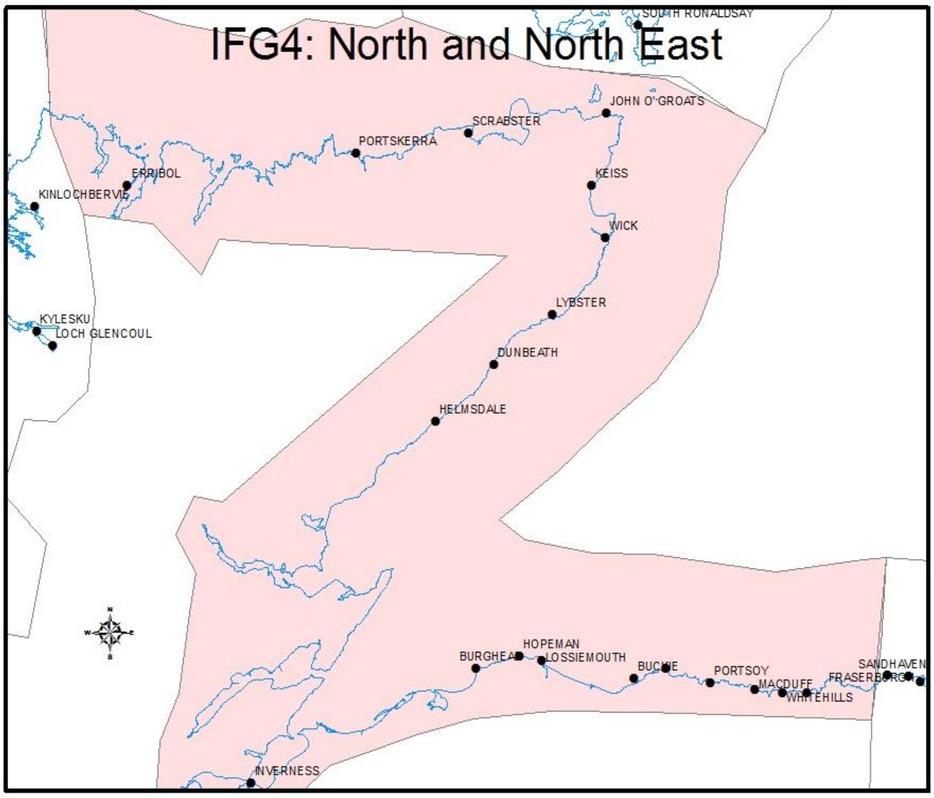
Within both the 0-1 and 0-3 nm, static gear take a larger share of the catch than mobile gears and 15 m and under vessels catch significantly more than the over 15 m vessels.

12 THE BASELINE: MF&NC IFG (IFG 4)

12.1 Introduction to Area

The area covers the North Coast, Highlands East Coast and the Moray Firth coast extending from Cape Wrath to Sandhaven just west of Fraserburgh. The port of Fraserburgh itself is geographically within the East Coast IFG, however the Fraserburgh Fishery District has administrative responsibility for ports which are all in the Moray Firth and North Coast IFG area.

Figure 12.1. Moray Firth and North Coast IFG Area



Section 20.3 of this report estimated the (notional) populations of the IFG areas by allocating data zones to the nearest IFG. The estimated population of the MF&NC IFG was 297,853 which is 5.9% of the Scottish population. It is the third most populous IFG area, though compared with the Moray Firth, the North Coast is sparsely populated and inaccessible.

There are two Fishery Districts, Buckie and Scrabster, within the IFG. A third District, Fraserburgh, straddles to boundary of the MF&NC IFG and the East Coast IFG. For the purposes of this section of the study, Fraserburgh District's reported statistics summarise activity (landings, fleet, employment etc) along the Moray Firth rather than the East Coast

The Fishery Districts and their administrative ports are listed in the table below

Table 12.1. MF&NC Fishery Districts and Their Ports

Fraserburgh (FO*)	Buckie (FO*)	Scrabster (FO*)
Fraserburgh	Buckie	Avoch
Gardenstown	Burghead	Brora
Macduff	Findochty	Dunbeath
Pennan	Hopeman	Helmsdale
Portsoy	Lossiemouth	Invergordon
Rosehearty	Portknockie	Inverness
Sandhaven		John O'Groats
Pitullie		Keiss
Whitehills		Lybster
		Portmahomack
		Portskerra

12.2 Active Vessels by District and Gear Type

Table 12.2. MF & NC Active Vessels by District and Gear Type

			Buckie	Scrabster	Fraserburgh	Total
10m & under		**Nephrop Trawls**	10	1	1	12
		Creel fishing	35	80	77	192
		Other	5	-	22	27
		Total	**50**	**81**	**100**	**231**
Over 10m	**Pelagic**	**Purse seine**			2	2
		Pelagic trawl			9	9
		Other			-	
		Total			**11**	**11**
	Demersal	**Trawl**	13	1	52	66
		Seine	4	2	5	11
		Lines	1	-	-	1
		Other	-	-	1	1
		Total	**18**	**3**	**58**	**79**
	Shellfish	**Nephrop trawls**	2	-	30	32
		Creel fishing	2	6	1	9
		Other	5	1	2	8
		Total	9	7	**33**	49
	Total Over10 m		**27**	**10**	**102**	**139**
Total All Vessels			**77**	**91**	**202**	**370**

Source *Scottish Sea Fisheries Statistics 2012*, Table 2.5

There are more 10 m and under vessels than over 1 0m. Whilst still the largest segment, compared with the three west coast IFG's, small creel vessels are less dominant.

12.3 MF& NC Employment by District

Table 12.3. MF&NC Catching Sector Employment by District

District	Regularly Employed	Irregularly Employed	Total
Buckie	136	48	184
Scrabster	111	-	111
Fraserburgh	643	154	797
Total	**1017**	**202**	**1092**

Source *Scottish Sea Fisheries Statistics 2012*

The absence of irregular employment in the Scrabster vessels is surprising.

12.4 MF&NC Coast Landings

Table 12.4. MF&NC IFG Landings by District by All Vessels and Scottish Vessels

	All Vessels				**Scottish Vessels**
District	**Total demersal**	**Total pelagic**	**Total shellfish**	**Total landings (£'000)**	**Total Landings (£ '000)**
Buckie	£115	£34	£3,012	£3,161	£3,136
Scrabster	£18,730	£4	£6,546	£25,279	£20,298
Fraserburgh	£6,126	£10,907	£19,537	£36,570	£35,459
Total	**£24,971**	**£10,945**	**£29,095**	**£65,010**	**£58,893**

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

Most of the landings are by Scottish vessels. Shellfish is the most important species category, but not as dominant as on the West Coast.

12.5 MPAs, Legislation & Regulations specific to the IFG Area

There are two MPAs within the IFG area. In the table below we have estimated the area of both the 0-1NM and 0-3NM that would be covered by an MPA site.

Table 12.5.1 IFG 1: MPAs in the MF&NC IFG in 0-1 NM and 0-3NM zones

MPA	**Area (KM) within 0-1 NM**	**Area (KM) within 0-3 NM**
East Caithness Cliffs	100.6	113.4
Noss Head	5.7	8.7
Total	106.3	122.1

PROHIBITION OF FISHING FOR SEA FISH WITH MOBILE OR ACTIVE GEAR

Area within which prohibition applies	***Period of prohibition***	***Method of fishing for species of sea fish excepted from prohibition***	***Period of exception***
Dornoch Firth	1st January to 31st December	Dredging (but not suction dredging) for mussels.	1st January to 31st December
Cromarty Firth	1st January to 31st December	Dredging (but not suction dredging) for cockles and mussels.	1st January to 31st December
Inverness Firth	1st January to 31st December	Dredging (but not suction dredging) for cockles and mussels.	1st January to 31st December

The next section reports the catch estimates derived through our manipulation of VMS and Scotmap data.

12.6 Moray Firth and North Coast Baseline Catch Estimates (IFG 4)

12.6.1 MF&NC Zone 0-1 nm

Table 12.6.1 IFG 4: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

MF&NC 1NM		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£190,793	£0	£0	£0	£0	£190,793
Nephrops Trawl	Val	£0	£0	£1,007,493	£0	£0	£1,007,493
Pelagic Lines	Val	£0	£94,066	£0	£0	£0	£94,066
Dredge	Val	£0	£0	£0	£39,811	£0	£39,811
Pots	Val	£0	£0	£7,860	£0	£1,661,938	£1,669,798
Hand Dive	Val	£0	£0	£0	£63,707	£0	£63,707
Total	**Val**	**£190,793**	**£94,066**	**£1,015,352**	**£103,518**	**£1,661,938**	**£3,065,667**

Table 12.6.2 IFG 4: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

MF&NC 1nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£46,636	£183	£1,009	£0	£0	£23,098	£70,927
Trawl		Vol	31	0	0	0	0	5	36
Nephrops		Val	£2,513	£25	£17,804	£0	£0	£2,043	£22,385
Trawl		Vol	2	0	5	0	0	0	7
Pelagic		Val	£0	£0	£0	£0	£0	£0	£0
Trawl		Vol	0	0	0	0	0	0	0
Other		Val	£2,072	£5,471	£65	£0	£0	£248,982	£256,590
Trawl		Vol	2	5	0	0	0	43	50
Dredge		Val	£0	£258	£0	£73,013	£0	£2,105	£75,376
	0	Vol	0	0	0	36	0	0	37
Pots		Val	£1,227	£0	£0	£319	£0	£20,461	£22,008
	0	Vol	1	0	0	0	0	14	15
Total		**Val**	£52,448	£5,937	£18,878	£73,332	£0	£296,690	£447,286
	0	**Vol**	36	5	5	36	0	63	146

Table 12.6.3 IFG 4: Catch Value by Gear Type by all Vessels in 0-1 NM zone

MF&NC 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£237,429	£183	£1,009	£0	£23,098	£261,720
Nephrops Trawl	Val	£2,513	£25	£1,025,297	£0	£2,043	£1,029,877
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£94,066	£0	£0	£0	£94,066
Other Trawl	Val	£2,072	£5,471	£65	£0	£248,982	£256,590
Dredge	Val	£0	£258	£0	£112,824	£2,105	£115,188
Pots	Val	£1,227	£0	£7,860	£319	£1,682,399	£1,691,805
Hand Dive	Val	£0	£0	£0	£63,707	£0	£63,707
Total	**Val**	**£243,241**	**£100,003**	**£1,034,230**	**£176,850**	**£1,958,628**	**£3,512,952**

12.6.2 MF&NC Zone 0-3 nm

Table 12.6.4 IFG 4: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

MF&NC 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£413,208	£0	£0	£0	£0	£413,208
Nephrops Trawl	Val	£0	£0	£2,056,269	£0	£0	£2,056,269
Pelagic Lines	Val	£0	£161,502	£0	£0	£0	£161,502
Dredge	Val	£0	£0	£0	£104,564	£0	£104,564
Pots	Val	£0	£0	£11,062	£0	£2,234,682	£2,245,744
Hand Dive	Val	£0	£0	£0	£101,995	£0	£101,995
Total	**Val**	**£413,208**	**£161,502**	**£2,067,330**	**£206,559**	**£2,234,682**	**£5,083,282**

Table 12.6.5 IFG 4: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

MF&NC 3nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	**355,933**	**1,083**	**4,252**	**0**	**0**	**96,325**	**457,593**
Trawl		Vol	**216**	**1**	**1**	**0**	**0**	**21**	**238**
Nephrops		Val	**4,317**	**34**	**46,085**	**0**	**0**	**4,656**	**55,093**
Trawl		Vol	**3**	**0**	**14**	**0**	**0**	**1**	**18**
Pelagic		Val	**0**	**14,030**	**0**	**0**	**0**	**0**	**14,030**
Trawl		Vol	**0**	**27**	**0**	**0**	**0**	**0**	**27**
Other		Val	**4,278**	**14,990**	**126**	**0**	**0**	**593,037**	**612,430**
Trawl		Vol	**4**	**13**	**0**	**0**	**0**	**108**	**125**
Dredge		Val	**0**	**469**	**0**	**408,172**	**0**	**4,603**	**413,244**
	0	Vol	**0**	**0**	**0**	**216**	**0**	**1**	**217**
Pots		Val	**1,227**	**0**	**0**	**461**	**0**	**24,713**	**26,402**
	0	Vol	**1**	**0**	**0**	**0**	**0**	**17**	**19**
Total		**Val**	**365,755**	**30,605**	**50,463**	**408,633**	**0**	**723,335**	**1,578,791**
	0	**Vol**	**224**	**41**	**15**	**216**	**0**	**148**	**644**

Table 12.6.6 IFG 4: Catch Value by Gear Type by all Vessels in 0-3 NM zone

MF&NC 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£769,141	£1,083	£4,252	£0	£96,325	£870,801
Nephrops Trawl	Val	£4,317	£34	£2,102,354	£0	£4,656	£2,111,361
Pelagic Trawl	Val	£0	£14,030	£0	£0	£0	£14,030
Pelagic Lines	Val	£0	£161,502	£0	£0	£0	£161,502
Other Trawl	Val	£4,278	£14,990	£126	£0	£593,037	£612,430
Dredge	Val	£0	£469	£0	£512,735	£4,603	£517,808
Pots	Val	£1,227	£0	£11,062	£461	£2,259,396	£2,272,146
Hand Dive	Val	£0	£0	£0	£101,995	£0	£101,995
Total	**Val**	**£778,963**	**£192,108**	**£2,117,794**	**£615,192**	**£2,958,017**	**£6,662,073**

12.6.3 MF&NC Zone 0-6 nm

Table 12.6.7 IFG 4: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

MF&NC 6nm		**DEMERSAL**	**PELAGIC**	**NEPHROPS**	**SCALLOPS**	**OTHER SHELLFISH**	**TOTAL**
Demersal Trawl	Val	£669,176	£0	£0	£0	£0	£669,176
Nephrops Trawl	Val	£0	£0	£3,046,106	£0	£0	£3,046,106
Pelagic Lines	Val	£0	£206,310	£0	£0	£0	£206,310
Dredge	Val	£0	£0	£0	£199,794	£0	£199,794
Pots	Val	£0	£0	£12,354	£0	£2,762,176	£2,774,530
Hand Dive	Val	£0	£0	£0	£99,009	£0	£99,009
Total	**Val**	**£669,176**	**£206,310**	**£3,058,460**	**£298,804**	**£2,762,176**	**£6,994,926**

Table 12.6.8 IFG 4: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

MF&NC 6nm		**DEMERSAL**	**PELAGIC**	**NEPHROPS**	**KING SCALLOPS**	**QUEEN SCALLOPS**	**OTHER SHELLFISH**	**TOTAL**
Demersal	Val	**742,824**	**1,323**	**20,356**	**0**	**0**	**112,029**	**876,532**
Trawl	Vol	**448**	**1**	**5**	**0**	**0**	**24**	**478**
Nephrops	Val	**31,912**	**84**	**255,531**	**0**	**0**	**8,447**	**295,974**
Trawl	Vol	**26**	**0**	**80**	**0**	**0**	**2**	**108**
Pelagic	Val	**0**	**482,134**	**0**	**0**	**0**	**0**	**482,134**
Trawl	Vol	**0**	**946**	**0**	**0**	**0**	**0**	**946**
Other	Val	**5,298**	**19,821**	**171**	**0**	**0**	**753,539**	**778,829**
Trawl	Vol	**5**	**17**	**0**	**0**	**0**	**138**	**160**
Dredge	Val	**0**	**727**	**0**	**763,292**	**0**	**6,407**	**770,425**
0	Vol	**0**	**1**	**0**	**396**	**0**	**1**	**398**
Pots	Val	**1,227**	**0**	**0**	**461**	**0**	**28,072**	**29,760**
0	Vol	**1**	**0**	**0**	**0**	**0**	**20**	**21**
Total	**Val**	**781,261**	**504,089**	**276,057**	**763,754**	**0**	**908,493**	**3,233,655**
0	**Vol**	**481**	**965**	**85**	**396**	**0**	**185**	**2,112**

Table 12.6.9 IFG 4: Catch Value by Gear Type by all Vessels in 0-6 NM zone

MF&NC 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£1,412,000	£1,323	£20,356	£0	£112,029	£1,545,708
Nephrops Trawl	Val	£31,912	£84	£3,301,637	£0	£8,447	£3,342,080
Pelagic Trawl	Val	£0	£482,134	£0	£0	£0	£482,134
Pelagic Lines	Val	£0	£206,310	£0	£0	£0	£206,310
Other Trawl	Val	£5,298	£19,821	£171	£0	£753,539	£778,829
Dredge	Val	£0	£727	£0	£963,087	£6,407	£970,220
Pots	Val	£1,227	£0	£12,354	£461	£2,790,247	£2,804,290
Hand Dive	Val	£0	£0	£0	£99,009	£0	£99,009
Total	**Val**	**£1,450,437**	**£710,399**	**£3,334,517**	**£1,062,558**	**£3,670,669**	**£10,228,581**

12.6.4 MF&NC Zone 0-12 nm

Table 12.6.10 IFG 4: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

MF&NC 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£717,057	£0	£0	£0	£0	£717,057
Nephrops Trawl	Val	£0	£0	£3,254,866	£0	£0	£3,254,866
Pelagic Lines	Val	£0	£224,127	£0	£0	£0	£224,127
Dredge	Val	£0	£0	£0	£215,714	£0	£215,714
Pots	Val	£0	£0	£11,967	£0	£2,909,342	£2,921,309
Hand Dive	Val	£0	£0	£0	£99,009	£0	£99,009
Total	**Val**	**£717,057**	**£224,127**	**£3,266,833**	**£314,724**	**£2,909,342**	**£7,432,083**

Table 12.6.11 IFG 4: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

MF&NC 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	**1,529,909**	**1,527**	**77,318**	**0**	**0**	**136,936**	**1,745,690**
Trawl	Vol	**972**	**1**	**21**	**0**	**0**	**29**	**1,023**
Nephrops	Val	**175,451**	**90**	**1,420,080**	**0**	**0**	**32,118**	**1,627,739**
Trawl	Vol	**144**	**0**	**454**	**0**	**0**	**9**	**607**
Pelagic	Val	**0**	**547,364**	**0**	**0**	**0**	**0**	**547,364**
Trawl	Vol	**0**	**1,071**	**0**	**0**	**0**	**0**	**1,071**
Other	Val	**6,476**	**24,726**	**270**	**0**	**0**	**864,595**	**896,067**
Trawl	Vol	**6**	**21**	**0**	**0**	**0**	**161**	**188**
Dredge	Val	**0**	**727**	**0**	**1,219,869**	**0**	**6,407**	**1,227,002**
0	Vol	**0**	**1**	**0**	**590**	**0**	**1**	**592**
Pots	Val	**5,561**	**0**	**0**	**461**	**0**	**92,948**	**98,970**
0	Vol	**5**	**0**	**0**	**0**	**0**	**65**	**71**
Total	**Val**	**1,717,397**	**574,434**	**1,497,668**	**1,220,330**	**0**	**1,133,003**	**6,142,832**
0	**Vol**	**1,127**	**1,094**	**475**	**591**	**0**	**265**	**3,552**

Table 12.6.12 ***IFG 4: Catch Value by Gear Type by all Vessels in 0-12 NM zone***

MF&NC 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£2,246,967	£1,527	£77,318	£0	£136,936	£2,462,748
Nephrops Trawl	Val	£175,451	£90	£4,674,945	£0	£32,118	£4,882,605
Pelagic Trawl	Val	£0	£547,364	£0	£0	£0	£547,364
Pelagic Lines	Val	£0	£224,127	£0	£0	£0	£224,127
Other Trawl	Val	£6,476	£24,726	£270	£0	£864,595	£896,067
Dredge	Val	£0	£727	£0	£1,435,583	£6,407	£1,442,716
Pots	Val	£5,561	£0	£11,967	£461	£3,002,290	£3,020,279
Hand Dive	Val	£0	£0	£0	£99,009	£0	£99,009
Total	**Val**	**£2,434,454**	**£798,561**	**£4,764,501**	**£1,535,054**	**£4,042,345**	**£13,574,916**

MF&NC Zone Summary Totals

Table 12.6.13 IFG 4: Catch Value by Gear Type From Shore to Zones Outer Limits

MF&NC	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£261,720	7.5%	£870,801	13.1%	£1,545,708	15.1%	£2,462,748	18.1%
Nephrops Trawl	£1,029,877	29.3%	£2,111,361	31.7%	£3,342,080	32.7%	£4,882,605	36.0%
Pelagic Trawl	£0	0.0%	£14,030	0.2%	£482,134	4.7%	£547,364	4.0%
Pelagic Lines	£94,066	2.7%	£161,502	2.4%	£206,310	2.0%	£224,127	1.7%
Other Trawl	£256,590	7.3%	£612,430	9.2%	£778,829	7.6%	£896,067	6.6%
Dredge	£115,188	3.3%	£517,808	7.8%	£970,220	9.5%	£1,442,716	10.6%
Pots	£1,691,805	48.2%	£2,272,146	34.1%	£2,804,290	27.4%	£3,020,279	22.2%
Hand Dive	£63,707	1.8%	£101,995	1.5%	£99,009	1.0%	£99,009	0.7%
Total	£3,512,952	100.0%	£6,662,073	100.0%	£10,228,581	100.0%	£13,574,916	100.0%
%	25.9%		49.1%		75.3%		100.0%	

Table 12.6.14 IFG 4: Catch Value by Gear Type For Each Zone

MF&NC	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£261,720	7.5%	£609,081	19.3%	£674,907	18.9%	£917,039	27.4%
Nephrops Trawl	£1,029,877	29.3%	£1,081,484	34.3%	£1,230,718	34.5%	£1,540,525	46.0%
Pelagic Trawl	£0	0.0%	£14,030	0.4%	£468,104	13.1%	£65,230	1.9%
Pelagic Lines	£94,066	2.7%	£67,436	2.1%	£44,808	1.3%	£17,817	0.5%
Other Trawl	£256,590	7.3%	£355,841	11.3%	£166,399	4.7%	£117,238	3.5%
Dredge	£115,188	3.3%	£402,620	12.8%	£452,412	12.7%	£472,496	14.1%
Pots	£1,691,805	48.2%	£580,341	18.4%	£532,144	14.9%	£215,989	6.5%
Hand Dive	£63,707	1.8%	£38,288	1.2%	-£2,986	-0.1%	£0	0.0%
Total	£3,512,952	100.0%	£3,149,121	100.0%	£3,566,507	100.0%	£3,346,335	100.0%

Table 12.6.15 IFG 4: Catch Value by Gear Type From Shore to Zones Outer Limits

MF&NC	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£1,691,805	48.2%	£2,272,146	34.1%	£2,804,290	27.4%	£3,020,279	22.2%
Mobile	£1,663,374	47.3%	£4,126,430	61.9%	£7,118,971	69.6%	£10,231,500	75.4%
Other	£157,773	4.5%	£263,497	4.0%	£305,320	3.0%	£323,137	2.4%
Total	£3,512,952	100.0%	£6,662,073	100.0%	£10,228,581	100.0%	£13,574,916	100.0%

Table 12.6.17 IFG 4: Catch Value by Vessel Size From Shore to Zones Outer Limits

MF&NC	1nm	%	3nm	%	6nm	%	12nm	%
Small	£3,065,667	87.3%	£5,083,282	76.3%	£6,994,926	68.4%	£7,432,083	54.7%
Large	£447,286	12.7%	£1,578,791	23.7%	£3,233,655	31.6%	£6,142,832	45.3%
Total	£3,512,952	100.0%	£6,662,073	100.0%	£10,228,581	100.0%	£13,574,916	100.0%

Table 12.6.18 IFG 4: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

MF&NC	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£343,244	9.8%	£971,071	14.6%	£2,160,837	21.1%	£3,233,016	23.8%
Shellfish	£3,169,708	90.2%	£5,691,003	85.4%	£8,067,744	78.9%	£10,341,900	76.2%
Total	£3,512,952	100.0%	£6,662,073	100.0%	£10,228,581	100.0%	£13,574,916	100.0%

From the above tables it is estimated that the catch taken in the IFG water (i.e. 0-6nm) by Scottish vessels is £10.2m of which 34.3% is caught within 1NM and 65% within 0-3nm.

The zone 0-1, 1-3 and 3-6NM deliver broadly the same value of catch. A total of £3.51m was caught in the 0-1NM zone, the comparable figures for the 1-3 and 3-6NM zones were £3.15 and £3.57m

Within both the 0-1, zone static and mobile gears catch the same value and the catch of small 15 and under exceeds the collective catch of over 15m vessels. Within the 0-3NM zone, the catch value attributed to mobile gears exceeds the catch value of static gears and smaller vessels land a greater value than over 15m vessels.

13 THE BASELINE: ORKNEY (IFG 5)

13.1 Introduction to Area

Orkney comprises over 70 islands; around 20 are inhabited. The largest island, known as "Mainland," has an area of 202 sq mi (523 km²), making it the sixth-largest Scottish island and the tenth-largest island in the British Isles. The largest settlement and administrative centre is Kirkwall and almost the whole population of 19,900 lives within 5 kmof the sea.

The Fishery Office in Kirkwall has responsibility for the ports of Hoy, Rousay, South Ronaldsay, Sanday and Stromness.

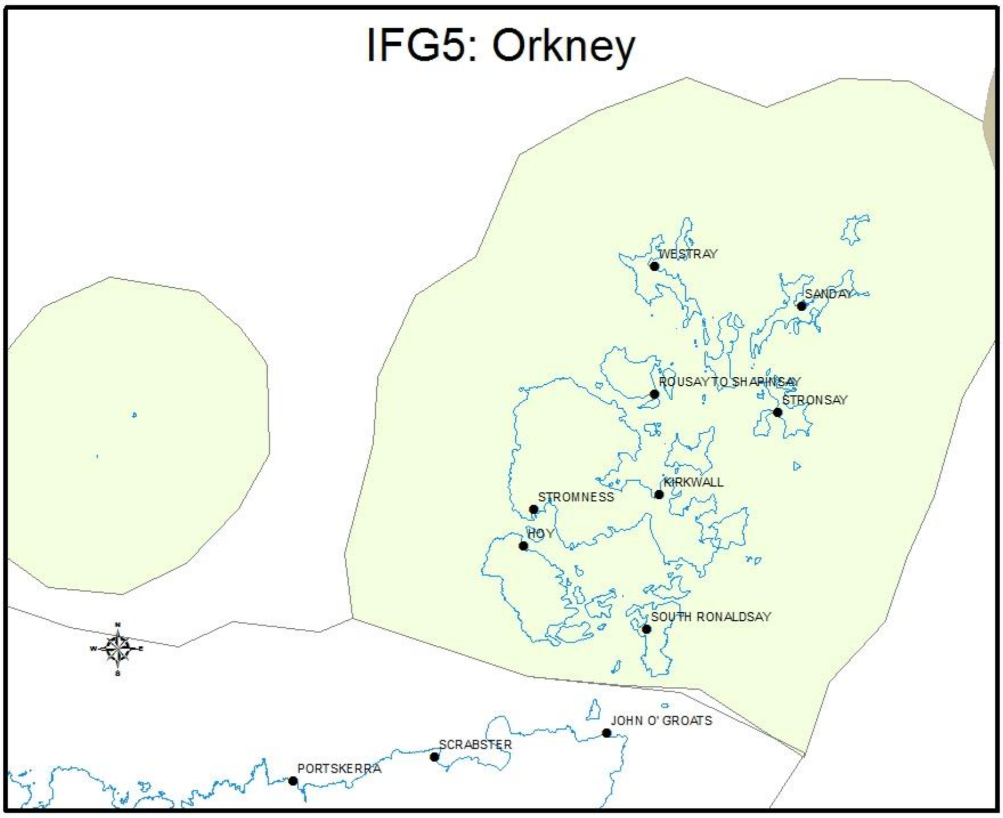


Figure 13.1 Orkney IFG

Orkney's fleet comprises 142 vessels, 102 of which are under 10m and 96 of these are creel vessels. Total landings were £6.5m almost all of this was shellfish. There are co-operatively owned crab processing factories in Westray and Stromness which have been expanding.

Although the population is around 20,000, the islands have a world class reputation for scuba diving. We identified 10 charter boat operators providing charters for divers. The charter boat operators in Orkney report regular charters from clubs and groups in North America, America, France, Germany and Holland.

On a similarly note, the islands are well regarded as sea angling venues and although sea anglers are visiting in smaller numbers they still support a number of specialist charter operators. Radford et al (2009) estimated the following sea angling activity levels.

Table 13.1 Orkney Sea Angling

	Number of sea anglers	Total Angler Days	Charter Days	Own/Friends Boat Days
Local	1,134	25,000	400	9,459
Visitors	1,000	4,500	800	500

Radford et al also identified 17 observable FTEs directly dependent on recreational sea angling. This does not include the indirect and induced employment.

13.2 Active Vessels by District and Gear Type

Table 13.2 Orkney Active Vessels by District and Gear Type

<table>
<tr><td colspan="2" rowspan="4">10m & under</td><td>Nephrop Trawls</td><td>3</td></tr>
<tr><td>Creel fishing</td><td>93</td></tr>
<tr><td>Other</td><td>6</td></tr>
<tr><td>Total</td><td>102</td></tr>
<tr><td rowspan="13">Over 10m</td><td rowspan="4">Pelagic</td><td>Purse seine</td><td>-</td></tr>
<tr><td>Pelagic trawl</td><td>-</td></tr>
<tr><td>Other</td><td>-</td></tr>
<tr><td>Total</td><td>-</td></tr>
<tr><td rowspan="5">Demersal</td><td>Trawl</td><td>6</td></tr>
<tr><td>Seine</td><td>-</td></tr>
<tr><td>Lines</td><td>-</td></tr>
<tr><td>Other</td><td>-</td></tr>
<tr><td>Total</td><td>6</td></tr>
<tr><td rowspan="4">Shellfish</td><td>Nephrop trawls</td><td>5</td></tr>
<tr><td>Creel fishing</td><td>26</td></tr>
<tr><td>Other</td><td>3</td></tr>
<tr><td>Total</td><td>34</td></tr>
<tr><td colspan="2">Total Over10 m</td><td>40</td></tr>
<tr><td colspan="3">Total All Vessel</td><td>142</td></tr>
</table>

Source *Scottish Sea Fisheries Statistics 2012*, Table 2.5

13.3 Orkney Employment

Table 13.3 Orkney Catching Sector Employment

Regularly Employed	Irregularly Employed	Total
235	119	354

Source *Scottish Sea Fisheries Statistics 2012*

13.4 MPAs, Legislation & Regulations specific to the IFG Area

Table 13.4.1 IFG 1: MPAs in the Orkney IFG in 0-1 NM and 0-3NM zones

MPA	Area (KM) within 0-1 NM	Area (KM) within 0-3 NM
Papa Westray	29.1	32.6
Wyre and Rousay Sounds	15.7	15.7
Total	44.8	48.3

Specific Legislation and Regulation:

AREA	CLOSURE	TIME
The Berry to Costa Head	Mobile of Active Gear	May 1st to September 30th

13.5 Orkney Landings

Table 13.4 Orkney IFG Landings by District by All Vessels and Scottish Vessels

All Vessels				Scottish Vessels
Total demersal	**Total pelagic**	**Total shellfish**	**Total landings (£'000)**	**Total Landings (£ '000)**
£52	**£20**	**£6,418**	**£6,491**	**£6,491**

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

The next section reports the catch estimates derived through our manipulation of VMS and Scotmap data.

13.6 Orkney Baseline Estimates (IFG 5)

13.6.1 Orkney Zone 0-1 nm

Table 13.6.1 IFG 5: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

ORKNEY 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£1,436	£0	£0	£0	£0	£1,436
Nephrops Trawl	Val	£0	£0	£120,734	£0	£0	£120,734
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£57,112	£0	£57,112
Pots	Val	£0	£0	£430	£0	£2,484,972	£2,485,402
Hand Dive	Val	£0	£0	£0	£731,212	£3,174	£734,387
Total	**Val**	**£1,436**	**£0**	**£121,164**	**£788,324**	**£2,488,147**	**£3,399,070**

Table 13.6.2 IFG 5: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

ORKNEY 1nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£12,602	£0	£67	£0	£0	£0	£12,668
Trawl		Vol	12	0	0	0	0	0	12
Nephrops		Val	£0	£0	£0	£0	£0	£0	£0
Trawl		Vol	0	0	0	0	0	0	0
Pelagic		Val	£0	£0	£0	£0	£0	£0	£0
Trawl		Vol	0	0	0	0	0	0	0
Other		Val	£3	£1	£0	£0	£0	£920	£924
Trawl		Vol	0	0	0	0	0	0	0
Dredge		Val	£0	£0	£0	£15,445	£0	£0	£15,445
	0	Vol	0	0	0	9	0	0	9
Pots		Val	£0	£0	£0	£0	£0	£90,804	£90,804
	0	Vol	0	0	0	0	0	41	41
Total		**Val**	£12,604	£1	£67	£15,445	£0	£91,723	£119,841
	0	**Vol**	12	0	0	9	0	41	62

Table 13.6.3 IFG 5: Catch Value by Gear Type by all Vessels in 0-1 NM zone

ORKNEY 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£14,037	£0	£67	£0	£0	£14,104
Nephrops Trawl	Val	£0	£0	£120,734	£0	£0	£120,734
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Other Trawl	Val	£3	£1	£0	£0	£920	£924
Dredge	Val	£0	£0	£0	£72,557	£0	£72,557
Pots	Val	£0	£0	£430	£0	£2,575,776	£2,576,206
Hand Dive	Val	£0	£0	£0	£731,212	£3,174	£734,387
Total	**Val**	**£14,040**	**£1**	**£121,230**	**£803,769**	**£2,579,870**	**£3,518,911**

13.6.2 Orkney Zone 0-3 nm

Table 13.6.4 IFG 5: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

ORKNEY 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£3,665	£0	£0	£0	£0	£3,665
Nephrops Trawl	Val	£0	£0	£180,634	£0	£0	£180,634
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£179,918	£0	£179,918
Pots	Val	£0	£0	£402	£0	£2,543,004	£2,543,406
Hand Dive	Val	£0	£0	£0	£874,597	£4,873	£879,470
Total	**Val**	**£3,665**	**£0**	**£181,036**	**£1,054,515**	**£2,547,877**	**£3,787,093**

Table 13.6.5 IFG 5: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

ORKNEY 3nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£37,798	£0	£67	£0	£0	£662	£38,527
Trawl		Vol	27	0	0	0	0	0	28
Nephrops		Val	£264	£0	£626	£0	£0	£11	£901
Trawl		Vol	0	0	0	0	0	0	0
Pelagic		Val	£0	£0	£0	£0	£0	£0	£0
Trawl		Vol	0	0	0	0	0	0	0
Other		Val	£0	£0	£0	£0	£0	£0	£0
Trawl		Vol	0	0	0	0	0	0	0
Dredge		Val	£0	£0	£0	£33,554	£0	£0	£33,554
	0	Vol	0	0	0	19	0	0	19
Pots		Val	£0	£0	£0	£0	£0	£168,437	£168,437
	0	Vol	0	0	0	0	0	91	91
Total		**Val**	£38,063	£0	£692	£33,554	£0	£169,110	£241,418
	0	**Vol**	28	0	0	19	0	91	138

Table 13.6.6 IFG 5: Catch Value by Gear Type by all Vessels in 0-3 NM zone

ORKNEY 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£41,463	£0	£67	£0	£662	£42,192
Nephrops Trawl	Val	£264	£0	£181,260	£0	£11	£181,535
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Other Trawl	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£213,471	£0	£213,471
Pots	Val	£0	£0	£402	£0	£2,711,440	£2,711,843
Hand Dive	Val	£0	£0	£0	£874,597	£4,873	£879,470
Total	**Val**	**£41,728**	**£0**	**£181,729**	**£1,088,068**	**£2,716,986**	**£4,028,511**

13.6.3 Orkney Zone 0-6 nm

Table 13.6.7 IFG 5: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

ORKNEY 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£8,414	£0	£0	£0	£0	£8,414
Nephrops Trawl	Val	£0	£0	£193,431	£0	£0	£193,431
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£338,283	£0	£338,283
Pots	Val	£0	£0	£492	£0	£3,861,166	£3,861,658
Hand Dive	Val	£0	£0	£0	£861,453	£4,761	£866,214
Total	**Val**	**£8,414**	**£0**	**£193,924**	**£1,199,736**	**£3,865,927**	**£5,268,000**

Table 13.6. 8 IFG 5: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

ORKNEY 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£84,592	£0	£93	£0	£0	£1,304	£85,989
Trawl	Vol	64	0	0	0	0	0	64
Nephrops	Val	£264	£0	£626	£0	£0	£11	£901
Trawl	Vol	0	0	0	0	0	0	0
Pelagic	Val	£0	£0	£0	£0	£0	£0	£0
Trawl	Vol	0	0	0	0	0	0	0
Other	Val	£0	£0	£0	£0	£0	£0	£0
Trawl	Vol	0	0	0	0	0	0	0
Dredge	Val	£0	£0	£0	£50,274	£0	£0	£50,274
0	Vol	0	0	0	28	0	0	28
Pots	Val	£0	£0	£0	£0	£0	£305,767	£305,767
0	Vol	0	0	0	0	0	206	206
Total	**Val**	£84,856	£0	£718	£50,274	£0	£307,083	£442,931
0	**Vol**	64	0	0	28	0	207	299

Table 13.6.9 IFG 5: Catch Value by Gear Type by all Vessels in 0-6 NM zone

ORKNEY 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£93,005	£0	£93	£0	£1,304	£94,402
Nephrops Trawl	Val	£264	£0	£194,057	£0	£11	£194,332
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Other Trawl	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£388,557	£0	£388,557
Pots	Val	£0	£0	£492	£0	£4,166,934	£4,167,426
Hand Dive	Val	£0	£0	£0	£861,453	£4,761	£866,214
Total	**Val**	**£93,270**	**£0**	**£194,642**	**£1,250,010**	**£4,173,010**	**£5,710,932**

13.6.4 Orkney Zone 0-12 nm

Table 13.6.10 IFG 5: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

ORKNEY 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£8,563	£0	£0	£0	£0	£8,563
Nephrops Trawl	Val	£0	£0	£202,180	£0	£0	£202,180
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Dredge	Val	£0	£0	£0	£392,070	£0	£392,070
Pots	Val	£0	£0	£493	£0	£4,034,484	£4,034,977
Hand Dive	Val	£0	£0	£0	£861,453	£4,761	£866,214
Total	**Val**	£8,563	£0	£202,674	£1,253,523	£4,039,245	£5,504,005

Table 13.6.11 IFG 5: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

ORKNEY 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£612,355	£111	£2,735	£0	£0	£19,423	£634,625
Trawl	Vol	448	0	1	0	0	6	454
Nephrops	Val	£1,448	£0	£3,511	£0	£0	£47	£5,006
Trawl	Vol	1	0	1	0	0	0	2
Pelagic	Val	£0	£1,320,083	£0	£0	£0	£0	£1,320,083
Trawl	Vol	0	2,460	0	0	0	0	2,460
Other	Val	£0	£179,162	£0	£0	£0	£0	£179,162
Trawl	Vol	0	329	0	0	0	0	329
Dredge	Val	£0	£0	£0	£55,619	£0	£0	£55,619
0	Vol	0	0	0	31	0	0	31
Pots	Val	£1,619	£0	£0	£0	£0	£665,502	£667,121
0	Vol	1	0	0	0	0	483	484
Total	**Val**	£615,422	£1,499,356	£6,247	£55,619	£0	£684,973	£2,861,616
0	**Vol**	450	2,790	1	31	0	488	3,760

Table 13.6.12 IFG 5: Catch Value by Gear Type by all Vessels in 0-12 NM zone

ORKNEY 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£620,918	£111	£2,735	£0	£19,423	£643,188
Nephrops Trawl	Val	£1,448	£0	£205,692	£0	£47	£207,187
Pelagic Trawl	Val	£0	£1,320,083	£0	£0	£0	£1,320,083
Pelagic Lines	Val	£0	£0	£0	£0	£0	£0
Other Trawl	Val	£0	£179,162	£0	£0	£0	£179,162
Dredge	Val	£0	£0	£0	£447,689	£0	£447,689
Pots	Val	£1,619	£0	£493	£0	£4,699,986	£4,702,098
Hand Dive	Val	£0	£0	£0	£861,453	£4,761	£866,214
Total	**Val**	**£623,985**	**£1,499,356**	**£208,921**	**£1,309,142**	**£4,724,217**	**£8,365,621**

13.6.5 Orkney Summary Tables

Table 13.6.13 IFG 5: Catch Value by Gear Type From Shore to Zones Outer Limits

ORKNEY	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£14,104	0.4%	£42,192	1.0%	£94,402	1.7%	£643,188	7.7%
Nephrops Trawl	£120,734	3.4%	£181,535	4.5%	£194,332	3.4%	£207,187	2.5%
Pelagic Trawl	£0	0.0%	£0	0.0%	£0	0.0%	£1,320,083	15.8%
Pelagic Lines	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Other Trawl	£924	0.0%	£0	0.0%	£0	0.0%	£179,162	2.1%
Dredge	£72,557	2.1%	£213,471	5.3%	£388,557	6.8%	£447,689	5.4%
Pots	£2,576,206	73.2%	£2,711,843	67.3%	£4,167,426	73.0%	£4,702,098	56.2%
Hand Dive	£734,387	20.9%	£879,470	21.8%	£866,214	15.2%	£866,214	10.4%
Total	£3,518,911	100.0%	£4,028,511	100.0%	£5,710,932	100.0%	£8,365,621	100.0%
%	42.1%		48.2%		68.3%		100.0%	

Table 13.6.14 IFG 5: Catch Value by Gear Type For Each Zone

	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£14,104	0.4%	£28,088	5.5%	£52,210	3.1%	£548,786	20.7%
Nephrops Trawl	£120,734	3.4%	£60,801	11.9%	£12,797	0.8%	£12,854	0.5%
Pelagic Trawl	£0	0.0%	£0	0.0%	£0	0.0%	£1,320,083	49.7%
Pelagic Lines	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Other Trawl	£0	0.0%	£0	0.0%	£0	0.0%	£179,162	6.7%
Dredge	£72,557	2.1%	£140,914	27.7%	£175,086	10.4%	£59,132	2.2%
Pots	£2,576,206	73.2%	£135,637	26.6%	£1,455,583	86.5%	£534,672	20.1%
Hand Dive	£734,387	20.9%	£145,083	28.5%	£0	0.0%	£0	0.0%
Total	£3,518,911	100.0%	£509,600	100.0%	£1,682,421	100.0%	£2,654,689	100.0%
%								

ORKNEY	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£2,576,206	73.2%	£2,711,843	67.3%	£4,167,426	72.8%	£4,702,098	56.1%
Mobile	£207,395	5.9%	£437,198	10.9%	£677,292	11.8%	£2,797,309	33.4%
Other	£734,387	20.9%	£879,470	21.8%	£879,470	15.4%	£879,470	10.5%
Total	£3,517,987	100.0%	£4,028,511	100.0%	£5,724,188	100.0%	£8,378,877	100.0%

Table 13.6.16 IFG 5: Catch Value by Vessel Size From Shore to Zones Outer Limits

ORKNEY	1nm	%	3nm	%	6nm	%	12nm	%
Small	£3,399,070	96.6%	£3,787,093	94.0%	£5,268,000	92.2%	£5,504,005	65.8%
Large	£119,841	3.4%	£241,418	6.0%	£442,931	7.8%	£2,861,616	34.2%
Total	£3,518,911	100.0%	£4,028,511	100.0%	£5,710,932	100.0%	£8,365,621	100.0%

Table 13.6.17 IFG 5: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

ORKNEY	1nm	%	3nm	%	6nm	%	12nm	%
Finfish	£14,042	0.4%	£41,728	1.0%	£93,270	1.6%	£2,123,341	25.4%
Shellfish	£3,504,869	99.6%	£3,986,783	99.0%	£5,617,662	98.4%	£6,242,280	74.6%
Total	£3,518,911	100.0%	£4,028,511	100.0%	£5,710,932	100.0%	£8,365,621	100.0%

From the above tables it is estimated that the catch taken in the Orkney IFG waters by Scottish vessels is £5.7m of which 61.6% is caught within 1 NM and 70% within 0-3 NM.

A total of £3.52m was caught in the 0-1 NM zone, the comparable figures for the 1-3 and 3-6 NM zones were £0.51m and £1.68m. The low catch value for the 1-3 NM zone is highly unusual

Within both the 0-1, zone static gear was much more significant (73%) than mobile gear and the catch of 15 m and over vessels was almost insignificant. A similar pattern was evident in the 0-12nmNM zone. Mobile gear deployed by larger vessels does not contribute much to the Orkney IFG catch.

14 THE BASELINE: EAST COAST (IFG 6)

14.1 Introduction to Area

The East Coast IFG extends from the east of Sandhaven down to the Scottish border. It is comprised of the former South East IFG and the embryonic East Coast IFG. Attaching data zones populations to the nearest IFG produces a notional population of 2.4million, which is a similar order of magnitude as for the South West IFG. Accordingly recreational values as well as general public values are likely to be highly significant.

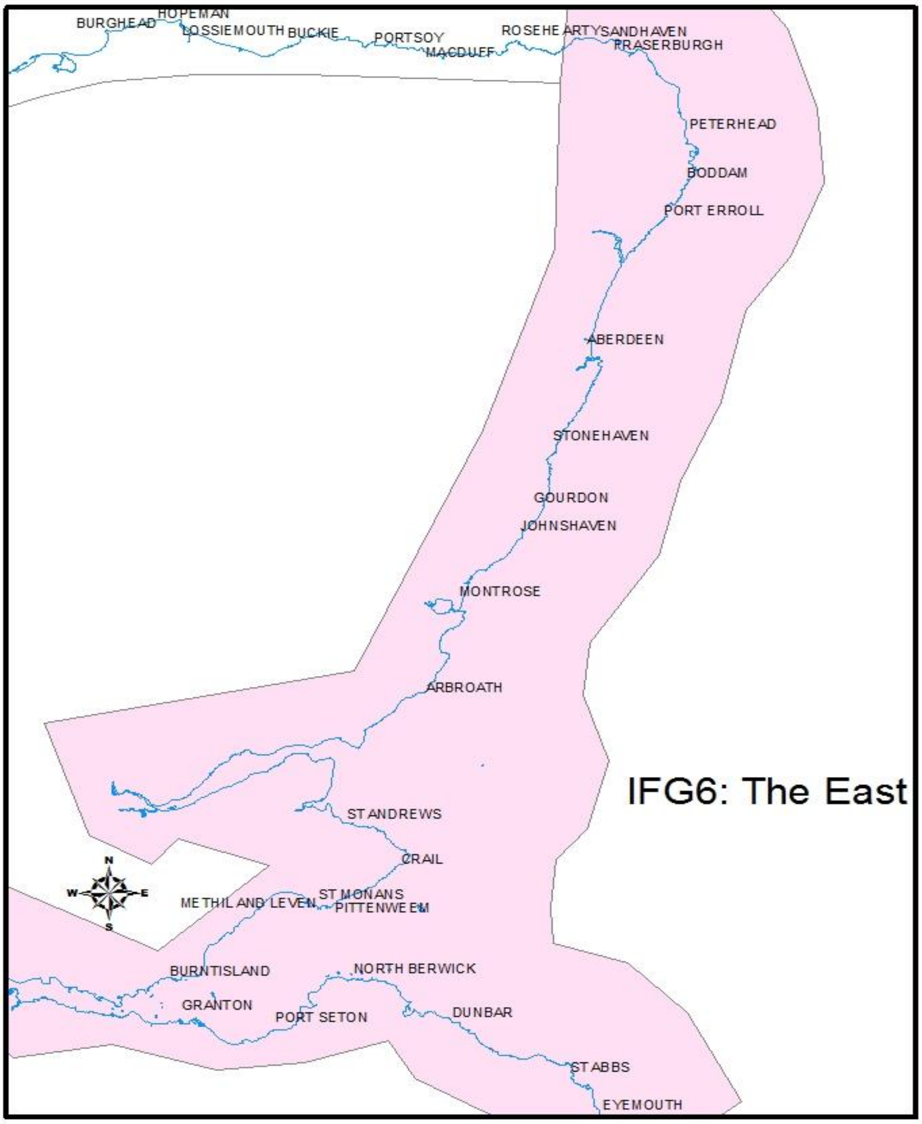


Figure 14.1 East Coast IFG Area

The largest inshore fleet segment comprises vessels targeting Nephrops. Lobsters are also important. Much of the lobster effort is part of a mixed fishery with brown crab, and velvet crab. This mixed fishery has developed over the years and enables a longer season than would be afforded by a single species fishery. Lobsters are caught primarily from the rocky coastal fringes. Brown crab are found softer ground and in deeper water locations and can migrate quite large distances. Velvet crab have become increasingly important with much of the catch sold abroad. The local King Scallop stocks are exploited by nomadic vessels.

With higher prices, hand lining for mackerel is now more important though constrained by quota. Creel fishermen can feasibly divert to mackerel hand lining.

The squid fishery is sporadic and local fishery operators informed us that this fiahery had expended in recent years. Exploitation can take place quite close to the shore.[40] There are four Fishery Districts which cover the IFG area.

Table 14.1 East Coast Fishery Districts and Their Administrative Ports.

Eyemouth (FO*)	Aberdeen (FO*)	Peterhead (FO*)	Pittenweem
Burnmouth	Aberdeen	Boddam	Anstruther (FO*)
Cove	Arbroath	Peterhead	Burntisland
Dunbar	Catterline	Port Errol	Crail
Eyemouth	Gourdon		Methil
Granton	Johnshaven		Leven
North Berwick	Montrose		Pittenweem
Port Seton	Stonehaven		St Andrews
St Abbs			St Monans

With respect to recreational activity, East Coast sites such as St Abbs and Eyemouth off the Berwickshire attract divers from all over the UK. Recreational sea angling is also significant. In the summer months, there is good mixed shore fishing and in the winter months migrating cod come in closer. Many angling clubs from across Scotland make regular trips to compete in competitions. Compared with shore angling effort, own boat angling is less popular, reflecting the difficult sea condition that smaller vessels encounter in the North Sea. Radford et al (2009) reported that local experts calculated 8,000 angler days over the winter months a significant percentage of these are visitors to Scotland, particularly from the North East of England. Another 3,000 angler days of fishing effort is estimated to be expended during the summer months targeting general species, as many as 50% of these days will be visitor angling effort.

[40] There is a significant wild salmon and sea trout fishery at Usan

14.2 Active Vessels by District and Gear Type

Table 14.2 East Coast IFG Active Vessels by District and Gear Type

			Aberdeen	Anstruther	Peterhead	Eyemouth	Total
10m & under		**Nephrop Trawls**	2	11	1	12	26
		Creel fishing	76	97	44	72	289
		Other[2]	1	1	3	2	7
		Total	**79**	**109**	**48**	**86**	322
Over 10m	**Pelagic**	**Purse seine**	-	-	2	-	2
		Pelagic trawl	-	-	2	-	2
		Other	-	-	-	-	
		Total	**-**	**-**	**4**	**-**	4
	Demersal	**Trawl[3]**	1	-	32	5	38
		Seine	-	-	5	1	6
		Lines	-	-	-	-	
		Other[4]	-	-	1	-	1
		Total	**1**	**-**	**38**	**6**	**45**
	Shellfish	**Nephrop trawls**	4	11	5	11	31
		Creel fishing	3	1	-	2	6
		Other	1	-	1	-	2
		Total	**8**	**12**	**6**	**13**	**39**
	Total Over 10 m		**9**	**12**	**48**	**19**	**88**
Total All Vessels			**88**	**121**	**96**	**105**	**410**

14.3 East Coast IFG Employment by District

Table 14.3 East Coast IFG Catching Sector Employment by District

District	Regularly Employed	Irregularly Employed	Total
Aberdeen	78	34	112
Anstruther	114	51	165
Eyemouth	116	50	166
Peterhead	347	31	378
Total	**655**	**166**	**821**

Source *Scottish Sea Fisheries Statistics 2012*

14.4 East Coast Landings

Table 14.4 East Coast IFG Landings by District by All Vessels and Scottish Vessels

	All Vessels				Scottish Vessels
District	**Total demersal**	**Total pelagic**	**Total shellfish**	**Total landings (£'000)**	**Total Landings (£ '000)**
Aberdeen	£77	£58	£4,193	£4,328	4,215
Anstruther	£2	£34	£4,501	£4,537	4,514
Eyemouth	£297	£46	£6,582	£6,925	6,187
Peterhead	£61,932	£69,504	£10,205	£141,641	109,947
Total	**£62,308**	**£69,642**	**£25,481**	**£157,431**	**124,863**

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

Peterhead is quite different from the other districts, being swamped by the demersal and pelagic landings at Peterhead itself. The pelagic and demersal fish landed at Peterhead were mostly caught outside the IFG area.

14.5 Legislation & Regulations specific to the IFG Area

he table below summarises fishery closures specified within “The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004” which directly relate to the East Coast IFG area.

PROHIBITION OF FISHING FOR SEA FISH WITH MOBILE OR ACTIVE GEAR

Area	***Period of prohibition***
Doolie Ness to Lang Craig	In respect of waters (a) within 1 mile of MHWS tides 1st January to 31st March and 1st October to 31st December each year; and (b) within 0.5 mile of MHWS tides 1st April to 30th September in each year
Lang Craig to Arbroath	In respect of waters within 2 miles of MHWS tides 1st January to 31st December in each year
St Andrews Bay	1st January to 31st December in each year
St Abbs Eyemouth Area	In respect of waters within 1 mile of MHWS tides 1st January to 31st December in each year.

14.6 East Coast Baseline Catch Estimates (IFG 6)

14.6.1 East Coast Zone 0-1 nm

Table 14.6.1 IFG 6 Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

EAST COAST 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£27,426	£0	£0	£0	£0	£27,426
Nephrops Trawl	Val	£0	£0	£689,000	£0	£0	£689,000
Pelagic Lines	Val	£0	£85,490	£0	£0	£0	£85,490
Dredge	Val	£0	£0	£0	£4,396	£0	£4,396
Pots	Val	£0	£0	£12,446	£0	£1,758,526	£1,770,972
Hand Dive	Val	£0	£0	£0	£0	£58,934	£58,934
Total	**Val**	**£27,426**	**£85,490**	**£701,446**	**£4,396**	**£1,817,460**	**£2,636,217**

Table 14.6.2 IFG 6: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

EAST COAST 1nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£582,742	£1,453	£14,682	£0	£0	£7,858	£606,735
Trawl	Vol	422	1	3	0	0	2	429
Nephrops	Val	£56,482	£102	£409,551	£112	£0	£4,430	£470,676
Trawl	Vol	37	0	128	0	0	1	166
Pelagic	Val	£0	£0	£0	£0	£0	£0	£0
Trawl	Vol	0	0	0	0	0	0	0
Other	Val	£1,061	£58,472	£498	£0	£0	£49,848	£109,880
Trawl	Vol	1	123	0	0	0	9	133
Dredge	Val	£0	£0	£0	£51,215	£0	£0	£51,215
0	Vol	0	0	0	31	0	0	31
Pots	Val	£0	£0	£0	£0	£0	£0	£0
0	Vol	0	0	0	0	0	0	0
Total	**Val**	£640,285	£60,027	£424,731	£51,327	£0	£62,137	£1,238,507
0	**Vol**	461	124	131	31	0	12	759

Table 14.6.3 IFG 6: Catch Value by Gear Type by all Vessels in 0-1 NM zone

EAST COAST 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£610,168	£1,453	£14,682	£0	£7,858	£634,161
Nephrops Trawl	Val	£56,482	£102	£1,098,551	£112	£4,430	£1,159,676
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£85,490	£0	£0	£0	£85,490
Other Trawl	Val	£1,061	£58,472	£498	£0	£49,848	£109,880
Dredge	Val	£0	£0	£0	£55,611	£0	£55,611
Pots	Val	£0	£0	£12,446	£0	£1,758,526	£1,770,972
Hand Dive	Val	£0	£0	£0	£0	£58,934	£58,934
Total	**Val**	**£667,711**	**£145,517**	**£1,126,177**	**£55,722**	**£1,879,596**	**£3,874,724**

14.6.2 East Coast Zone 0-3 nm

Table 14.6.4 IFG 6: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

EAST COAST 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£86,665	£0	£0	£0	£0	£86,665
Nephrops Trawl	Val	£0	£0	£2,153,020	£0	£0	£2,153,020
Pelagic Lines	Val	£0	£211,484	£0	£0	£0	£211,484
Dredge	Val	£0	£0	£0	£14,165	£0	£14,165
Pots	Val	£0	£0	£30,420	£0	£3,906,175	£3,936,595
Hand Dive	Val	£0	£0	£0	£0	£127,196	£127,196
Total	**Val**	**£86,665**	**£211,484**	**£2,183,440**	**£14,165**	**£4,033,372**	**£6,529,125**

Table 14.6.5 IFG 6: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

EAST COAST 3nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	**722,083**	**1,685**	**22,718**	**0**	**0**	**11,837**	**758,324**
Trawl		Vol	**526**	**1**	**5**	**0**	**0**	**2**	**535**
Nephrops		Val	**78,091**	**461**	**636,371**	**335**	**0**	**6,661**	**721,918**
Trawl		Vol	**52**	**0**	**204**	**0**	**0**	**2**	**258**
Pelagic		Val	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Trawl		Vol	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Other		Val	**2,344**	**90,775**	**632**	**0**	**0**	**276,286**	**370,038**
Trawl		Vol	**2**	**163**	**0**	**0**	**0**	**53**	**218**
Dredge		Val	**0**	**0**	**0**	**173,309**	**0**	**0**	**173,309**
	0	Vol	**0**	**0**	**0**	**79**	**0**	**0**	**79**
Pots		Val	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	0	Vol	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total		**Val**	£802,519	£92,921	£659,722	£173,644	£0	£294,784	£2,023,590
	0	**Vol**	580	164	209	79	0	58	1,090

Table 14.6.6 IFG 6: Catch Value by Gear Type by all Vessels in 0-3 NM zone

EAST COAST 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£808,748	£1,685	£22,718	£0	£11,837	£844,988
Nephrops Trawl	Val	£78,091	£461	£2,789,391	£335	£6,661	£2,874,939
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£211,484	£0	£0	£0	£211,484
Other Trawl	Val	£2,344	£90,775	£632	£0	£276,286	£370,038
Dredge	Val	£0	£0	£0	£187,474	£0	£187,474
Pots	Val	£0	£0	£30,420	£0	£3,906,175	£3,936,595
Hand Dive	Val	£0	£0	£0	£0	£127,196	£127,196
Total	**Val**	**£889,183**	**£304,405**	**£2,843,161**	**£187,809**	**£4,328,156**	**£8,552,714**

14.6.3 East Coast Zone 0-6 nm

Table 14.6.7 IFG 6: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

EAST COAST 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£145,773	£0	£0	£0	£0	£145,773
Nephrops Trawl	Val	£0	£0	£3,376,002	£0	£0	£3,376,002
Pelagic Lines	Val	£0	£231,843	£0	£0	£0	£231,843
Dredge	Val	£0	£0	£0	£28,621	£0	£28,621
Pots	Val	£0	£0	£40,776	£0	£4,571,984	£4,612,760
Hand Dive	Val	£0	£0	£0	£0	£131,506	£131,506
Total	**Val**	**£145,773**	**£231,843**	**£3,416,778**	**£28,621**	**£4,703,490**	**£8,526,505**

Table 14.6.8 IFG 6: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

EAST COAST 6nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	**818,975**	**1,986**	**31,692**	**0**	**0**	**14,795**	**867,447**
Trawl		Vol	**601**	**2**	**8**	**0**	**0**	**3**	**614**
Nephrops		Val	**104,461**	**1,415**	**1,037,421**	**335**	**0**	**11,584**	**1,155,216**
Trawl		Vol	**70**	**1**	**341**	**0**	**0**	**3**	**415**
Pelagic		Val	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Trawl		Vol	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Other		Val	**3,465**	**103,603**	**812**	**0**	**0**	**391,871**	**499,751**
Trawl		Vol	**3**	**173**	**0**	**0**	**0**	**76**	**252**
Dredge		Val	**0**	**0**	**0**	**395,645**	**0**	**0**	**395,645**
	0	Vol	**0**	**0**	**0**	**193**	**0**	**0**	**193**
Pots		Val	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	0	Vol	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total		**Val**	£926,901	£107,003	£1,069,925	£395,979	£0	£418,250	£2,918,059
	0	**Vol**	**674**	**175**	**349**	**193**	**0**	**83**	**1,474**

Table 14.6.9 IFG 6: Catch Value by Gear Type by all Vessels in 0-6 NM zone

EAST COAST 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£964,748	£1,986	£31,692	£0	£14,795	£1,013,221
Nephrops Trawl	Val	£104,461	£1,415	£4,413,423	£335	£11,584	£4,531,218
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£231,843	£0	£0	£0	£231,843
Other Trawl	Val	£3,465	£103,603	£812	£0	£391,871	£499,751
Dredge	Val	£0	£0	£0	£424,265	£0	£424,265
Pots	Val	£0	£0	£40,776	£0	£4,571,984	£4,612,760
Hand Dive	Val	£0	£0	£0	£0	£131,506	£131,506
Total	**Val**	**£1,072,675**	**£338,847**	**£4,486,703**	**£424,600**	**£5,121,740**	**£11,444,564**

14.6.4 East Coast Zone 0-12 nm

Table 14.6.10 IFG 6: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

EAST COAST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£160,892	£0	£0	£0	£0	£160,892
Nephrops Trawl	Val	£0	£0	£3,723,623	£0	£0	£3,723,623
Pelagic Lines	Val	£0	£254,754	£0	£0	£0	£254,754
Dredge	Val	£0	£0	£0	£31,436	£0	£31,436
Pots	Val	£0	£0	£40,900	£0	£5,034,690	£5,075,590
Hand Dive	Val	£0	£0	£0	£0	£131,506	£131,506
Total	**Val**	**£160,892**	**£254,754**	**£3,764,524**	**£31,436**	**£5,166,195**	**£9,377,802**

Table 14.6.11 IFG 6: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

EAST COAST 12nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	**1,082,629**	**3,132**	**56,074**	**0**	**0**	**21,458**	**1,163,292**
Trawl	Vol	**793**	**3**	**14**	**0**	**0**	**5**	**814**
Nephrops	Val	**169,679**	**1,536**	**1,745,795**	**335**	**0**	**17,472**	**1,934,818**
Trawl	Vol	**117**	**1**	**589**	**0**	**0**	**5**	**712**
Pelagic	Val	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Trawl	Vol	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Other	Val	**6,971**	**122,019**	**1,151**	**0**	**0**	**516,170**	**646,311**
Trawl	Vol	**7**	**187**	**0**	**0**	**0**	**100**	**294**
Dredge	Val	**0**	**0**	**0**	**973,490**	**0**	**0**	**973,490**
0	Vol	**0**	**0**	**0**	**498**	**0**	**0**	**498**
Pots	Val	**0**	**517,581**	**0**	**0**	**0**	**0**	**517,581**
0	Vol	**0**	**976**	**0**	**0**	**0**	**0**	**976**
Total	**Val**	£1,259,280	£644,268	£1,803,021	£973,824	£0	£555,100	£5,235,492
0	**Vol**	**916**	**1,167**	**604**	**498**	**0**	**109**	**3,295**

Table 14.6.12 IFG 6: Catch Value by Gear Type by all Vessels in 0-12 NM zone

EAST COAST 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£1,243,522	£3,132	£56,074	£0	£21,458	£1,324,185
Nephrops Trawl	Val	£169,679	£1,536	£5,469,419	£335	£17,472	£5,658,441
Pelagic Trawl	Val	£0	£0	£0	£0	£0	£0
Pelagic Lines	Val	£0	£254,754	£0	£0	£0	£254,754
Other Trawl	Val	£6,971	£122,019	£1,151	£0	£516,170	£646,311
Dredge	Val	£0	£0	£0	£1,004,926	£0	£1,004,926
Pots	Val	£0	£517,581	£40,900	£0	£5,034,690	£5,593,171
Hand Dive	Val	£0	£0	£0	£0	£131,506	£131,506
Total	**Val**	**£1,420,172**	**£899,022**	**£5,567,544**	**£1,005,261**	**£5,721,295**	**£14,613,294**

East Coast Summary Tables

Table 14.6.13 IFG 6: Catch Value by Gear Type From Shore to Zones Outer Limits

EAST COAST	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£634,161	16.4%	£844,988	9.9%	£1,013,221	8.9%	£1,324,185	9.1%
Nephrops Trawl	£1,159,676	29.9%	£2,874,939	33.6%	£4,531,218	39.6%	£5,658,441	38.7%
Pelagic Trawl	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Pelagic Lines	£85,490	2.2%	£211,484	2.5%	£231,843	2.0%	£254,754	1.7%
Other Trawl	£109,880	2.8%	£370,038	4.3%	£499,751	4.4%	£646,311	4.4%
Dredge	£55,611	1.4%	£187,474	2.2%	£424,265	3.7%	£1,004,926	6.9%
Pots	£1,770,972	45.7%	£3,936,595	46.0%	£4,612,760	40.3%	£5,593,171	38.3%
Hand Dive	£58,934	1.5%	£127,196	1.5%	£131,506	1.1%	£131,506	0.9%
Total	£3,874,724	100.0%	£8,552,714	100.0%	£11,444,564	100.0%	£14,613,294	100.0%
%	26.5%		58.5%		78.3%		100.0%	

Table 14.6.14 IFG 6: Catch Value by Gear Type For Each Zone

EAST COAST	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£634,161	16.4%	£210,827	4.5%	£168,232	5.8%	£310,964	9.8%
Nephrops Trawl	£1,159,676	29.9%	£1,715,262	36.7%	£1,656,280	57.3%	£1,127,223	35.6%
Pelagic Trawl	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Pelagic Lines	£85,490	2.2%	£125,994	2.7%	£20,359	0.7%	£22,911	0.7%
Other Trawl	£109,880	2.8%	£260,158	5.6%	£129,713	4.5%	£146,560	4.6%
Dredge	£55,611	1.4%	£131,863	2.8%	£236,791	8.2%	£580,661	18.3%
Pots	£1,770,972	45.7%	£2,165,623	46.3%	£676,165	23.4%	£980,411	30.9%
Hand Dive	£58,934	1.5%	£68,263	1.5%	£4,309	0.1%	£0	0.0%
Total	£3,874,724	100.0%	£4,677,991	100.0%	£2,891,850	100.0%	£3,168,730	100.0%

Table 14.6.15 IFG 6: Catch Value by Gear Type From Shore to Zones Outer Limits

EAST COAST	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£1,770,972	45.7%	£3,936,595	46.0%	£4,612,760	40.3%	£5,593,171	38.3%
Mobile	£1,959,328	50.6%	£4,277,439	50.0%	£6,468,455	56.5%	£8,633,863	59.1%
Other	£144,424	3.7%	£338,680	4.0%	£363,349	3.2%	£386,260	2.6%
Total	£3,874,724	100.0%	£8,552,714	100.0%	£11,444,564	100.0%	£14,613,294	100.0%

Table 14.6.16 IFG 6: Catch Value by Vessel Size From Shore to Zones Outer Limits

EAST COAST	1nm	%	3nm	%	6nm	%	12nm	%
Small	£2,636,217	68.0%	£6,529,125	76.3%	£8,526,505	74.5%	£9,377,802	64.2%
Large	£1,238,507	32.0%	£2,023,590	23.7%	£2,918,059	25.5%	£5,235,492	35.8%
Total	£3,874,724	100.0%	£8,552,714	100.0%	£11,444,564	100.0%	£14,613,294	100.0%

Table 14.6.17 IFG 6: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

EAST COAST	1nm	%	3nm	%	6nm	%	12nm	%
Finfish	£813,228	21.0%	£1,193,589	14.0%	£1,411,521	12.3%	£2,319,194	15.9%
Shellfish	£3,061,495	79.0%	£7,359,126	86.0%	£10,033,043	87.7%	£12,294,100	84.1%
Total	£3,874,724	100.0%	£8,552,714	100.0%	£11,444,564	100.0%	£14,613,294	100.0%

From the above tables, it is estimated that in 2011 the value of landings taken in the East Coast IFG water (i.e. 0-6 NM) by Scottish vessels is £11.4 m of which 33.86% is caught within 1 NM and 74.73% within 0-3 NM.

A total of £3.87m was caught in the 0-1 NM zone, the comparable figures for the 1-3 and 3-6 NM zones were £4.68m and £2.89m. Relative to the South West IFG and the North West IFG, the 3-6 NM and 6-12 NM zones are more significant in terms of the value of landings.

Within both 0-1 NM and 1-3NM static and mobile gears have landings of similar value. The value of landings of 15 m and under vessles is significantly more the value of landings for over 15m vessels. Within the 0-3 NM zone, the catch value attributed to mobile gears is broadly similar to static gears.

15 THE BASELINE: SHETLAND

15.1 Introduction to Area

The Lerwick Fishery Office has responsibility for the ports of Lerwick (FO*) Central Mainland, Northmavine, S Mainland, Fair Isle, Scalloway, Skerries, West Mainland, Whalsay, Yellr, Fetla and Unst. Although Marine Scotland has a presence, inshore fisheries management has been delegated to local interests (see below)

15.2 Active Vessels by District and Gear Type

Table 15.2. Shetland Active Vessels by Gear Type

10m & under		**Nephrop Trawls**	3
		Creel fishing	114
		Other[2]	18
		Total	**135**
Over 10m	**Pelagic**	**Purse seine**	-
		Pelagic trawl	8
		Other	-
		Total	**8**
	Demersal	**Trawl**	18
		Seine	5
		Lines	-
		Other[4]	-
		Total	**23**
	Shellfish	***Nephrop trawls***	2
		Creel fishing	2
		Other	7
		Total	**11**
	Total Over10 m		**42**
Total All Vessel			**177**

Source *Scottish Sea Fisheries Statistics 2012*, Table 2.5

15.3 Shetland Employment

Table 15.3 Shetland Catching Sector Employment

Regularly Employed	Irregularly Employed	Total
231	**201**	**432-**

Source *Scottish Sea Fisheries Statistics 2012*

15.4 Shetland Landings

Table 15.4 Shetland Landings by All Vessels and Scottish Vessels

All Vessels				Scottish Vessels
Total demersal	**Total pelagic**	**Total shellfish**	**Total landings (£'000)**	**Total Landings (£ '000)**
£21,536	**£33,632**	**£3,955**	**£59,124**	**44,604**

Source *Scottish Sea Fisheries Statistics 2012*, Tables 1.6 and 1.7

15.5 Legislation & Regulations specific to the IFG Area

Following long standing concerns about the lack of management and increases in inshore effort directed at shellfish, local Shetland interests were successful in obtaining a Regulating Order granting the Shetland Shellfish Management Organisation (SSMO) the legal right to manage the commercial shellfisheries within the 0-6 NM zone (lobsters, crabs, scallops, queens, whelks, razorshells, cockles, mussels and oysters) The Order gives the SSMO powers to issue licences, levy tolls to impose restrictions and regulations The SSMO itself is a partnership of local stakeholders with an interest in shellfish. The SSMO's main objectives are to ensure the long-term sustainability of these fisheries, to promote the recovery of shellfish stocks and to promote the environmental sustainability of Shetland's shellfish fisheries.

The SSMO licence system has a number of key features:

- Licences are valid for one calendar year.
- Licences will normally be renewed except where the licensee(s) or the vessel fails to satisfy the SSMO regulations.
- Licensees will not be entitled to any compensation if the licence is not renewed.
- Licences may not be traded.
- Licences are only transferrable between people or vessels with the written authority of the SSMO.
- If the vessel named on a licence is sold then the licence shall expire immediately. At the SSMO discretion a new licence will normally be issued to the owner of the vessel sold for a replacement vessel of comparable size and fishing power.
- All licensees must complete and submit a monthly (confidential) logsheet or book to the Organisation by the 7th day of every month.
- There is a general presumption will be that the transfer of the licence to the new vessel should not result in an increase in fishing capacity. If so, the SSMO will normally approve the transfer of the licence to the new vessel.
- At its discretion the SSMO may approve the transfer of a licence to a vessel which is of greater size, capacity and/or fishing power if it considers that this would not have an adverse effect on shellfish stocks.

The SSMO regulations include the following:

- A licence will not be issued in respect of a vessel, nor may that vessel be used to dredge, fish for, or take any of the prescribed species within the area covered by the Regulating Order, if it exceeds 17 metres in overall length (as stated on the vessel's domestic fishing licence – issued by a UK Fisheries Department - and registration certificate), except where the vessel is used wholly to dredge for scallops (in which case no vessel size limit applies).

- No vessel which is used to dredge for scallops may use or carry onboard more than two tow-bars with a combined overall length, or a single tow bar with an overall length, of more than 8.80 metres, or more than a total of 10 scallop dredges.
- Any vessel that was using more than 10 but not more than 14 dredges, between the 1st of January 2001 and the 31st of December 2001, and for which log sheets showing the number of dredges in use were submitted to the Organisation during that period, may apply to the Organisation for a dispensation to this regulation to allow them to continue using their existing tow-bar(s) and dredges. Any dispensation granted will not be transferable to any other vessel or licensee and will lapse when the licence is surrendered.
- The use of any form of hydraulic or suction dredge, or any similar type of gear, to dredge, fish for, or take any of the prescribed species within the area covered by the Order is prohibited.
- The use of French dredges to dredge, fish for or take any of the prescribed species within the area covered by the Order is prohibited. (A French dredge means a scallop dredge of the type known as “a French dredge” incorporating paravanes, diving plates, pressure plates, water deflecting plates or any similar device and having rigid fixed teeth)
- The buoys attached to any static fishing gear being used to fish for or take any of the prescribed species within the area covered by the Order must be brightly coloured and clearly marked with the vessel’s name and registration number.
- The minimum landings size for whelks will be 75 mm overall shell length.
- Fishing for velvet crabs every SSMO licenced creel vessel must tie up for a minimum consecutive 8 week period during the months of June to September inclusive.
- The minimum landings size for velvet crabs (Necora puber) will be 70 mm carapace width; measured across the broadest part of the carapace, excluding spines.
- The minimum landings size for lobsters (Homarus gammarus) will be 90 mm carapace length; measured parallel to the mid-line from the back of either eye socket to the distal edge of the carapace.
- No vessel may use a scallop dredge or dredges, or may dredge, fish for or take scallops or queen scallops, before 0600 hours (local time) or after 2100 hours (local time) on any day.
- UK size brown crab 140 mm

The next section reports the catch estimates derived through our manipulation of VMS and the SSMO maps of fishing activity.

15.6 Shetland Baseline Estimates (IFG 7)

15.6.1 Shetland Zone 0-1 nm

Table 15.6.1 IFG 7: Catch Value by Gear Type by Vessels 15m or Under in 0-1 NM zone

Shetland 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£6,398	£0	£0	£0	£0	£6,398
Nephrops Trawl	Val	£0	£0	£1,695	£0	£0	£1,695
Pelagic Lines	Val	£0	£4,351	£0	£0	£0	£4,351
Dredge	Val	£0	£0	£0	£1,550,920	£0	£1,550,920
Pots	Val	£0	£0	£0	£0	£952,175	£952,175
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£6,398**	**£4,351**	**£1,695**	**£1,550,920**	**£952,175**	**£2,515,539**

Table 15.6.2 IFG 7: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-1 NM zone

Shetland 1nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£860,259	£34	£3,164	£0	£0	£32,823	£896,279
Trawl	Vol	477	0	0	0	0	8	485
Nephrops	Val	£158	£0	£834	£0	£0	£0	£991
Trawl	Vol	0	0	0	0	0	0	0
Pelagic	Val	£0	£2,058,859	£0	£0	£0	£0	£2,058,859
Trawl	Vol	0	1,481	0	0	0	0	1,481
Other	Val	£190	£0	£0	£0	£0	£11,188	£11,379
Trawl	Vol	0	0	0	0	0	2	3
Dredge	Val	£0	£0	£0	£79,589	£0	£0	£79,589
0	Vol	0	0	0	44	0	0	44
Pots	Val	£0	£0	£0	£0	£0	£0	£0
0	Vol	0	0	0	0	0	0	0
Total	**Val**	£860,607	£2,058,893	£3,997	£79,589	£0	£44,012	£3,047,097
0	**Vol**	478	1,481	1	44	0	10	2,013

Table 15.6.3 IFG 7: Catch Value by Gear Type by all Vessels in 0-1 NM zone

Shetland 1nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£866,657	£34	£3,164	£0	£32,823	£902,677
Nephrops Trawl	Val	£158	£0	£2,529	£0	£0	£2,686
Pelagic Trawl	Val	£0	£2,058,859	£0	£0	£0	£2,058,859
Pelagic Lines	Val	£0	£4,351	£0	£0	£0	£4,351
Other Trawl	Val	£190	£0	£0	£0	£11,188	£11,379
Dredge	Val	£0	£0	£0	£1,630,509	£0	£1,630,509
Pots	Val	£0	£0	£0	£0	£952,175	£952,175
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£867,005**	**£2,063,243**	**£5,692**	**£1,630,509**	**£996,187**	**£5,562,636**

15.6.2 Shetland Zone 0-3 nm

Table 15.6.4 IFG 7: Catch Value by Gear Type by Vessels 15m or Under in 0-3 NM zone

Shetland 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£44,788	£0	£0	£0	£0	£44,788
Nephrops Trawl	Val	£0	£0	£11,865	£0	£0	£11,865
Pelagic Lines	Val	£0	£30,454	£0	£0	£0	£30,454
Dredge	Val	£0	£0	£0	£2,469,984	£0	£2,469,984
Pots	Val	£0	£0	£0	£0	£1,436,068	£1,436,068
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£44,788**	**£30,454**	**£11,865**	**£2,469,984**	**£1,436,068**	**£3,993,159**

Table 15.6.5 IFG 7: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-3 NM zone

Shetland 3nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£2,202,237	£109	£13,654	£0	£0	£90,956	£2,306,956
Trawl	Vol	1,259	0	2	0	0	20	1,281
Nephrops	Val	£1,792	£0	£5,323	£0	£0	£57	£7,172
Trawl	Vol	1	0	2	0	0	0	3
Pelagic	Val	£0	£9,533,519	£0	£0	£0	£0	£9,533,519
Trawl	Vol	0	6,588	0	0	0	0	6,588
Other	Val	£1,721	£0	£0	£0	£0	£47,614	£49,335
Trawl	Vol	1	0	0	0	0	9	10
Dredge	Val	£2,133	£0	£0	£147,654	£0	£2	£149,790
0	Vol	1	0	0	82	0	0	84
Pots	Val	£0	£0	£0	£0	£0	£0	£0
0	Vol	0	0	0	0	0	0	0
Total	**Val**	£2,207,883	£9,533,628	£18,976	£147,654	£0	£138,630	£12,046,772
0	**Vol**	1,262	6,588	4	82	0	30	7,966

Table 15.6.6 IFG 7: Catch Value by Gear Type by all Vessels in 0-3 NM zone

Shetland 3nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£2,247,025	£109	£13,654	£0	£90,956	£2,351,745
Nephrops Trawl	Val	£1,792	£0	£17,188	£0	£57	£19,037
Pelagic Trawl	Val	£0	£9,533,519	£0	£0	£0	£9,533,519
Pelagic Lines	Val	£0	£30,454	£0	£0	£0	£30,454
Other Trawl	Val	£1,721	£0	£0	£0	£47,614	£49,335
Dredge	Val	£2,133	£0	£0	£2,617,638	£2	£2,619,773
Pots	Val	£0	£0	£0	£0	£1,436,068	£1,436,068
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£2,252,672**	**£9,564,082**	**£30,841**	**£2,617,638**	**£1,574,697**	**£16,039,931**

15.6.3 Shetland Zone 0-6 nm

Table 15.6.7 IFG 7: Catch Value by Gear Type by Vessels 15m or under in 0-6 NM zone

Shetland 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£127,967	£0	£0	£0	£0	£127,967
Nephrops Trawl	Val	£0	£0	£33,900	£0	£0	£33,900
Pelagic Lines	Val	£0	£87,012	£0	£0	£0	£87,012
Dredge	Val	£0	£0	£0	£2,872,074	£0	£2,872,074
Pots	Val	£0	£0	£0	£0	£1,560,943	£1,560,943
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£127,967**	**£87,012**	**£33,900**	**£2,872,074**	**£1,560,943**	**£4,681,896**

Table 15.6.8 IFG 7: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-6 NM zone

Shetland 6nm		DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal	Val	£3,732,331	£264	£30,184	£0	£0	£116,507	£3,879,286
Trawl	Vol	3,694	4	266	0	0	61	4,025
Nephrops	Val	£5,458	£0	£15,020	£0	£0	£97	£20,575
Trawl	Vol	3	0	5	0	0	0	9
Pelagic	Val	£0	£23,712,119	£0	£0	£0	£0	£23,712,119
Trawl	Vol	0	16,418	0	0	0	0	16,418
Other	Val	£2,092	£300,858	£0	£0	£0	£49,516	£352,466
Trawl	Vol	1	212	0	0	0	10	223
Dredge	Val	£2,826	£0	£0	£150,811	£0	£5	£153,642
0	Vol	2	0	0	84	0	0	86
Pots	Val	£0	£0	£0	£0	£0	£0	£0
0	Vol	0	0	0	0	0	0	0
Total	**Val**	£3,742,707	£24,013,241	£45,204	£150,811	£0	£166,125	£28,118,089
0	**Vol**	3,701	16,635	271	84	0	70	20,760

Table 15.6.9 IFG 7: Catch Value by Gear Type by all Vessels in 0-6 NM zone

Shetland 6nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£3,860,298	£264	£30,184	£0	£116,507	£4,007,253
Nephrops Trawl	Val	£5,458	£0	£48,920	£0	£97	£54,475
Pelagic Trawl	Val	£0	£23,712,119	£0	£0	£0	£23,712,119
Pelagic Lines	Val	£0	£87,012	£0	£0	£0	£87,012
Other Trawl	Val	£2,092	£300,858	£0	£0	£49,516	£352,466
Dredge	Val	£2,826	£0	£0	£3,022,885	£5	£3,025,716
Pots	Val	£0	£0	£0	£0	£1,560,943	£1,560,943
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£3,870,674**	**£24,100,253**	**£79,104**	**£3,022,885**	**£1,727,068**	**£32,799,985**

15.6.4 Shetland Zone 0-12 nm

Table 15.6.10 IFG 7: Catch Value by Gear Type by Vessels 15m or under in 0-12 NM zone

Shetland 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£127,967	£0	£0	£0	£0	£127,967
Nephrops Trawl	Val	£0	£0	£33,900	£0	£0	£33,900
Pelagic Lines	Val	£0	£87,012	£0	£0	£0	£87,012
Dredge	Val	£0	£0	£0	£2,872,074	£0	£2,872,074
Pots	Val	£0	£0	£0	£0	£1,560,943	£1,560,943
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	£127,967	£87,012	£33,900	£2,872,074	£1,560,943	£4,681,896

Table 15.6.11 IFG 7: Catch Value and Volume by Gear Type by Vessels Over 15m in 0-12 NM zone

Shetland 12nm			DEMERSAL	PELAGIC	NEPHROPS	KING SCALLOPS	QUEEN SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal		Val	£10,043,365	£643	£69,144	£0	£0	£202,680	£10,315,832
Trawl		Vol	5,627	0	11	0	0	51	5,689
Nephrops		Val	£18,825	£0	£38,311	£0	£0	£165	£57,302
Trawl		Vol	12	0	13	0	0	0	25
Pelagic		Val	£0	£49,631,099	£0	£0	£0	£0	£49,631,099
Trawl		Vol	0	34,547	0	0	0	0	34,547
Other		Val	£4,154	£902,573	£0	£0	£0	£53,332	£960,059
Trawl		Vol	3	636	0	0	0	10	649
Dredge		Val	£7,735	£0	£0	£151,174	£0	£37	£158,946
	0	Vol	4	0	0	84	0	0	89
Pots		Val	£0	£0	£0	£0	£0	£0	£0
	0	Vol	0	0	0	0	0	0	0
Total		**Val**	£10,074,080	£50,534,315	£107,456	£151,174	£0	£256,214	£61,123,239
	0	**Vol**	5,645	35,184	24	84	0	62	40,999

Table 15.6.12 IFG 7: Catch Value by Gear Type by all Vessels in 0-12 NM zone

Shetland 12nm		DEMERSAL	PELAGIC	NEPHROPS	SCALLOPS	OTHER SHELLFISH	TOTAL
Demersal Trawl	Val	£10,171,332	£643	£69,144	£0	£202,680	£10,443,799
Nephrops Trawl	Val	£18,825	£0	£72,211	£0	£165	£91,202
Pelagic Trawl	Val	£0	£49,631,099	£0	£0	£0	£49,631,099
Pelagic Lines	Val	£0	£87,012	£0	£0	£0	£87,012
Other Trawl	Val	£4,154	£902,573	£0	£0	£53,332	£960,059
Dredge	Val	£7,735	£0	£0	£3,023,248	£37	£3,031,020
Pots	Val	£0	£0	£0	£0	£1,560,943	£1,560,943
Hand Dive	Val	£0	£0	£0	£0	£0	£0
Total	**Val**	**£10,202,047**	**£50,621,327**	**£141,356**	**£3,023,248**	**£1,817,157**	**£65,805,135**

15.6.5 Shetland Summary Tables

Table 15.6.13 IFG 7 Catch Value by Gear Type From Shore to Zones Outer Limits

Shetland	1nm	%	3nm	%	6nm	%	12nm	%
Demersal Trawl	£902,677	16.2%	£2,351,745	14.7%	£4,007,253	12.2%	£10,443,799	15.9%
Nephrops Trawl	£2,686	0.0%	£19,037	0.1%	£54,475	0.2%	£91,202	0.1%
Pelagic Trawl	£2,058,859	37.0%	£9,533,519	59.4%	£23,712,119	72.3%	£49,631,099	75.4%
Pelagic Lines	£4,351	0.1%	£30,454	0.2%	£87,012	0.3%	£87,012	0.1%
Other Trawl	£11,379	0.2%	£49,335	0.3%	£352,466	1.1%	£960,059	1.5%
Dredge	£1,630,509	29.3%	£2,619,773	16.3%	£3,025,716	9.2%	£3,031,020	4.6%
Pots	£952,175	17.1%	£1,436,068	9.0%	£1,560,943	4.8%	£1,560,943	2.4%
Hand Dive	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Total	£5,562,636	100.0%	£16,039,931	100.0%	£32,799,985	100.0%	£65,805,135	100.0%
%	8.5%		24.4%		49.8%		100.0%	

Table 15.6.14 IFG 7: Catch Value by Gear Type For Each Zone

Shetland	0-1nm	%	1-3nm	%	3-6nm	%	6-12nm	%
Demersal Trawl	£902,677	16.2%	£1,449,067	13.8%	£1,655,509	9.9%	£6,436,546	19.5%
Nephrops Trawl	£2,686	0.0%	£16,351	0.2%	£35,437	0.2%	£36,727	0.1%
Pelagic Trawl	£2,058,859	37.0%	£7,474,660	71.3%	£14,178,600	84.6%	£25,918,980	78.5%
Pelagic Lines	£4,351	0.1%	£26,104	0.2%	£56,558	0.3%	£0	0.0%
Other Trawl	£11,379	0.2%	£37,956	0.4%	£303,131	1.8%	£607,593	1.8%
Dredge	£1,630,509	29.3%	£989,265	9.4%	£405,943	2.4%	£5,304	0.0%
Pots	£952,175	17.1%	£483,892	4.6%	£124,875	0.7%	£0	0.0%
Hand Dive	£0	0.0%	£0	0.0%	£0	0.0%	£0	0.0%
Total	£5,562,636	100.0%	£10,477,295	100.0%	£16,760,054	100.0%	£33,005,151	100.0%

Table 15.6.15 IFG 7: Catch Value by Gear Type From Shore to Zones Outer Limits

Shetland	1nm	%	3nm	%	6nm	%	12nm	%
Fixed	£952,175	17.1%	£1,436,068	9.0%	£1,560,943	4.8%	£1,560,943	2.4%
Mobile	£4,606,110	82.8%	£14,573,409	90.9%	£31,152,030	95.0%	£64,157,180	97.5%
Other	£4,351	0.1%	£30,454	0.2%	£87,012	0.3%	£87,012	0.1%
Total	£5,562,636	100.0%	£16,039,931	100.0%	£32,799,985	100.0%	£65,805,135	100.0%

Table 15.6.16 IFG 7: Catch Value by Vessel Size From Shore to Zones Outer Limits

Shetland	1nm	%	3nm	%	6nm	%	12nm	%
Small	£2,515,539	45.2%	£3,993,159	24.9%	£4,681,896	14.3%	£4,681,896	7.1%
Large	£3,047,097	54.8%	£12,046,772	75.1%	£28,118,089	85.7%	£61,123,239	92.9%
Total	£5,562,636	100.0%	£16,039,931	100.0%	£32,799,985	100.0%	£65,805,135	100.0%

Table 15.6.17 IFG 7: Catch Value by Fin Fish and Shellfish From Shore to Zones Outer Limits

Shetland	**1nm**	**%**	**3nm**	**%**	**6nm**	**%**	**12nm**	**%**
Finfish	£2,930,249	52.7%	£11,816,754	73.7%	£27,970,927	85.3%	£60,823,375	92.4%
Shellfish	£2,632,388	47.3%	£4,223,177	26.3%	£4,829,057	14.7%	£4,981,761	7.6%
Total	£5,562,636	100.0%	£16,039,931	100.0%	£32,799,985	100.0%	£65,805,135	100.0%

Fisheries in Shetland are quite different to those in the other IFG areas.

From the above tables it is estimated that the catch taken in Shetland water by Scottish vessels was valued at £32.79 m of which 16.96% is caught within 1 NM but 48.9% within 0-3 NM.

A total of £5.56m was caught in the 0-1 NM zone, the comparable figures for the 1-3 and 3-6 NM zones were £10.48m and £16.76m. The relatively high catch for the 3-6 NM zone, contrasts with observations on the other IFG areas. In 2011 this was because only in Shetland was there high value pelagic catches so close to the shore. Though these pelagic catches can vary year to year, given the variable distribution of pelagic stocks and where fishing takes place.

Within both the 0-1 and 0-3 NM zone mobile (pelagic) gear was much more significant (83%) than static gear. The catch of 15 m and over vessels was slightly more than the smaller vessels. By way of comparison, in Orkney the larger vessels were insignificant in the 0-1NM zone.

In the 0-3 NM zone, mobile gear accounted for 91% of the catch. Larger vessels caught 75% of the catch by value.

16 GEAR CONFLICT

16.1 Introduction

A potential benefit of 1 NM or 3 NM restrictions on mobile gear is the reduction in the incidence of gear conflict. The quantification of these benefits requires quite detailed information. Specifically, the analysis requires data for each IFG on gear conflict incidence, the gears involved and the costs involved. Ideally, for each IFG these data should be available for the 0-1, 1-3, 3-6 and 6-12 NM distance zones.

Whilst Marine Scotland (MS) does record gear conflict incidents, it was believed that many incidents remain unreported. Moreover, the intelligence files retained by MS do not systematically record the financial costs of conflict, or other information this study requires. It became clear that primary data was needed. At the same time, beyond the immediate requirements of this study, MS was aware that generally there needed to be a better understanding of the extent and characteristics of gear conflict in Scottish inshore waters. A survey of fishery operators was therefore necessary. The primary function of the survey was to serve the requirement of this study, and questionnaire design reflects this. It was however accepted that where feasible the survey should also seek to generate outputs with a broader relevance for MS. The overall aim of the survey was to "to identify the location and frequency of gear conflict within specific zones in the IFGs, the gear types involved and the financial cost to those involved".

16.2 Survey Design

Not all operators would complete the survey and there was the possibility of response bias, since those experiencing conflict would be more likely to respond. It was therefore desirable to be able to contact non-respondents and make due adjustment for the bias. One difficulty is that, whilst MS has contact details for operators, these could not be made available to Grid Economics. The responses would therefore be anonymous and individual non-respondents would not be identifiable.

Scaling for non-response therefore required extra sample information which was free from response bias. The most obvious information was the intelligence files on gear conflict held by MS, plus the detailed local knowledge of the Fishery Officers (FOs). In working with FOs on other aspects of this study it became apparent that local FOs have very detailed and nuanced knowledge of local inshore fishing activity. It was hoped that FOs would be able to estimate the total number and spatial distribution of all gear conflicts in their IFG area(s). The totals numbers estimated by FOs would comprise the recorded conflicts held on file plus the numbers of unreported events known to FOs.

Two survey instruments were therefore required. These are explained below.

16.2.1 Survey of Fishery Officers

Initially it was proposed that a nominated FO would complete a questionnaire covering an entire IFG. Unfortunately, the IFG boundaries and Fishery Office territories overlap and a few Fishery Office territories straddle the boundary between two IFG's. Also, given the size of some IFG areas, an individual FO might not have the required local knowledge covering the whole IFG area. It was therefore agreed with Marine Scotland Compliance that each Fishery Office would complete a questionnaire relating to **their Fishery Office territory within** the IFG(s). On receipt they would be aggregated to generate totals for each IFG.

Where a Fishery Office territory straddled the boundary between two IFG's it was necessary for that Office complete two questionnaires. In an effort to minimise this requirement the following configuration applied:

- Fraserburgh Office reported only on its territory within Moray and the North Coast IFG area, even although Fraserburgh Bay is in the East IFG.
- Oban reported only on its territory within the South West area.
- Mallaig reported only its territory within the North West area.

Thus, only Kinlochbervie was required to complete two questionnaires, one for its territory in the North West and one for its territory in Moray Firth and North Coast IFG. The table below summarises the Fishery Office aggregations.

Table 16.2.1 IFGs and Fishery Office Territories

IFG	FISHERY OFFICES
East Coast	Anstruther Eyemouth Aberdeen Peterhead
Moray Firth and North Coast	Fraserburgh Buckie Scrabster Kinlochbervie (Cape Wrath to Tongue)
North West	Kinlochbervie (Cape Wrath to Scourie) Lochinver Ullapool Portree Mallaig
South West	Oban Campeltown Ayr
Outer Hebrides	Stornoway
Orkney	Kirkwall
Shetland	Lerwick

The questionnaire was piloted in hard copy form with FOs at meetings in Peterhead, Inverness and Oban which were arranged to review this study's baseline estimates of commercial fishing in each IFG. The final version was emailed and all Fishery Offices provided a response.

Whist the primary purpose was to generate on a bias free estimate of the total number of gear conflicts, the questionnaire examined the percentage reported, trends in gear conflict, location and the gear types in conflict. These additional data would provide a check on key elements of the operator survey.

16.2.2 The On-Line Survey of Fishery Operators

Given resource and other constraints, an on-line questionnaire was preferred to other survey instruments, such as face to face interviews, postal or telephone questionnaires.

The survey was piloted among 40 representative inshore fishery operators. The pilot revealed that the questionnaire was heavily burdened in seeking to generate data disaggregated down to individual IFGs and specific zones within each IFG (01nm, 1-3nm, 3-6NM and 6-12nm). The questionnaire was simplified and made available on-line between 2nd October and 13th December 2013.

A number of channels were used to alert and invite fishery businesses to participate. Using their email lists, MS invited every operators to access the link. The link was trailed in Fishing News and posted on various fishermen's federation and association websites. It was also highlighted on the MS website where operators are expected to check weekly with licence variations and other MS announcements.

16.2.2.1 Owner Questionnaire Structure

As respondents progressed through the questionnaire they were presented with questions addressing the following:

- Their vessel and gear type in 2012.
- Their fishing in 2012.
- Their perception of trends in the incidence of gear conflicts.
- Their reporting of gear conflicts to MS.
- The financial costs to them.
- Location and number of gear conflicts.
- Gear types in conflict.
- Scenarios giving rise to conflict.

Finally operators were invited to provide additional comments which would be presented verbatim to MS, but which would only be included in publicly available documents with the agreement of the individual respondent.

16.2.2.2 Owner Questionnaire Response Rate

A total of 341 started the survey resulting in 294 useable responses. Some fished more than one IFG area hence we have 323 observations across the IFG areas. Those fishing more than one IFG areas were allocated to the IFG in which they undertook most of their fishing. The estimated vessel populations for each IFG were compiled from MS data on vessels home ports or creeks.

Table 16.2.2 Respondents by IFG

IFG	Nos
South West	57
North West	96
Outer Hebrides	38
MF&NC	42
Orkney	11
East Coast	51
Shetland	7
Non IFG	21
Total	323

Table 16.2.3 Estimated Vessel Pop. by Size by IFG

IFG	<10m	10-15m	>15m	Total
South West	214	73	78	365
North West	157	44	33	234
Outer Hebrides	149	21	19	189
MF&NC	148	19	45	212
Orkney	94	25	8	127
East Coast	298	31	129	458
Shetland	123	10	35	168
Total	1183	223	347	1753

Table 16.2.4 Estimated Response Rate by IFG

IFG	<10m	10-15m	>15m	Total
South West	15.0%	19.2%	7.7%	14.2%
North West	36.9%	31.8%	15.2%	32.9%
Outer Hebrides	4.7%	28.6%	68.4%	13.8%
MF&NC	18.9%	10.5%	11.1%	16.0%
Orkney	5.3%	20.0%	12.5%	8.7%
East Coast	12.8%	12.9%	1.6%	9.6%
Shetland	2.4%	0.0%	2.9%	2.4%
Total	14.5%	20.2%	9.2%	14.1%

Given the exposure provided for the survey, the response rate was a bit disappointing. In addition, many respondents simply skipped some key questions.

The requirement to generate data on individual zones within individual IFG may have placed a strain on the response rate. As a result, some of cross tabulations produce cells with no observations and estimates which are based on small numbers. In addition, a low response probably increases the potentially distorting effects of response bias.

The key findings from both questionnaires are presented under the following headings:

- Trends
- Relative Frequency Across IFG's
- Location of Conflict Within Each IFG
- Reporting of Incidents
- Gears in Conflict
- Beliefs About Causation
- Costs to Operators
- Respondents' Comments

16.3 Trends

Both operators and FOs were asked to compare the number of incidents in 2012 with the number in previous years and with their expectations for the 2013 which was nearly over when the questionnaires were launched.

Table 16.3.Tends in Gear Conflict

	Operators				Fishery Officers			
	2012 Compared with Previous Years		2013 Compared with 2012		2012 Compared with Previous Years		2013 Compared with 2012	
	Nos.	Percent	Nos.	Percent	Nos.	Percent	Nos.	Percent
Substantially more	33	19%	34	23%	0	0%	3	17%
Slightly more	50	29%	41	27%	3	18%	3	17%
About the same	64	37%	63	42%	7	41%	9	50%
Slightly less	13	8%	5	3%	3	18%	3	17%
Substantially less	7	4%	2	1%	2	12%	0	0%
Don't Know	4	2%	6	4%	2	12%	0	0%
Total	171	100%	151	100%	17	100%	18	100%

A total of 48% of operators believed that there were either substantially more or slightly more incidents in 2012 than in previous years. Only 12% believed that there were substantially less or slightly less than in previous years. A similar pattern emerges in the comparison between 2012 and 2013. This picture of gear conflict incidents becoming more frequent was not entirely reflected in responses from FOs. This differential may be due to the response bias or FOs not being fully aware of the full extent of gear conflict.

16.4 Relative Frequency Across IFG's

Information on gear conflicts was obtained from operators and from FO's. Fishery businesses recorded gear conflicts on 3,948 days. Most of these (67%) occurred in the South West and North West IFGs. The FO's responses present a broadly similar picture but with the conflict in the Outer Hebrides being more prominent. In terms of the number of conflicts in each as a proportion of all IFG fishing days, the South West and North West would appear to have a relatively bigger gear conflict problems. Gear conflict would not appear to be an issue in Orkney and Shetland.

Table 16.4 Relative Frequency of Gear Conflicts

IFG Area	Survey of Fishery Operators		Fishery Officers
	Conflict Days	% of Fishing Days in IFG	% of all FO Recorded and Unrecorded Scottish Conflicts
South West	1121 (28%)	12.5%	18%
North West	1536 (39%)	11.8%	25%
Outer Hebrides	295 (7%)	6.7%	38%
MF&NC	333 (8%)	5.6%	9%
Orkney	42 (1%)	2.5%	2%
East Coast	560 (14%)	7.3%	8%
Shetland	60 (2%)	8.2%	0%
Total	3948 (100%)	9.3%	100%

16.5 Location of Conflict Within Each IFG

For the purposes of this study, it was important to identify where the gear conflicts were occurring. The estimates in each row in the table below are cumulative. Of the total of 3,938 conflict days, 35% are taking place within 1NM of the shore and 77% within 3nm. In the South West 61% take place within the 1NM zone. In the South West and the North West, 96% and 84% respectively take place within 3nm. This is proportionately more than in the other IFG's. Given the coastal topography and island configuration, this possibly reflects the distribution of fishing effort rather than particular hot spots

Table 16.5.1 Location of Conflicts within IFG Areas

IFG		<1NM	<3NM	<6NM	<12NM	>12NM
SOUTH WEST	Days	686	1070	1072	1121	1121
	%	61.1%	95.5%	95.2%	99.9%	100.0%
NORTH WEST	Days	504	1286	1503	1536	1536
	%	32.8%	83.7%	97.9%	100.0%	100.0%
OUTER HEBRIDES	Days	34	93	232	290	295
	%	11.6%	31.4%	78.6%	98.3%	100.0%
MORAY FIRTH and NORTH COAST	Days	0	196	296	315	333
	%	0.0%	58.8%	88.9%	94.6%	100.0%
ORKNEY	Days	32	38	40	42	42
	%	76.2%	90.5%	95.2%	100.0%	100.0%
EAST COAST	Days	124	322	467	560	560
	%	22.2%	57.4%	83.3%	100.0%	100.0%
SHETLAND	Days	0	40	40	44	60
	%	0.0%	66.7%	66.7%	73.3%	100.0%
Total	Days	1380	3044	3650	3908	3948
	%	35.0%	77.1%	92.5%	99.0%	100.0%

The Table below which presents the distribution of fishing effort broadly confirms that the distribution of conflicts broadly reflects the intensity of fishing effort within each IFG.

Table 16.5.2 Location of Fishing Effort within IFG Areas

IFG		<1NM	<3NM	<6NM	<12NM	>12NM
SOUTH WEST	Days	3958	6995	8194	8893	8957
	%	44.2%	78.1%	91.5%	99.3%	100.0%
NORTH WEST	Days	3016	9577	11997	12877	13064
	%	23.1%	73.3%	91.8%	98.6%	100.0%
OUTER HEBRIDES	Days	579	1632	3125	4026	4427
	%	13.1%	36.9%	70.6%	90.9%	100.0%
MORAY FIRTH and NORTYH COAST	Days	2368	3817	5539	5720	5992
	%	39.5%	63.7%	92.4%	95.5%	100.0%
ORKNEY	Days	1007	1414	1514	1567	1690
	%	59.6%	83.6%	89.6%	92.7%	100.0%
EAST COAST	Days	1771	3965	6097	7313	7724
	%	22.9%	51.3%	78.9%	94.7%	100.0%
SHETLAND	Days	325	509	585	634	736
	%	44.1%	69.1%	79.4%	86.2%	100.0%
Total	Days	13024	27908	37050	41031	42590
	%	30.6%	65.5%	87.0%	96.3%	100.0%

16.6 Reporting of Incidents

Along with the questionnaire FOs were forwarded a copy of the Marine Compliance record of gear conflict incidents. They were invited to identify the number of known incidents in their IFG area resulting in an incident being recorded. There was significant variation in rates of recording and, given the information from fishery operators a surprisingly low number of recorded incidents. Once again it is difficult to determine whether response bias or some gaps in the local knowledge of FOs. No criticism of FOs is implied by this speculation.

Table 16.6.1 % of Incidents Recorded by Marine Compliance (Fishery Officers)

	South West	North West	Outer Hebrides	MF&NC	Orkney	East Coast	Shetland	Total
Known incidents	34	53	71	20	4	16	0	198
Recorded by FO	24	43	7	6	3	9	0	92
%Recorded	71%	81%	10%	30%	75%	56%	0	46%

From the table above, it would appear that 46% of incidents known to FOs resulted in a recorded incident. This contrasts with the percentage of incidents reported by operators.

Table 16.6.2 % of Incidents Reported by Fishery Operators

	% of Incidents Reported by Fishery Operators					
	None	0 to <20%	20% to <50%	50% to <100%	100%	Respondents
Number	97	18	8	8	20	151
Percent	64.2%	11.9%	5.3%	5.3%	13.2%	100.0%

In the table above, 64% of operators did not report any incidents. From the responses we calculate that only 1 in 5 incidents were recorded. This would imply that, assuming perfect local knowledge, FOs would know of 460 incidents from just our respondents. We need to make allowances that a single gear conflict generates an incident for both of those involved. This would imply 230 incidents from the respondent alone. FOs were only aware of 198 incidents. Given a 14% response rate, and assuming no response bias, this suggests that FO's would collectively be aware of 1,400 incidents. It is difficult to explain this discrepancy through response bias or operators over-stating the gear conflict issue. This is problematic, since our proposed extra sample scaling factor is larger than the sample estimate itself.

16.7 Gears in Conflict

Respondents were asked to identify the gear types they were having conflict with. They were asked to identify the "other gear" type within 0-1nm, 1-3nm, 3-6nm, 6-12NM and beyond 12nm. The results are presented below.

Table 16.7.1 Incidents by Gear Type on Gear Type within 1nm

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving	Total
Demersal trawl	0	0	0	2	0	0	0	2
Nephrop pots/creels	29	2	11	13	4	0	0	59
Nephrop trawl	1	0	0	13	3	0	0	17
Other shell fish pots/creels	6	7	13	1	22	1	1	51
Other shellfish hand diving	1	0	0	0	0	1	0	2
Pelagic and other lines	0	0	0	0	0	0	0	0
Pelagic trawl	1	0	1	1	1	0	0	4
Scallop dredge	0	0	0	0	1	0	0	1
Scallop hand diving	1	0	2	1	1	1	1	7
Total	39	9	27	31	32	3	2	143

From the above table, we can identify that within 1 NM of the shore the gear of 29 nephrop creelers came into physical contact with Nephrops trawls. The gears of 11 nephrop creelers were in contact with dredges and 13 with other nephrop creelers.

Table 16.7.2 Incidents by Gear Type on Gear Type between 1 and 3nm

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving	Total
Demersal trawl	0	0	0	1	0	0	0	1
Nephrop pots/creels	43	2	11	15	6	0	0	77
Nephrop trawl	0	0	0	12	4	0	0	16
Other shell fish pots/creels	5	10	16	1	8	1	1	42
Other shellfish hand diving	0	0	0	0	0	0	0	0
Pelagic and other lines	0	0	0	0	0	0	0	0
Pelagic trawl	1	0	1	1	0	0	0	3
Scallop dredge	0	0	0	0	2	0	0	2
Scallop hand diving	0	0	0	0	0	0	0	0
Total	49	12	28	30	20	1	1	141

Table 16.7.3 Incidents by Gear Type on Gear Type between 3 and 6nm

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving	Total
Demersal trawl	0	0	0	1	0	0	0	1
Nephrop pots/creels	23	1	4	8	1	0	0	37
Nephrop trawl	1	0	1	12	3	0	0	17
Other shell fish pots/creels	5	13	20	0	7	1	1	47
Other shellfish hand diving	0	0	0	0	0	0	0	0
Pelagic and other lines	0	0	0	0	0	0	0	0
Pelagic trawl	1	0	1	1	0	0	0	3
Scallop dredge	0	0	0	0	3	0	0	3
Scallop hand diving	0	0	0	0	0	0	0	0
Total	30	14	26	22	14	1	1	108

Table 16.7.4 Incidents by Gear Type on Gear Type between 6 and 12nm

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving	Total
Demersal trawl	0	0	0	0	0	1	0	1
Nephrop pots/creels	7	0	1	2	1	0	0	11
Nephrop trawl	0	0	0	5	1	0	0	6
Other shell fish pots/creels	1	8	11	1	3	1	1	26
Other shellfish hand diving	0	0	0	0	0	0	0	0
Pelagic and other lines	0	0	0	0	0	0	0	0
Pelagic trawl	0	0	0	0	0	0	0	0
Scallop dredge	0	0	0	0	2	0	0	2
Scallop hand diving	0	0	0	0	0	0	0	0
Total	8	8	12	8	7	2	1	46

The above tables provided a detailed picture of where particular gear conflicts are occurring. The table below summaries the gear types in conflict.

Table 16.7.5 All Incidents by Gear Type on Gear Type

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving	Total
Demersal trawl	0	0	0	4	0	1	0	5
Nephrop pots/creels	102	5	27	38	12	0	0	184
Nephrop trawl	2	0	1	42	11	0	0	56
Other shell fish pots/creels	17	38	60	3	40	4	4	166
Other shellfish hand diving	1	0	0	0	0	1	0	2
Pelagic and other lines	0	0	0	0	0	0	0	0
Pelagic trawl	3	0	3	3	1	0	0	10
Scallop dredge	0	0	0	0	8	0	0	8
Scallop hand diving	1	0	2	1	1	1	1	7
Total	126	43	93	91	73	7	5	438

The results suggest the in addition to the contact between mobile and static gear, there is territorial conflict between static gear types. From the above table we can identify the following features:

- Nephrop creelers experience most gear conflicts with nephrop trawlers (55%), other nephrop creelers (25%) and dredges (15%) in that order.
- 75% of nephrop trawlers' gear conflicts are with nephrop creelers and 20% with other shellfish pots and creels.
- Other shellfish pots and creels seem to interact with a broader range of gear types. 36% of their conflicts are with dredges, 24% with their fellow shellfish potters and creelers and 23% with other trawlers. Anecdotal evidence and written testimony suggest that this might be trawlers targeting squid close to the shore.
- There is very little conflict between mobile gear types

The table identifies the 9 most common types of gear conflicts (see first column) and identifies their distribution from the shore.

Table 16.7.2.6 Location of the most common conflicts

Type of Conflict (9 most Common)	**No. of Respondents Experiencing**			
	0-1NM	**1-3NM**	**3-6NM**	**6-12m**
Nephrop Pots/Creels + Nephrop Trawls	42	55	35	12
Nephrop Pots/Creels + Dredges	11	11	4	1
Nephrop Pots/Creels + Nephrop Pots/Creels	13	15	8	2
Nephrop Pots/Creels + Other Shellfish Pots/ Creels	5	7	1	2
Nephrop Pots/Creels + Other Trawls	5	4	3	0
Other Shellfish Pots/ Creels + Nephrop Trawls	9	9	8	2
Other Shellfish Pots/ Creels + Dredges	14	18	23	13
Other Shellfish Pots/ Creels + Other Trawls	8	10	13	8
Other Shellfish Pots/ Creels + Other Shellfish Pots/ Creels	22	8	7	3

For the most common conflicts the area inside 3NM is very significant. The exception would appear to be Other Shellfish Pots/Creels which have almost as many conflicts with dredges and trawls in the 3 to 12NM zone as they do in the 0-3NM zone, though their encounters with their fellow Other Shellfish Pots/Creels are mostly in the 0-1NM zone.

16.8 Beliefs About Causation

In an effort to tease out the circumstances giving rise to gear conflicts operators were presented with the question below. In the right hand column, we have provided a short hand form of words to summarise.

"With reference to 2012, please estimate the PERCENTAGE OF TOTAL GEAR CONFLICTS described by each of the following scenarios"

Scenario	
% where OTHERS fished their gear where they COULD NOT HAVE reasonably expected YOUR gear already to be there.	Other Initiated and Probable Accident
% where OTHERS fished their gear where they MIGHT HAVE reasonably expected YOUR gear already to be there.	Other Initiated and Uncertain Intent.
% where OTHERS fished their gear where they ALMOST CERTAINLY could have expected YOUR gear already to be there.	Other Initiated and Probably Deliberate
% where YOU deployed your gear in locations where you COULD NOT HAVE reasonably expected OTHER gear already to be there.	Respondent Initiated and Probable Accident
% where YOU deployed your gear in locations where you MIGHT HAVE reasonably expected OTHER gear already to be there.	Respondent Initiated and Uncertain Intent.
% where YOU deployed your gear where you ALMOST CERTAINLY could have expected OTHER gear already to be there.	Respondent Initiated and Probably Deliberate
% of conflicts where there was a different or unknown scenario	

Table 6.8 Gear Conflict Scenarios

	My Gear There First				Their Gear There First					
Gear	**Accident**	**Uncertain**	**Deliberate**	**Them**	**Accident**	**Uncertain**	**Deliberate**	**Me**	**Other**	**N**
Demersal trawl	0.0	3.3	50.0	53.3	20.0	23.3	1.7	45.0	1.7	3
Nephrop pots/creels	1.1	22.0	67.6	90.7	1.4	1.9	3.0	6.3	3.0	61
Nephrop trawl	3.9	2.2	27.2	33.3	39.0	17.5	1.9	58.4	8.2	18
Other shell fish pots/creels	6.9	22.4	62.8	92.0	2.7	3.8	0.7	7.3	0.6	54
Other shellfish hand diving	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	50.0	2
Pelagic trawl	5.0	20.0	20.0	45.0	20.0	10.0	10.0	40.0	15.0	1
Scallop dredge	0.0	0.0	25.0	25.0	15.0	60.0	0.0	75.0	0.0	2
Scallop hand diving	0.0	25.0	0.0	25.0	0.0	25.0	0.0	25.0	50.0	2
Total	3.6	18.7	58.2	80.5	7.3	6.2	1.9	15.4	4.1	143

By and large, static operators are stating there is quite widespread deliberate intent on the part of others. Over 67% of all nephrop creelers and 63% of all those using other creels thought conflict was almost certainly a deliberate act by another. A majority of nephrop trawlers stated the conflict was accidental or not entirely. On this evidence there would seem to be different declared understandings about how conflicts arise. Given the financial cost, the inconvenience and stress associated with gear conflict, it is not surprising that personal conflicts arise. In the absence of something changing these conflict are likely continue to be a feature of inshore fishing in some parts of Scotland.

16.9 Costs to Operators

Respondents were asked the *"financial cost to your business of all gear conflicts. Please include lost profit whilst being unable to use damaged gear, repair and replacement costs, legal bills etc"*

The total costs by for each IFG disaggregated by gear type is given in the Table below

Table 16.9.1 Total Gear Conflict Costs by Gear Type by IFG

Home	Gear	Mean	N	Std. Deviation	Sum
South West	Demersal trawl	£2,600	2	3,394	£5,200
	Nephrop pots/creels	£8,494	17	12,367	£144,400
	Nephrop trawl	£6,967	6	7,431	£41,800
	Other shell fish pots/creels	£1,983	10	1,759	£19,825
	Pelagic trawl	£15,000	1		£15,000
	Scallop dredge	£9,000	1		£9,000
	Total	£6,357	37	9,345	£235,225
North West	Demersal trawl	£0	1		£0
	Nephrop pots/creels	£4,340	42	6,547	£182,300
	Nephrop trawl	£4,700	9	4,232	£42,301
	Other shell fish pots/creels	£5,940	5	8,350	£29,699
	Other shellfish hand diving	£0	1		£0
	Scallop dredge	£0	1		£0
	Scallop hand diving	£8,000	2	0	£16,000
	Total	£4,431	61	6,160	£270,300
Outer Hebrides	Nephrop pots/creels	£10,850	10	15,649	£108,500
	Nephrop trawl	£5,000	6	3,688	£30,000
	Other shell fish pots/creels	£26,000	3	30,790	£78,000
	Total	£11,395	19	16,760	£216,500
Moray Firth & North Coast	Nephrop pots/creels	£2,000	1		£2,000
	Nephrop trawl	£5,000	1		£5,000
	Other shell fish pots/creels	£4,066	16	6,184	£65,050
	Scallop dredge	£0	1		£0
	Total	£3,792	19	5,744	£72,050
Orkney	Nephrop pots/creels	£3,750	2	1,768	£7,500
	Other shell fish pots/creels	£1,100	2	1,273	£2,200
	Other shellfish hand diving	£0	1		£0
	Total	£1,940	5	2,029	£9,700
East Coast	Demersal trawl	£1	1		£1
	Nephrop trawl	£3,000	1		£3,000
	Other shell fish pots/creels	£13,478	27	26,134	£363,900
	Scallop dredge	£0	1		£0
	Total	£12,230	30	25,041	£366,901
Shetland	Demersal trawl	£20,000	1		£20,000
	Other shell fish pots/creels	£8,000	1		£8,000
	Total	£14,000	2	8,485	£28,000
Total	Demersal trawl	£5,040	5	8,632	£25,201
	Nephrop pots/creels	£6,176	72	9,853	£444,700
	Nephrop trawl	£5,309	23	4,830	£122,101
	Other shell fish pots/creels	£8,854	64	19,106	£566,674
	Other shellfish hand diving	£0	2	0	£0
	Pelagic trawl	£15,000	1		£15,000
	Scallop dredge	£2,250	4	4,500	£9,000
	Scallop hand diving	£8,000	2	0	£16,000
	Total	£6,929	173	13,505	£1,198,676

The table below provides the mean gear conflict costs by gear type by IFG.

Table 16.9.2 The Mean Annual Cost of Conflict by Gear Type by IFG

	South West	North West	Outer Hebrides	MF&NC	Orkney	East Coast	Shetland	Overall Mean	N
Demersal trawl	£2,600	£0	£0	£0	£0	£1	£20,000	**£5,040**	5
Nephrop pots/creels	£8,494	£4,340	£10,850	£2,000	£3,750	£0	£0	**£6,176**	72
Nephrop trawl	£6,967	£4,700	£5,000	£5,000	£0	£3,000	£0	**£5,309**	23
Other shell fish pots/creels	£1,983	£5,940	£26,000	£4,066	£1,100	£13,478	£8,000	**£8,854**	64
Other shellfish hand diving	£0	£0	£0	£0	£0	£0	£0	**£0**	2
Pelagic trawl	£15,000	£0	£0	£0	£0	£0	£0	**£15,000**	1
Scallop dredge	£9,000	£0	£0	£0	£0	£0	£0	**£2,250**	4
Scallop hand diving	£0	£8,000	£0	£0	£0	£0	£0	**£8,000**	2
Overall Mean	**£6,357**	**£4,431**	**£11,395**	**£3,792**	**£1,940**	**£12,230**	**£14,000**	**£6,929**	

From the table above, the overall annual average costs within each IFG area was £6,929. The column and row totals are weighted averages. Thus operators in the MF&NC have the lowest annual costs. For many cells in the above table there are no observations and for others there is a small number problem. Given this and the variance, the mean cost for all conflicts is the most reliable measure of cost likely to be avoided by the introduction of the 0-1 1NM or 3 nmNM restrictions.

16.9.1 Benefits from Restricting Mobile Gear

Most conflicts arise between mobile and fixed gear and we assume that a ban on mobile gear within 1 or 3 miles of the coast would remove such conflicts. In the absence of other measures conflict between static gears would continue. The table below presents an estimate of the % of the mobile / static conflicts that would be avoided in each IFG area.

Table 16.9.3 Conflicts Avoided

IFG		<1nm Fixed	<1nm Mobile	<1nm Avoided	<3nm Fixed	<3nm Mobile	<3nm Avoided
SOUTH WEST	**Fixed**	11	11	65.6%	18	23	68.4%
	Mobile	10	0		16	0	
NORTH WEST	**Fixed**	8	18	75.0%	17	43	77.0%
	Mobile	6	0		14	0	
OUTER HEBRIDES	**Fixed**	3	2	42.9%	6	5	46.7%
	Mobile	1	1		2	2	
MF&NC	**Fixed**	6	6	50.0%	8	13	61.9%
	Mobile	0	0		0	0	
ORKNEY	**Fixed**	1	1	50.0%	2	2	50.0%
	Mobile	0	0		0	0	
EAST COAST	**Fixed**	8	2	20.0%	12	7	50.0%
	Mobile	0	0		8	3	
SHETLAND	**Fixed**	1	0	0.0%	1	1	50.0%
	Mobile	0	0		0	0	
Total	**Fixed**	38	40	59.4%	64	94	65.8%
	Mobile	17	1		33	2	

Having estimated the percentage of conflicts and therefore costs saved, it is necessary to know the number of conflicts (and costs) occurring within 1 NM and 3

NM. Table 16.5.1 provides an estimate of the number and % of conflict days for each IFG by distance zones. This distribution can be used to allocate the total IFG conflict costs. This is presented in the table below along with the estimated savings

Table 16.9.4 Estimated Gear Conflict Savings

		0-1NM			0-3NM		
IFG	**Total Cost**	**<1nm**	**%Avoided**	**Savings**	**<3nm**	**%Avoided**	**Savings**
SOUTH WEST	£235,225	£143,722	65.60%	**£94,282**	£224,640	68.40%	**£153,654**
NORTH WEST	£270,300	£88,658	75.00%	**£66,494**	£226,241	77.00%	**£174,206**
OUTER HEBRIDES	£216,500	£25,114	42.90%	**£10,774**	£67,981	46.70%	**£31,747**
MF&NC	£72,050	£42,365	50.00%	**£21,183**	£64,052	61.90%	**£39,648**
ORKNEY	£9,700	£7,391	50.00%	**£3,696**	£8,779	50.00%	**£4,390**
EAST COAST	£366,901	£81,452	20.00%	**£16,290**	£210,601	50.00%	**£105,301**
SHETLAND	£28,000	£0	0.00%	**£0**	£18,676	50.00%	**£9,338**
Total	£1,198,676	£388,702	54.73%	**£212,718**	£820,970	63.13%	**£518,283**

Scaling these estimates by the response rates of Table 16.2.4 produces the following total costs and savings within 1NM and within 3NM that would arise for, restricting mobile gear.

Table 16.9.5 Scaled Annual Gear Conflict Savings

IFG	**Total Cost**	**< 1NM Savings**	**<3NM Savings**
SOUTH WEST	£1,656,514	£663,958	£1,082,070
NORTH WEST	£821,581	£202,109	£529,502
OUTER HEBRIDES	£1,568,841	£78,072	£230,051
MF&NC	£450,313	£132,394	£247,800
ORKNEY	£111,494	£42,483	£50,460
EAST COAST	£3,821,885	£169,688	£1,096,885
SHETLAND	£1,166,667	£0	£389,083
Total	£9,597,294	£1,288,704	£3,625,851

There is undoubtedly a response bias and the estimates in Table 16.9.5 should not be used. Because of the low response rate, the un-scaled estimates of Table 16.9.4 have an equally dubious provenance. The final table below 16.9.6 is based on a mid-point estimate. This is not ideal but is preferable to using the scaled or un-scaled estimates, or indeed not producing any estimate.

Table 16.9.6 Final Estimates Annual Gear Conflict Savings

IFG	**< 1NM Savings**	**<3NM Savings**
SOUTH WEST	**£379,120**	**£617,862**
NORTH WEST	**£134,302**	**£351,854**
OUTER HEBRIDES	**£44,423**	**£130,899**
MF&NC	**£76,789**	**£143,724**
ORKNEY	**£23,090**	**£27,425**
EAST COAST	**£92,989**	**£601,093**
SHETLAND	**£0**	**£199,211**
Total	**£750,712**	**£2,072,068**

17 THEORETICAL CONTRIBUTION OF MARINE RECREATION

Historically, the benefits to society from exploitation of its stocks of sea fish were believed to comprise food for the table plus the income and employment generated for those associated with commercially catching and processing fish. It is now widely recognised that sea fish are a significant recreational resource. As stated previously, among marine recreational activity, there is a spectrum of sensitivity to changes in fish stocks.

17.1 Sensitivity of Marine Recreation to Changes in Fish Stocks

At one end, there are sea anglers and, to a lesser extent, marine divers whose recreational experience involves direct interaction with fish stocks. Their enjoyment and participation levels would be most sensitive to changes in the near shore availability of fish populations. Further along the spectrum there is bird watching and marine/coastal wildlife tours and charters. Their enjoyment and participation is sensitive largely to changes in populations who predate on inshore fish stocks. These predators would include sea birds such as puffins and sea eagles and sea mammals such as porpoise, dolphins, seals and mike whales. At the other end of the spectrum might be sea kayakers, sailors and informal visitors to coastal areas. For these activities, the prospect of interaction with predator populations is not even a necessary ingredient of their recreational experience. Nonetheless, a decreased probability of sightings of dolphins, porpoise, minke whales, seals, sea eagles, puffins etc would detract from their experience and possibly affect their activity levels.

An important issue is whether the analysis should seek to embrace every conceivable form of marine recreation which might be impacted by near shore mobile gear restrictions. The decision on which activities to include is a balance of their sensitivity to changes in fish stocks, the numbers participating and the availability of information on which to base an economic evaluation.

Recreational sea angling (RSA) is included because there is obvious sensitivity to changes in fish stocks, large numbers of participants and quite recent and reasonably robust sources of economic data. Compared with RSA, recreational diving (RD) is less sensitive, has fewer participants and less reliable data sources. Despite this, RD was also included. The following two chapters are dedicated to providing benchmark estimates for these activities and an assessment of the potential consequences of mobile gear restrictions.

The section below considers those groups whose sensitivity to changes in fish populations is dependent on there being a change in predator populations.

17.2 Marine Recreational Based on Predator Populations

The value of these activities to the Scottish Economy is possibly quite substantial, though the evidence is patchy.

Bryden et al (2010) put the value of offshore sailing at £61.4m (£27m non-Scottish) with £10m being the estimated expenditure on other water sports.

Blake et al (2010) examine wildlife tourism in Scotland and found that visitors who are primarily motivated by marine wildlife spend a total of £63 million per year (23%

of all wildlife tourism spending), and generate net economic impacts of £15 million of income and 633 FTE jobs. Almost half (46%) of marine wildlife tourist trips are between May and June.

Marine wildlife domestic tourists make a shorter trip than the average wildlife tourist (3.6 nights per trip compared to the average of 4.4) but spend more in Scotland per trip and per night than is average for domestic wildlife tourists (£353 per trip, £88 per night compared to averages of £330 and £74). They spend an average of £23 at wildlife attractions per trip, or £6 per night, which is the lowest spending at wildlife attractions of all visitors, possibly because they are attracted by one particular species and undertake fewer other wildlife activities while on their trip.

According to Blake et al (2010), marine wildlife tourists are much less likely to come from within Scotland than other wildlife tourists. Only 11% of marine wildlife tourists are resident in Scotland compared to 55% for all wildlife tourists. They are also more likely to be over 55 years of age (40% of them are) than all wildlife tourists (28% of all wildlife tourists are over 55).

Dickie, Hughes and Esteban (2006) suggest that the Sea Eagles on Mull were responsible for £1.4 to 1.6m in visitor spending per year, and 36-42 FTE's supported. The RSPB (2010) also examined the local economic impact of the seabird reserve at the Rhinns of Galloway and found that in 2008, an income into the local area of over £126,000 was attributable directly to seabirds. This equates to nearly 4 (i.e. 3.62) full time jobs being supported in the region. It was a very similar picture in 2009, when nearly £115,000 of income into the local area was attributable to seabirds, or over 3 full time jobs in addition to the staff employed at the Reserve. Other popular ornithological trips include visits to the puffin colony on the Treshnish Island, the Gannetry on Bass rock and the sea bird colonies of St Kilda and Fair Isle. In total these almost certainly would more than treble the impact of the Sea Eagles alone.

On balance, there is insufficient information on any one of these activity to enable formal inclusion in the economic evaluation. This is unfortunate because the policy benefits will be under estimated by excluding bird watching and wildlife tourism which possibly have large numbers of participants. On the other hand, there is an extended causal chain linking near shore (0-3 NM) restrictions on mobile gear to increases in participants well-being and activity levels. This means that what happens in near shore areas may only have a limited impact on fish predator populations. Moreover that limited impact might not sufficiently affect the quality of the recreational experience to alter the activity levels of participants.

The conclusion is that existing knowledge and available data does not presently enable the analysis of marine recreation to extend beyond those who interact directly with fish stocks (sea anglers and divers). However, as discussed in Section 20, the process of estimating general public values may inadvertently capture the user value of these other activities.

17.3 The Income and Employment Impact of RSA, RD and OMRA

RSA, RD and Other Marine Recreational Activity (OMRA) contribute through their economic impact, as well as through the positive effects these activities can have on participants and wider society.

The contribution of RSA, RD and OMRA to well-being in Scotland comprises three elements:

i. The economic impact of RSA, RD and OMRA through increased **local income and employment**.
ii. Benefits to participants (user values)
iii. Benefits to wider society (externalities)

As explained previously, the first element is assessed though the Economic Impact Assessment. The Net Economic Value / Cost Benefit Analysis (NEV/CBA) framework is conceptually relevant for both (ii) and (iii), though in terms of estimating the monetary value only elements of (ii) and (iii) can be estimated. This is explained below.

The expenditure of sea anglers, divers and others can create income and employment for others. Most apparent is the income and employment of businesses directly supplying services, such as charter vessels, temporary accommodation providers, gas suppliers and tackle shops. As explained earlier this is the **direct effect.** Charter operator may purchase local vessel repair services, or the hotelier may purchase food locally. These purchase support the wages, profits and jobs of the local ship repairer and butcher. As explained earlier, this is the **indirect effect**. The repair or butcher company itself may purchase materials from local suppliers thereby generating a further round of indirect effects. **Induced effects** can arise from the direct and indirect effects as increased household incomes are spent locally thereby supporting, shops and pubs. Thus, in some regions, as well as Scotland as a whole, the income and employment of quite a diverse range of local businesses and households (charter crew, hoteliers, ship repair staff, butchers, bar staff) are dependent on RSA, RD and OMRA.

In order to estimate the income and employment effects it is necessary to:

- Define a local area
- Estimate sea angler / diver expenditure
- Estimate how changes to RSA, RD or OMRA would change sea angler, diver or other participants' expenditure in the local area.
- Develop a local economy model which captures the inter-linkages within the local economy
- Use the model to analyse the impact on the local economy of the change in angler or diver expenditure

17.4 The Positive effects of RSA, RD and OMRA on Participants

The contribution of RSA, RD or OMRA to the quality of life can operate through its positive effects on participants themselves:

- The most obvious benefit to participants is their enjoyment of the recreational experience which embraces their anticipation, participation and eventual reflection.
- Like many outdoor recreational activities, RSA, RD and OMRA are believed to reduce stress and improve anglers' mental and physical health.
- For RSA there are low start-up costs. This and the absence of access charges, enable youngsters and individuals on low incomes to start and

regularly participate. In some communities, participation in RSA could broaden otherwise narrow horizons and have positive effects on some youngsters life choices.

17.5 The Positive Effects of RSA, RD and OMRA on Wider Society

In addition to participants' benefits, wider society could benefit:

- Society may benefit if participants in marine recreation are mentally and physically healthier and this translates into better family and personal relationships, improved productivity and reduced demands on health care budgets.
- If participation does broaden otherwise narrow horizons RSA, RD and OMRA could contribute to reductions in anti-social behaviour.
- Increasingly, marine scientists are using informal data sources. For example, established survey methods are not suited to many inshore areas, owing to shallow depths, obstructions, or vulnerable habitats. Systematic rod and line surveys can provide much needed information on inshore fish stock abundance. Similarly scuba divers help to monitor the spread of invasive species and report on our marine heritage and artefacts.

17.6 Monetising the Positive Effects on Participants[41]

Following the explanation in Section 4, the ***Gross Economic Value*** **(GEV)** of RSA or RD is the aggregate Willingness to Pay (WTP) of sea anglers or divers. The more relevant concept of ***Net Economic Value*** **(NEV)** of RSA is obtained by subtracting from GEV, the opportunity costs of the resources used by participants. In applied economic work, it is normally assumed that the market value of resources used by participants (e.g. petrol, accommodation, bottle gas, bait, tackle) reflects society's opportunity costs. NEV of RSA or RD is found by estimating the participants willingness to pay (i.e. GEV) and then subtracting the market value of the resources they use as reflected by their actual expenditure on tackle, petrol, bait, accommodation etc. (i.e. their actual expenditure).

The discussion can also be couched in a bottom up approach by focussing on the welfare of individual participants. The benefit to a sea angler or diver from his/her current activity is the amount they are WTP for it. This maximum willingness-to-pay (WTP) can be divided into two parts: the expenditure anglers actually incur (e.g. on travel costs, bait etc) and their **Consumers' Surplus**. This is a benefit an individual derives from a good over and above what s/he actually has to pay to create the angling or diving experience.

Consumers' surplus is the NEV of the activity to the participant. This is because if the activity is not available the participant forgoes the enjoyable angling or diving experience which s/he is willing to pay for, but s/he saves the money previously

[41] Since this study attempts to estimates monetary values for RSA and RD, this section does not embrace other recreational activity such as marine ornithology but the analytical framework articulated here would be relevant for these activities. For the remainder of this report, RSA and RD should be considered as a proxy for all marine recreation interests

spent on travel, bait etc. Thus if an angler's or diver's gross WTP is £30 and s/he only has to spend £20 on creating the experience (travel, tackle, bait) etc the net worth of the experience is £10, which is his/her consumer's surplus. We therefore focus on changes in consumers' surplus (i.e. NEV) as the measure of the benefit to participants from restoration of the marine ecosystem. Thus for non-priced angling such as RSA or RD:

NEV of RSA or RD = Participants Consumers' Surplus

Consumers' surplus associated with RSA or RD might be described as a 'direct consumptive user values'. It is conceivable that there are other less obvious sources of the NEV to society from RSA. It is appropriate to articulate all these possibilities, even those which are quite tenuous.

17.6.1 GPNUV and Bequest Value (BV) of RSA and RD.

Some individuals in society may derive a non-user value from knowing that the activity of sea angling or diving exists and is enjoyed by others. In other words, they would be willing to pay something to preserve the activity for the enjoyment of their contemporaries. In this study this is termed the General Public Non User Value (**GPNUV)** of RSA or RD. Some individuals may derive some satisfaction from knowing that future generations will be able to participate in sea angling or diving and are even willing to pay something to ensure future generations' participation. This is the **Bequest Value (BV)** of RSA or RD.

The common feature of BV and GPNUV is that they derive from the individual's appreciation of a use of a natural resource by others. Essentially, if they exist, they arise from the altruism of individuals. These are passive values but in the case of RSA relate to a consumptive use value.

If a sizeable proportion of the **non-angling or diving public** has some vicarious concern for anglers and divers, then GPNUV and BV might be significant, but this is unlikely. Indeed, in the case of RSA, the non-angling public is just as likely to view angling as an undesirable activity because of its impacts on fish welfare. In contrast, an angler or diver may have an altruistic concern for fellow anglers or divers that manifests itself in a willingness to pay so that others, now and in the future, may participate. This study takes the view that there may be GPNUV and BV associated with sea angling, but only within the angling population itself and therefore is a user value. BV may be worth of consideration because of anglers' and divers' concern for participation of their offspring and generations.

Consumers' surplus reflects circumstances where the participants are sure of their income, their preferences both now and in the future, and the availability of the natural resource when they (and others) wish to use it. If there is uncertainty, say, about the future availability of an activity and if we assume that individuals show 'risk-aversion', then there is the possibility of another category of value.[42] We presume that anglers and divers would be prepared to pay a premium to avoid risk. This gives rise to their **Option Value.**

[42] Risk-averse individuals would, for example, prefer a certain outcome of £100 to a gamble having the same aggregate outcome (e.g. a 50% chance of £50 and a 50% chance of £150).

In conclusion, the Total NEV of RSA or RD is as follows:

		Value:	Comment:
Total NEV of RSA or RD	=	**Participants' Consumer Surplus**	Could be substantial
		+	
		GPNUV of RSA or RD	Probably not relevant
		+	
		Bequest Value of RSA or RD	Possibly relevant but unlikely to significant
		+	
		Participants' Option Value	Relevant, could be significant

It should be noted that the 'values' discussed in this section are intrinsically additive since they are based on a common assigned value (i.e. WTP) and constituency (i.e. Scottish society as a whole). It is also possible to assess the sensitivity of NEV to changes in circumstances, such as changes in the use of a resource or changes in fish abundance.

In later sections we address the applied aspects of quantifying Total NEV of RSA and RD

17.7 Monetising the Positive Effects on Wider Society

The benefits to wider society are readily articulated but extremely difficult to estimate. The beneficial effects on third parties (such as through reduced crime, better social and work interactions with anglers) are known as **Externalities** in economics. These have not been estimated for any type of angling in the UK.) Other effects result in to reduced costs such as in health care and cheaper fish stock monitoring. Theoretically these are easier to estimate, but only if the relationships between RSA participation and health are known. The conclusion is that monetisation of these externalities for Scottish RSA is not feasible

18 SCOTLAND'S RECREATIONAL SEA ANGLING

There is a broad spectrum of engagement with Recreational Sea Angling (RSA). There are for example a small number of **professional sea angling coaches** and a substantial number who might be regarded as **specialist and/or competition anglers**. For these anglers, RSA is their primary leisure interest and they will travel extensively in pursuit of their specialism and/or to compete in competition. Their capital expenditure on equipment and boats can be high and days fished may well exceed 50 days per year. Some of these anglers target single species or specimen sized fish. They are most aware of changes in species diversity, size of fish and the general abundance of inshore fish stock. This group are most likely to fish outside Scotland if the relative quality of RSA is better overseas. There are also a range of **pleasure anglers**. A high proportion of this group live near the coast, they fish regularly on short visits to favoured local marks and may travel farther to fish when conditions are good. Many of these will be young people, and/or could have constraints on their ability to fish further afield. The easily accessible mark, typically a pier or headland, can be very important to this group. Similarly, local pleasure boat owners may keep a few rods on board which they use opportunistically. There are also **visiting pleasure anglers**. Families on coastal holidays or visiting family and friends may take the opportunity to fish for sea fish. These family groups can be quite content fishing for mackerel or relatively small fish. Also, many urban residents now own accommodation in Scottish coastal locations (second homes, mobile caravans, residential caravans and boats) and might engage in RSA during weekend breaks and short stays.

Clearly the fish stock requirements of these different groups will vary. A high probability of catching something is important for some groups; for others, species diversity or the availability of a particular species is the key characteristic. As a generalisation anglers prefer to catch larger rather than smaller fish of the same species, but other fish stock characteristics also matter.

18.1 Background

In 1973, the Scottish Tourist Board declared that, "*Scotland is now recognised sea anglers as one of the most exciting sea angling countries in Europe.*"[43] Not only was Scotland an attractive proposition for sea anglers, the demersal fisheries of the Clyde were sufficient to attract anglers from England and overseas[44]. Up to the early 1980's the west coast of Scotland, and even the Clyde system, was capable of supporting a renowned recreational fishery predicated on large specimen fish and demersal species diversity. As outlined in Section 3 by the mid to late 1980's sea angling catches steadily declined. As the activity declined so did much of the infrastructure of RSA clubs as well as jobs in the supporting service industries.

[43] Scotland For Sea Angling, 1973. Published by Scottish Tourist Board.

[44] For example a 1987 guide to angling in Scotland stated *"the coastline from Largs to Greenock is probably the most popular area in Scotland for shore angling, with many anglers from the Midlands and beyond making regular trips north."*

Although Scottish RSA is believed to be much diminished it remains a popular coastal activity and, in refuge locations, it continues to attract travelling specialist anglers who are seeking a variety of species or to catch 'high status' fish like Shark, Tope and Skate.

Neither the current extent of sea angling, nor its current contribution was known until a study undertaken for the Scottish Government by Radford et al (2009). This study involved an Omnibus Telephone Survey of over 15,000 Scottish households, 501 sea anglers who responded to an Internet Survey and 215 face to face interviews with anglers and key stakeholders.

The study identified that, in Scotland, RSA is an activity carried out by all ages and classes roughly in line with the proportion in the population at large, though middle aged, skilled working men form a group somewhat larger than their proportion in the population. Young people, however, are relatively more likely to fish than their elders and men almost six times more likely than women. By its nature sea angling can be an activity for all the family and when women participate it is more often as part of the family experience.

The remit of study was to estimate the income and employment contribution of sea angling to Scotland and its regions. Scotland was divided into 9 regions largely based on the regions used by Visit Scotland. The regions are presented in the table below along with activity levels and expenditure.

18.1.1 Scottish and Regional RSA: Activity Levels and Expenditure

Radford et al estimated that 125,188 adults went sea angling in Scotland (plus some 23,445 juveniles). Nearly 43% of Scotland's population resides within 5 km of the shore and the RSA participation rate in these "coastal" areas is double that of inland areas.

The mean number of days fished by each person was 12.3 days per angler, though this figure masks significant variations with some anglers reporting over 200 or even 300 days per annum but 51% reporting less than 10 days. Glasgow and the West area has the greatest number of adult resident sea anglers in excess of 23,000.

Table 18.1.1 Estimates of Regional Sea Angling Activity and Expenditure (Radford et al).

Region	Anglers from Region	Total Angler Days in Region	Annual Variable Expenditure in Region (£'000s)	Capital Expenditure in Region (£'000s)	Total Expenditure in Region (£'000s)	Net Flow of Angler Days	Net Expenditure Flow (£'000s)
Argyll & Lochaber	5,825	252,615	£16,744	£5,879	£22,623	125,327	£11,308
Dumfries & Galloway	3,224	233,080	£16,247	£9,048	£25,294	215,777	£23,873
Glasgow and West	23,548	269,783	£16,481	£7,645	£24,126	{137,134}	{£10,797}
North East Scotland	8,904	234,307	£9,818	£5,659	£15,477	99,134	£7,121
Northern Scotland	7,894	144,346	£8,909	£2,251	£11,160	29,889	£2,193
Edinburgh Fife and South East	20,455	250,868	£13,902	£12,994	£26,896	{79,792}	{£1,618}
Western Isles	2,515	80,567	£5,518	£3,672	£9,190	46,196	£5,985
Orkney & Shetland	2,823	74,640	£3,949	£2,153	£6,102	46,258	£7,187
Visitors	50,000	NA	NA	NA	NA	{127,288}	{£42,164}
Total	125,188	1,540,206	£91,567	£49,301	£140,868		

From the Table above, the estimated total expenditure on sea angling across the whole of Scotland is £141m. There is significant variation in expenditure between some anglers. This applies, particularly, but not exclusively, to own boat anglers who spent as much as £10k per year and others (such as young people) spending less than £50 per year. The mean annual expenditure in Scotland by adult sea anglers was £1,500.

In the Table above, from the first column, it can be seen that Glasgow and the West had the greatest number of resident sea anglers (23,548 anglers). From column two, it also had the greatest number of angler days (269,783 days), despite relatively poor sea angling. From column five, Edinburgh Fife and the South East Region had the greatest total expenditure (£26.896m). Total expenditure on sea angling across the whole of Scotland was £140.868m

Column six informs that Glasgow and the West also had the greatest net export of angler effort (137,134 days). In contrast Dumfries and Galloway had the largest net inflow of sea angler effort (215,777 days), and the greatest net inflow of expenditure £23.873m

18.1.2 The Current Economic Impact of RSA to Scotland.

The table below summarises Radford et al estimates of RSA's current economic contribution in terms of jobs and income supported as well as and the net loss of income and employment if sea angling were to cease to exist.

Table 18.1.2 Economic Impact of Sea Angling (2009 prices)

Currently Supported		**Net Impact**	
Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
3,148 FTEs	£69,670	1,675 FTEs	£37,042

This above table shows that currently sea angling support 3,148 Full Time Job Equivalents (FTE's)[45] and £69.67m annually of Scottish household income in the form of wages, self employment income, rents and profits i.e. Gross Value Added (GVA).

This means that if RSA completely ceased in Scotland then 3,148 jobs and £70 m of income (i.e. GVA) would be lost. However, a proportion of the expenditure of sea anglers would likely be diverted elsewhere within Scotland and would create income and employment in other sectors. Despite this there would still be a **Net Loss** of at least 1,675 FTEs in Scotland and annual loss of £37 m in GVA. Clearly, if the status quo trajectory for inshore fisheries is a complete loss of species targeted by RSA then the net loss to Scotland could be substantial.

On the other hand, based on the estimates above, if Scotland were to achieve a 50% increase in sea angling activity levels this would safeguard a net minimum of 1,675 full time equivalent jobs (FTEs) and, assuming linear relationships, could possibly add a further 840 FTEs.

Expansion of RSA in many Scottish locations has the potential to generate significant increases in socio-economic benefits. From society's perspective, development of RSA should be an attractive prospect because of the twin characteristics of a potentially significant and diverse flow of socio-benefits (increased income and employment, benefits to participants and other societal benefits) and a relatively low ecological impact, especially if catch and release is widely practised.

Notwithstanding the problem of the availability of fish to catch in some areas, there is significant capacity for expanding the socio-economic contribution of Scottish RSA. A network of sea angling clubs still exists and encourages sea anglers to develop their interest and participate in competitions. Scotland has many beautiful, peaceful, un-crowded angling areas, an extensive range of native sea species many of which are still available, a diverse shoreline and, particularly on the West Coast and the islands, safe sheltered coastal waters offering the possibility of all year round fishing. The coastal communities themselves have excess capacity of visitor accommodation. There is an infrastructure of breakwaters, harbours, piers and slipways and an emerging network of Scottish marinas for berthing and maintaining own boats.

18.1.3 The Potential Economic Impact of RSA to Scotland.

In Section 3.2, we described two status quo trajectories and indicative outcomes of the policy options. For the 0-3 NM restriction we define, a Major Transformative Effect as causing a 50% increase in RSA activity levels of all types. Technically, there is no evidence to unambiguously confirm that RSA activity in Scotland would

[45] A single FTE could be one full-time all year post, or two part-time jobs, or two seasonal jobs, or four part-time seasonal jobs.

increase by as much as 50% if the near shore were to undergo a major transformation. This is because in recent times, Scotland has not experienced increases in near shore fish stock abundance. There is therefore no formal direct Scottish evidence on the relationship between the increased availability of fish stocks and sea angler participation.

We can, however, be quite confident that when demersal stocks declined in the 1980's, RSA in Scotland also declined (see Sections 3.3 and 18.1 above). Compared with the early 1980's, across Scotland the current number of tackle shops, sea angling charter vessels, sea angling clubs and competitions would suggest that RSA in Scotland is a fraction of its former levels. As well as informal historical evidence, casual cross sectional observations suggest that RSA activity levels are sensitive to the availability of fish to catch. The spatial distribution of RSA effort across Scotland is largely dependent on the availability of fish.[46]

Against that background, a major transformative effect that substantially altered the number, variety and average size of demersal fish could, quite reasonably, increase RSA activity levels by 50%. The 50% should be regarded as illustrative but not unreasonable.

We are assuming a linear relationship between activity levels and income and employment effects, simply because we have insufficient information to substantiate another functional form. In this event the economic impact table would be as follows:

Table 18.1.3 Economic Contribution 50% Increase in RSA (2009 prices) [47]

	Currently Supported		**Net Impact**	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Current Impact[48]	3,148	£69,670	1,675	£37,042
Additional Impact [49]	1574	£34,835	837.5	£18,521
Total	4,722	£104,505	2,513	£55,563

"Some enhanced flow," as described in Section 3, is estimated for illustrative purposes as a 25% increase, whereas a 10% increase is described as a "Minimal Enhanced Flow". This generates the two tables below

[46] Sea anglers will travel to Scrabster to fish for porbeagle, or to the Mull of Galloway to fish for tope, or Mull for rays. Similalry, in coastal communities, anglers crowd piers and other promintaries when mackerel shoals come closer inshore during the summer months.

[47] As explained in Section 21, the impact of the 0-1 NM restriction is assumed to be 50% of the 0-3 NM restriction. This proportion better reflects the relative importance of the 0-1 NM to RSA than, say, a 30% reduction. For clarity and brevity the 0-1 NM are not presented here but are easily calculated.

[48] This is the jobs and income "currently supported" and the "net loss" in jobs and income if RSA was to decline to zero. This is equivalent to the "decline to zero" status quo scenario

[49] Under heading "currently supported", this is the total additional jobs and income that would be supported by RSA with a major transformative environmental effect which delivered a significantly enhanced flow of benefits from RSA. Under heading the "net impact" this is the jobs and income that a major environmental effect would deliver once we had allowed for the decrease in jobs and income that would arsise elsewhere as anglers switched expenditure to RSA.

Table 18.1.4 Economic Contribution 25% Increase in RSA (2009 prices)

	Currently Supported		**Net Impact**	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Current Impact	3,148	£69,670	1,675	£37,042
Additional Impact	787	£17,418	419	£9,261
Total	3,935	£87,088	2,094	£46,303

Table 18.1.5 Economic Contribution 10% Increase in RSA (2009 prices)

	Currently Supported		**Net Impact**	
	Jobs	**Income (£'000s)**		
Current Impact	3,148	£69,670	1,675	£37,042
Additional Impact	315	£6,967	168	£3,704
Total	3,463	£76,637	1,843	£40,746

The columns headed "currently supported" are descriptively interesting, but for decision making the more relevant estimate is net balance of jobs and income gained in RSA over the number of jobs and income lost elsewhere as RSA expenditure is diverted. In completing the scenario table below we therefore focus on the Net Impact. Please note the income figures below are in 2013 prices whereas 2009 prices are used in tables 18.1.3 -18.1.5.

18.1.5 RSA's Potential Economic Impact on Scotland (2013 prices)

Impact Scenarios: / **Status Quo Scenarios:**	**Major Transformative Effect (50%)**		**Some Enhanced flow (25%)**		**Minimal Enhanced Flow (10%)**	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Continued Decline to zero	2,513	£59,371	2,094	£49,476	1,843	£43,539
Stability	837.5	£19,790	419	£9,896	168	£3,958

18.2 The Current Economic Impact of RSA to IFG areas

The table below summarises the estimates for the eight regions. Note that the *jobs and incomes lost* would not be expected to sum to the Scotland equivalent figure because loss to one region normally results in gains in another and smaller loss to Scotland as a whole.[50]

[50] The Scottish total for jobs and income *supported* was estimated by running a model of the Scottish economy and not by summing the totals for each region. Because of these procedural differences, there will be slight differences between the Scottish total and the regional sum, though conceptually they should be identical.

Table 18.2.1 The Economic Impact of Sea Angling by Region

	Currently Supported		Net Impact	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Argyll & Lochaber	524	£8,446	392	£6,342
Dumfries and Galloway	534	£7,714	462	£6,670
Glasgow and West	523	£11,892	249	£5,657
North East Scotland	343	£7,319	226	£4,822
Northern Scotland	299	£5,009	167	£2,800
Edinburgh, Fife and South East	504	£11,866	397	£9,370
Western Isles	184	£3,172	117	£2,028
Orkney & Shetland	145	£2,498	96	£1,657

Radford et al used 9 regions loosely based on the regions used by Visit Scotland. It is necessary to reconfigure the Radford et al RSA regions to reflect the IFG areas. This requires the above regions to be split and reassembled.

18.2.1 Mapping RSA Regions to IFGs

Fortunately we were able to access the first part of the postcodes area (e.g. G84) along with the anglers region as revealed by the anglers identified by the telephone survey of 15,000 households (the RSA study's internet survey did not generate postcodes). GIS was used to allocate postcode areas to IFG's on the basis of shortest distance. The percentage of anglers in the sub-division was then calculated. For example for the RSA study, the Moray Coast was part of the North East Scotland Region (33.3%) had postcodes in the area. Thus, 33.3% of expenditures for the North East were allocated to the Moray and North Coast IFG, the balance were allocated to the East Coast IFG. Similarly the North West IFG consists of 42.8% of the expenditures of Northern Scotland plus 2.25% of the aggregate expenditure of the Argyll and Lochaber. The Orkney and Shetland region was split 52% Orkney, 48% Shetland. All the adjustments are summarised in the Table below.

Table 18.2.2 Table of RSA Regional Adjustments

IFG	Relevant RSA Regions	Adjustment
South West IFG	**Glasgow and West**	OK
	Dumfries & Galloway	OK
	Argyll & Lochaber Excluding Ardnamurchan, Moidart, Morven, Knoydart	Minus 2.25% of Argyll and Lochaber
North West IFG	**Northern Scotland, but Excluding Cape Wrath to Nairn** **Plus** **Ardnamurchan, Moidart, Morven, Knoydart from Argyle and Lochaber**	42.86% of Northern Scotland Plus 2.25% of Glasgow and West
Moray Firth and North Coast IFG	**Cape Wrath to Nairn from Northern Scotland** **Plus** **North East Scotland Excluding Fraserburgh to Dundee**	57.14% of North Scotland Plus 33.3% of North East
East Coast IFG	**Edinburgh, Fife and South East**	OK
	Fraserburgh to Dundee From North East Scotland	66.67% of North East
Outer Hebrides	**Western Isles**	OK
Orkney	**Orkney & Shetland**	48% of Orkney and Shetland
Shetland	**Orkney & Shetland**	52% of Orkney and Shetland

18.2.2 RSA Activity and Expenditure Flows for IFG Areas

It was thus possible to reconfigure the RSA data to be consistent with IFG areas. The re-calculated activity levels and expenditure flow are presented in the Table below. The South West IFG has the biggest RSA element with 0.75m angler days and total expenditure of £71m. This is a reflection of the size of the area its very large population and the fact that Dumfries and Galloway and Argyll contain many RSA centres and hotspots. The net expenditure for this IFG area is low relative to the total. This is because a net outflow of sea anglers from Glasgow and the West has been bundled in with the Dumfries and Galloway which attracts anglers from Glasgow. The result is that much expenditure is simply a transfer within the region.

Table 18.2.3 RSA Activity and Expenditure flows for IFG Areas

IFG	Anglers from Region	Total Angler Days in Region	Annual Variable Exp in Region (£'000s)	Capital Exp. in Region (£'000s)	Total Exp in Region (£'000s)	Net Flow of Angler Days	Net Exp Flow (£'000s)
South West IFG	32,451	749,163	£49,053	£22,425	£71,477	200,837	£24,101
North West IFG	3,529	68,182	£4,237	£1,112	£5,349	15,944	£1,223
Outer Hebrides	2,515	80,567	£5,518	£3,672	£9,190	46,196	£5,985
MF&NC IFG	7,476	160,504	£8,360	£3,171	£11,531	50,090	£3,624
Orkney	1,342	35,489	£1,878	£1,024	£2,901	21,994	£3,417
East Coast IFG	26,394	407,151	£20,451	£16,769	£37,219	-13,670	£3,132
Shetland	1481	39151	£2,071	£1,129	£3,201	24264	£3,770
Visitors	50,000	NA	NA	NA	NA	- 127,288	-£42,164
Total	125,188	1,540,206	£91,568	£49,301	£140,868		

18.2.3 The Economic Impact of RSA to IFG Areas

The table below provides the estimates of the current economic impact of RSA in each of the IFG areas.

Table 18.2.4 Current Economic Impact Of RSA In Each IFG Area..

	Currently Supported		**Would be Lost**	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
South West IFG	1568	£27,841	1093	£18,510
North West IFG	141	£2,358	81	£1,359
Outer Hebrides	184	£3,172	117	£2,028
MF&NC IFG	285	£5,299	171	£3,206
Orkney	69	£1,188	46	£788
East IFG	733	£16,748	548	£12,586
Shetland	76	£1,310	50	£869

The estimates above for the IFG areas are the best that can be obtained though they are not as reliable as the regional estimates in the Radford at al RSA study. The reason for this is that the income and employment estimates are quite specific to the regions as defined. For example, the size of the region itself is important. A large region has stronger internal linkages so that firms are more likely to buy from firms within the region and pay wages to households resident in the region. For their part, households are more likely to source goods and services from local firms if the defined region is large rather than small. The stronger internal linkages of larger regions mean that the direct, induced and indirect effects associated with each pound of angler expenditure are much stronger. On the other hand, the larger the region the less likely that RSA expenditure would be diverted outside the region in the event of RSA demise, simply because there are more alternatives in a larger region. The analysis conducted by Radford et al was specific to each of their RSA regions and strictly they cannot be uncritically aggregated. There is a measure of re-assurance in the knowledge that one cannot readily conclude whether the consequence of aggregation is an over or under-estimate of RSA's true contribution to income and employment in IFG areas.

18.3 The Potential Economic Impact of RSA to IFG Areas

The procedure for estimating the potential impact follows that used to produce the Scottish economic impact estimates in table 18.1.5.

Table 18.3.1 RSA's Potential Economic Impact to IFGs (2013 Prices)

IFG AREA	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (50%)		Some Enhanced flow (25%)		Minimal Enhanced Flow (10%)	
		Jobs	Income (£'000s)	Jobs	Income (£'000s)	Jobs	Income (£'000s)
South West	Continued Decline to zero	1640	£29,668	1366	£24,724	1202	£21,756
	Stability	547	£9,889	273.3	£4,945	109	£1,978
North West	Continued Decline to zero	122	£2,179	101	£1,815	89	£1,597
	Stability	41	£727	20.3	£363	8	£145
Outer Hebrides	Continued Decline to zero	176	£3,250	146	£2,709	129	£2,384
	Stability	59	£1,083	29.3	£542	12	£217
MF&NC	Continued Decline to zero	257	£5,139	214	£4,283	188	£3,769
	Stability	86	£1,713	42.8	£857	17	£343
Orkney	Continued Decline to zero	69	£1,263	58	£1,053	51	£926
	Stability	23	£421	11.5	£211	5	£84
East Coast	Continued Decline to zero	822	£20,173	685	£16,811	603	£14,794
	Stability	274	£6,724	137.0	£3,363	55	£1,345
Shetland	Continued Decline to zero	75	£1,393	63	£1,160	55	£1,022
	Stability	25	£465	12.5	£232	5	£93

18.4 Estimating RSA's NEV/CBA Contribution: User Value

Section 17 above explained that **Anglers' Consumers' Surplus** was relevant and could be substantial and **Sea Anglers' Option Value** was relevant and could be significant. This section considers how these two can be estimated for Scotland and each IFG.

It is beyond the resources of this study to undertake primary research on these user values. The options are; either to simply acknowledge their relevance for decision making, or to explore using benefit transfer where estimates from other studies are imported. The problem is that there have been very few studies in Scotland of the current user values for sea angling in Scotland, or indeed the UK.

The next section briefly reviews current knowledge and considers the options for benefit transfer.

18.4.1 Review of Existing Knowledge: NEV of RSA.

A major study for the Scottish Environmental Link by **Indurot (2012)** estimated the benefits of a network of Scottish MPA's, including leisure and recreation. They first calculated the value to the UK of a range of environmental goods and services flows provided by the entire UK marine ecosystem. There were 13 specific flows identified (E1-E13). The valuation of each was based on benefit transfer. The table below provides the UK totals for two of these services (E9 and E11) which are relevant to this study

Environmental Service	Annual UK value
Leisure and recreation (E9)	**£4,372,400,000**
Non-user/Bequest Values (E11)	**£1,363,276,766**

Once the aggregate UK value for each environmental service was established, the proportional contribution of each 35 different types of marine landscapes was estimated. For example, the contribution of aphotic reef landscapes to the UK's benefits from nutrient recycling is estimated to be 0.72%. For some services, such as leisure and recreation and non-user/bequest values there was no scientific basis for allocating the service flow across marine landscapes and each landscape was (arbitrarily) apportioned the same share of the total service flow value, i.e. 1/35th.

The proportion of each of the 35 landscapes protected by a Scottish MPA network was then estimated (eg 15.2% for aphotic reefs). Combing these proportions provides an estimate of the percentage of the benefits from each service flow (eg nutrient re-cycling) protected by Scottish MPA network (0.11% for aphotic reefs).

The next step was to estimate the marginal contribution of MPA network (s). Expert knowledge and existing literature was used to make a judgment about the effect of the MPA's network on the each landscape/habitats (eg aphotic reefs) capacity to deliver specific environmental goods and services (eg nutrient re-cycling). The judgment was based on a comparison between the protection scenario and a no-designation scenario. This was then converted into a percentage improvement compared with the current provision of that service (eg 90% improvement on current service flow)

The study considered three possible networks (A, G and I) and two management regime (Maintenance of Conservation Status (MCS) and Highly Restrictive HR)). The benefits were considered over a 20 year period and their value was expressed both in a capitalized value (using a discount rate of 3.5%) and in terms of undiscounted mean annual benefits.

The overall capitalized benefits of designating a *Scottish* network of MPAs ranged between £6.3 billion and £10 billion, depending on the assessed network scenario and management regime combination. The undiscounted mean annual benefits range from £566 million to £758 million. Interestingly, the estimated benefits hardly increased when the more restricted management regime (HR) was modeled. Indurot et al state that this is probably because both management regimes restrict the more damaging fishing gears such as bottom towed trawls and dredges.

The estimated benefits include both use and non-use values. The non-use values accounts for around 12%-14% of the overall on-site benefits, depending on the network scenario and the applied management regime; while use values (direct and indirect) sum up the remaining 86%-88%. These use values range between £5.5 billion and £8.9 billion, assuming a 3.5% discount rate over a 20 years period. These magnitudes completely dwarf the current NEV of use values generated by catching shellfish by whetever means.

Unfortunately, the leisure and recreational values seem to be based on angler expenditure rather than their consumers' surplus and therefore cannot be used in the context of this study. The Non-User/Bequest Values used by Indurot et al (2012) come from McVittie and Moran (2010) and are useful when we address the general public values in a later section.

More promisingly, **Kenter et al** (2012), investigated the recreational use and non-use values of UK divers and sea anglers for 25 Scottish potential Marine Protected Areas (pMPAs), 119 English recommended Marine Conservation Zones (rMCZs) and 7 existing Welsh marine Special Areas of Conservation (SACs). They used a travel cost choice experiment to estimate the total annual recreational use values of anglers and divers. It assessed how marginal use values would increase through ecological improvement improving the quality of the existing angling and diving experience.

Respondent were asked to consider ***hypothetica***l diving or angling sites with a range of environmental and recreational attributes including travel distance, which was used as a cost proxy. Since each hypothetical marine site was described in terms of its characteristics, this enabled an assessment of the components of the economic value of hypothetical sites. The choice experiment and modelling exercise therefore enables lower bound estimate of current recreational use value and marginal changes to this value under differing sets of management restrictions.

Benefit transfer was used to estimate the value of actual sites. Specifically the transfer of benefits from hypothetical sites to actual site was enabled by a matrix that matched habitats, species and other features of actual sites against the attributes of the hypothetical sites from the choice experiment and the values from contingent valuation (see below). Recreational use values for sites were calculated by multiplying individual WTP by visit numbers

For Scotland, the areas assessed currently provide an estimated £67 – £117 million in annual recreational user benefits (i.e. NEV) to **divers and anglers**.

Table 18.4.1 Annual Angler User Values (Kenter et al, 2012)

	Visits (000s)		Mean WTP per visit	No Restriction		No Dredge or Trawls		No fishing at all		No Dr/Tr/Anch/Moor	
	Low	Upp		Low	Upp	Low	Upp	Low	Upp	Low	Upp
South Arran	-	-	43	-	-	-	-	-	-	-	-
Clyde Sea sill	191	348	11	2,122	3,859	2,122	3,859	3,032	5,512	2,122	3,859
Lochs Duich, Long and Alsh	155	282	30	4,730	8,599	4,730	8,599	5,468	9,942	4,730	8,599
East Caithness Cliffs SPA	-	-	40	-	-	-	-	-	-	-	-
Firth of Forth Banks Complex	104	188	18	1,908	3,469	1,908	3,469	2,401	4,365	1,908	3,469
Fetlar to Haroldswick	-	-	43	-	-	-	-	-	-	-	-
Loch Creran	104	188	17	1,713	3,115	1,713	3,115	2,206	4,010	1,713	3,115
Upper Loch Fyne and Loch Goil	37	66	40	1,466	2,666	1,466	2,666	1,640	2,982	1,466	2,666
Loch Sunart	133	242	40	5,330	9,691	5,330	9,691	5,963	10,843	5,330	9,691
Loch Sween	39	71	31	1,203	2,188	1,203	2,188	1,388	2,524	1,203	2,188
Monach Islands	-	-	15	-	-	-	-	-	-	-	-
Mousa to Boddam	41	75	40	1,669	3,034	1,669	3,034	1,866	3,392	1,669	3,034
Noss Head	-	-	21	-	-	-	-	-	-	-	-
North-west Orkney	-	-	19	-	-	-	-	-	-	-	-
North-west sea lochs and Summer Isles	96	174	31	2,917	5,305	2,917	5,305	3,372	6,131	2,917	5,305
Papa Westray	-	-	16	-	-	-	-	-	-	-	-
Loch Sunart to the Sound of Jura	194	353	37	7,124	12,953	7,124	12,953	8,048	14,632	7,124	12,953
Small Isles	83	151	41	3,433	6,242	3,433	6,242	3,827	6,959	3,433	6,242
Turbot Bank	-	-	20	-	-	-	-	-	-	-	-
Wyre and Rousay Sounds	-	-	16	-	-	-	-	-	-	-	-
TOTAL	**1,177**	**2,138**		**33.6m**	**61.1m**	**33.6m**	**61.1m**	**39.2m**	**71.3m**	**33.6m**	**61.1m**
MEAN per site (20)	**107**	**194**	28.45	**3,056**	**5,556**	**3,056**	**5,556**	**3,565**	**6,481**	**3,056**	**5,556**

From the table below it can be seen that for Scotland the estimated annual angler user value (upper boundary) varies from £12.9 m for Loch Sunart to the Sound of Jura to £2.2 m for Loch Sween. These are very high annual values. The mean per trip WTP values seem reasonable, and based on sound research design and procedures. However, the estimated number of visitors is high. For example they estimate that, on average, 39 visits per individual UK sea angler just to the pool of the sites considered in their study. For Loch Sunart to the Sound of Jura it is estimated there would be between 194,000 and 353,000 sea angler visits per annum. This is between 13% and 23% of the total 1.54m of all Scottish RSA days estimated by Radford et al. Equivalent figures for Loch Sween were 39,000 to 71,000. The total number of angler visits to the 20 sites was between 1,177,000 and 2,138,000.

Even allowing for visits to multiple sites on a single angler day, these figures are not consistent with the total of 1.54m angler days across the whole of Scotland estimated by Radford et al. The estimates of Kenter et al were based on 422 sea anglers across the whole of the UK and they warn that the Scottish sample of anglers was too small. The Radford at al estimates were based on a sample of over 15,000 households, and over 700 sea anglers.

There might also be an issue over scaling. Kenter et al used the same procedure for angling and diving. The number of site visits was based on

> *"how often our participants stated they visited a random selection of 15 sites in their region in an interactive mapping application within the survey. To estimate visitor numbers to a site, the ratio of the total number of diver respondents in the relevant region who had been presented with the site over the number of divers who indicated they had actually visited the site in the past 12 months. We multiplied this with the ratio of the estimated total population of UK divers over the total number of diver respondents. This was then multiplied this by the total frequency of visits that respondents who were presented with the site had made to the site".*

Because they used a lower and upper bound for the UK sea angler population (1.1m to 2m) they produced lower and upper bound of visits and visitors per annum. It thus appears they obtained a visit rate based on Scottish respondents but might have scaled visits using the UK population.

A further issue is that Kenter et al have estimated sea anglers' total willingness to pay, or Gross Economic Value (i.e. GEV). Above, we have argued that for decision making purposes NEV or more specifically Consumers' Surplus should be the relevant value. Because GEV ignores opportunity costs it does not reflect sea anglers' or society's welfare. For example it is perfectly possible to have a very high total WTP (GEV) for an angling site which is very expensive to access because of its remoteness. The high cost (i.e. opportunity costs) mean few if any anglers visit, despite the attractive fishing on offer.

It would be theoretically possible to estimate sea anglers total Consumers' Surplus by subtracting the actual expenditure (£140.9m at 2009 prices, as estimated by Radford et al) from anglers' total WTP. Whilst, the estimates of Kenter et al relate to 20 sites, they have produced a mean WTP per sea angler visit of £28.45. Using the 1.540m visits estimated by Radford et al would suggest a total sea angler WTP of £42.813m, which is much less than the actual expenditure of £140.9m. Logically, the amount that anglers are willing to pay cannot be less than what they actually do pay. A further issue highlighted by Kenter et al is that they do not address the value of additional angler days that would be made as a result of these improvements.

We conclude that with respect to sea angler user values, this study cannot make use of the study by Kenter et al, despite its impressive scope and technical quality. As discussed later, there are other aspects of this study which provide some valuable insight.

There have been a number of studies carried out for fresh water but the only equivalent sea angling study was by Drew et al (2004). They used three methods to directly estimate anglers' consumers' surplus; Contingent Valuation (CVM), The Travel Cost Method (TCM) and a Choice Experiment (CE). The Table below gives the results for the CVM. (2013 Prices)

Table 18.4.2 Estimates of Consumers Surplus (net WTP) from Contingent Valuation

	Payment P.A.	Days	2003	2013[51]
	Mean	Per annum	WTP/DAY	WTP/DAY
Shore	£380	67	£5.67	£7.06
Charter Boat	£552	30	£18.40	£22.92
Own/Friends Boat	£885	62	£14.27	£17.78

The alternative, and less reliable, TCM examines the demand function derived from the revealed relationship between travel costs and percentage of a zone participating. The net WTP is obtained from the estimated linear demand function. The reported WTP/trip figures are shown in the Table below.

Table 18.4 3 Estimates from TCM Analysis

Net WTP		
	2003	**2013**
Shore	£26.45	£32.95
Charter Boat	£42.01	£53.06
Own/Friends Boat	£104.16	£131.56

Finally it is worth noting the results of the Choice Experiment. The key factors were species variety, quantity and quality. Unfamiliar species carried a substantial premium of between £10.40 and £14.70 (2013 prices). Size was important, with 27p extra WTP for every 1% increase in size. Surprisingly the number of fish was not significant. This probably reflects the survey locations where there were still numbers of fish to be caught. Drew et al suggest that CVM estimates are conservative. We therefore adopt the CV estimates for this study, whilst recognizing that they may understate angler benefits.

The Table below combines the boat/shore mix found for the Scotland and its regions by Radford et al with the WTP estimate from the CVM published by Drew et al.

Table 18.4.4 Current Consumer Surplus for RSA

	Angler Days	**Consumer Surplus Day**	**Total Consumer Surplus**
Shore	721,611	£7.06	£5,094,574
Charter Boat	229,443	£22.92	£5,258,834
Own/Friends Boat	589,152	£17.78	£10,475,123
Total	1,540,206	£13.52	£20,828,530

This suggests the current NEV of Scotland's RSA to anglers is around **£21 m** per annum. This is low relative to spending on sea angling in Scotland of around £140 m. This estimate is informing us that if the cost of sea angling (tackle, fuel, etc) increased by £21 m there would probably be very little RSA in Scotland. A similar outcome might be possible if the quality of the sea angling experience were to decline further and drag down anglers' willingness to cover the costs of their angling.

[51] Using the GDP Deflator series

Normally we would expect to find relatively high levels of consumers' surplus in sea angling, simply because access is free. In contrast most freshwater anglers have to pay an owner for the right to fish. Other things being equal, the access payments that freshwater anglers have to pay simply reduces the anglers' consumers' surplus. A profit maximising freshwater fishery owner might endeavor to levy prices to capture as much of the freshwater angler's consumer surplus as possible, whilst of course leaving sufficient surplus that angler participation would continue. There is no owner capturing sea anglers' consumers' surplus and this should translate into high values for their consumers' surplus. Perhaps these low consumers' surplus estimates for a non-priced activity is simply a reflection of the relatively poor *average* quality of RSA in Scotland.

We know that all sea anglers will have a surplus (otherwise they would not participate), and we expected it to be high relative to angler expenditure. The results do not conform to our expectations. In any event, the current level of consumer surplus only matters for the baseline scenario predicting a continued decline. We also need to include the change in consumers' surplus which matters. This is discussed below.

18.4.2 The Potential Change to Anglers' Consumer Surplus in Scotland

Any increase in consumers' surplus could come from two sources. Firstly there maybe an increase in the number of sea angler days induced by better quality angling. As a result of any improvements to the inshore environment the value of the pleasure anglers would now obtain, (measured by the maximum amount they are willing to pay) is sufficient to warrant them committing more time and money to sea angling. We would have more angler days because existing anglers participate more or delay their exit from the activity and new sea anglers are recruited.

We can be certain that the amount they are willing to pay will be greater than the amount they are required to sacrifice (expenditure on travel, bait etc), otherwise they would not participate. In other words, the additional angler days will generate a consumer's surplus.

The relevant question is, what will be the consumer surplus associated with these new angler days. We know that it will not be zero. One possibility is to assume that it might be similar to the consumers' surplus that current angler days generate.

The second effect is that the quality of the existing angler days would be enhanced and this would also increase aggregate consumer surplus. We could explore these two effects separately and then combine them. Given the absence of suitable secondary data, we follow the procedure used to assess the possible consequences for income and employment[52]. Quite simply, we will explore the magnitude that might emerge with the illustrative 50%, 25% and 10% improvement in the flow of sea anglers' consumers' surplus from RSA.

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[52] This assumes that all relationships are linear. In reality very few economic relationships have this property, especially those which arise from human behaviour. More commonly we would expect consumer surplus, spending and employment to increase at a decreasing rate. Consequently, the equivalence between EIA and NEV is a simplifying assumption which is necessary in the absence of other evidence.

Table 18.4.5 Estimated Changes in Anglers' Consumer Surplus: Scotland

	Existing CS	50% Increase	25% Increase	10%Increase
Shore	£5,094,574	£2,547,287	£1,273,644	£509,457
Charter Boat	£5,258,834	£2,629,417	£1,314,709	£525,883
Own/Friends Boat	£10,475,123	£5,237,562	£2,618,781	£1,047,512
Total	£20,828,530	£10,414,266	£5,207,133	£2,082,853

The information in the above table is sufficient to complete the scenario table for Scotland

Table 18.4.6 RSA's Potential Impact Consumers' Surplus (Scotland Scenarios)

Impact Scenarios: / **Status quo scenarios:**	**Major Transformative Effect (50%)**	**Some Enhanced Flow (25%)**	**Minimal Enhanced Flow (10%)**
Continued Decline to zero	£31,242,796	£26,035,663	£22,911,383
Stability	£10,414,266	£5,207,133	£2,082,853

18.4.3 Current Magnitude of Anglers' Consumers Surplus in IFGs Areas

The same procedure is used to estimate the anglers' consumers' surplus for the IFG areas. The Table below is constructed from data in the RSA study by Radford et al.

Table 18.4.7 Regional Sea Angling Activity by Type of Angling

Region	Angler Days in Region	Shore	Own/Friends	Charter
Argyll & Lochaber	252,615	118,729	103,572	30,314
Dumfries & Galloway	233,080	114,209	74,586	44,285
Glasgow and West	269,783	102,518	113,309	53,957
North East Scotland	234,307	128,869	67,949	37,489
Northern Scotland	144,346	62,069	63,512	18,765
Edinburgh, Fife and S.E.	250,868	125,434	107,873	17,561
Western Isles	80,567	35,449	32,227	12,891
Orkney & Shetland	74,640	34,334	26,124	14,182
Total	1,540,206	721,611	589,152	229,443

As before, it is necessary to reconfigure the above data to reflect the geographical areas covered by individual IFG's. This was explained in Section 18.2 above. The Table below presents the results.

Table 18.4.8 Consumers Surplus for Each IFG

IFG	Angler Type	Angler Days	Consumer Surplus per Day	Total Consumer Surplus
South West	Shore	332,488	£7.06	£2,347,365
	Charter Boat	127,798	£22.92	£2,929,130
	Own/Friends Boat	288,877	£17.78	£5,136,233
	Total	**749,163**		**£10,412,729**
North West	Shore	29,571	£7.06	£208,771
	Charter Boat	8,801	£22.92	£201,719
	Own/Friends Boat	29,811	£17.78	£530,040
	Total	**68,182**		**£940,530**
Outer Hebrides	Shore	35,449	£7.06	£250,270
	Charter Boat	12,891	£22.92	£295,462
	Own/Friends Boat	32,227	£17.78	£572,996
	Total	**80,567**		**£1,118,728**
MFNC	Shore	78,379	£7.06	£553,356
	Charter Boat	23,206	£22.92	£531,882
	Own/Friends Boat	58,918	£17.78	£1,047,562
	Total	**160,504**		**£2,132,799**
Orkney	Shore	16,481	£7.06	£116,356
	Charter Boat	6,807	£22.92	£156,016
	Own/Friends Boat	12,540	£17.78	£222,961
	Total	**35,827**		**£495,334**
East Coast	Shore	211,390	£7.06	£1,492,413
	Charter Boat	42,566	£22.92	£975,613
	Own/Friends Boat	153,195	£17.78	£2,723,807
	Total	**407,151**		**£5,191,833**
Shetland	Shore	17,854	£7.06	£126,049
	Charter Boat	7,374	£22.92	£169,012
	Own/Friends Boat	13,584	£17.78	£241,524
	Total	**38,813**		**£536,585**
Overall Total	Shore	721,611	£7.06	£5,094,574
	Charter Boat	229,443	£22.92	£5,258,834
	Own/Friends Boat	589,152	£17.78	£10,475,123
	Total	**1,540,206**		**£20,828,530**

18.4.4 The Potential Change to Anglers' Consumer Surplus in IFG Areas

The table below applies the 50%, 25% and 10% scaling to the estimated consumers' surplus estimates for each of the IFG areas.

Table 18.4.9 RSA's Potential Impact Consumers' Surplus in IFGs Areas

IFG	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (50%)	Some Enhanced Flow (25%)	Minimal Enhanced Flow (10%)
South West	Continued Decline to zero	£15,619,094	£13,015,911	£11,454,002
	Stability	£5,206,365	£2,603,182	£1,041,273
North West	Continued Decline to zero	£1,410,795	£1,175,663	£1,034,583
	Stability	£470,265	£235,133	£94,053
Outer Hebrides	Continued Decline to zero	£1,678,092	£1,398,410	£1,230,601
	Stability	£559,364	£279,682	£111,873
MFNC	Continued Decline to zero	£3,199,199	£2,665,999	£2,346,079
	Stability	£1,066,400	£533,200	£213,280
Orkney	Continued Decline to zero	£743,001	£619,168	£544,867
	Stability	£247,667	£123,834	£49,533
East Coast	Continued Decline to zero	£7,787,750	£6,489,791	£5,711,016
	Stability	£2,595,917	£1,297,958	£519,183
Shetland	Continued Decline to zero	£804,878	£670,731	£590,244
	Stability	£268,293	£134,146	£53,659

18.4.5 Current Anglers' Option (User) Value in Scotland

Kenter et al also used contingent valuation to estimate what they term the non-use values of anglers (and divers). As described above, non-use Values normally arise from the vicarious concerns or sympathy for sentient or non sentient natural assets, independent of their use. This is usually termed Existence Value (or GPNUV in this study). Since Kenter et al addressed their questions to users they are more likely to be capturing user values, in particular Option Value. It is theretically possible that **users** have vicarious concerns for species or habitats and therefore GPNUVs which are unrelated to their or anyone else's current or future use. Very careful survey design would be required to separate users' non-user vicarious concerns for the environment (ie (Existence value / GPNUV) from their self centred concerns about their future use (Users Option Value) or their offspring / future generations use Bequest (use) Value. In this study we will use the term Option (User) Value (OV) to describe the Kenter et al Non User Value.

As part of the choice experiment exercise, two presented sites were selected at random and a contingent valuation question asked respondents' willingness to pay a one-off payment for future protection of the site and its natural features. It is uncertain whether users believed they were paying to eliminate the risk of the total demise of RSA activity at some time in the future, or paying just to preserve the site and its natural features.

The marginal option value of protecting sites was calculated on the basis of the contingent valuation results and was aggregated over UK sea angler and diver populations. GIS was used to account for distance decay, as participants valued nearby sites higher than sites further away.

The CVM results for anglers give an individual mean value per site of £4.77 for Scotland. When scaled, the CVM mean site value was between £5.3 and £9.5 m with the aggregate value across all sites estimated at £105-£191 m. No dredging/trawling added £15-£27 m to the aggregate value, no potting/gillnetting adding £18-£34 m, no anchoring/mooring would increase the base value by

£11- £21 m. These estimates are not annual values but based on a one-off payment by anglers.

Table 18.4.10 Annual Angler Non User Values (Kenter et al, 2012)

	Mean Ind WTP	No Restriction (£000)		No Dredging or Trawling (£000)		No fishing at all (£000)		No Dr/Tr/Anch/ Mooring (£000)	
		Low	Upp	Low	Upp	Low	Upp	Low	Upp
South Arran	6.39	7,032	12,786	7,987	14,522	8,213	14,933	7,757	14,104
Clyde Sea sill	5.29	5,819	10,580	6,632	12,058	6,824	12,407	6,436	11,702
Lochs Duich, Long and Alsh	5.23	5,752	10,458	6,557	11,921	6,747	12,268	6,363	11,569
East Caithness Cliffs SPA	5.18	5,702	10,368	6,501	11,821	6,690	12,164	6,309	11,471
Firth of Forth Banks Complex	4.04	4,441	8,074	5,092	9,257	5,246	9,537	4,935	8,972
Fetlar to Haroldswick	4.33	4,763	8,660	5,452	9,912	5,615	10,209	5,286	9,611
Loch Creran	4.67	5,136	9,339	5,869	10,670	6,042	10,985	5,692	10,349
Upper Loch Fyne and Loch Goil	5.97	6,565	11,936	7,465	13,573	7,678	13,961	7,248	13,179
Loch Sunart	5.61	6,170	11,218	7,023	12,770	7,225	13,137	6,818	12,396
Loch Sween	5.9	6,489	11,799	7,381	13,419	7,592	13,803	7,166	13,029
Monach Islands	4.12	4,528	8,232	5,189	9,434	5,345	9,719	5,030	9,145
Mousa to Boddam	4.03	4,432	8,058	5,082	9,240	5,236	9,519	4,925	8,955
Noss Head	3.62	3,984	7,244	4,581	8,330	4,723	8,587	4,438	8,068
North-west Orkney	3.09	3,400	6,181	3,928	7,142	4,053	7,369	3,801	6,910
North-west sea lochs and Summer Isles	5.08	5,583	10,152	6,368	11,579	6,554	11,916	6,179	11,235
Papa Westray	3.82	4,203	7,643	4,826	8,775	4,974	9,043	4,676	8,502
Loch Sunart to the Sound of Jura	6.11	6,723	12,224	7,642	13,894	7,859	14,290	7,420	13,492
Small Isles	5.53	6,082	11,059	6,926	12,592	7,125	12,955	6,723	12,223
Turbot Bank	3.6	3,957	7,194	4,550	8,274	4,691	8,529	4,407	8,013
Wyre and Rousay Sounds	3.87	4,256	7,738	4,885	8,882	5,034	9,153	4,733	8,606
TOTAL		**105.0m**	**190.9m**	**119.9m**	**218.1m**	**123.5m**	**224.5m**	**116.3m**	**211.5m**
MEAN per site (20)	**4.77**	**5,251**	**9,547**	**5,997**	**10,903**	**6,173**	**11,224**	**5,817**	**10,577**

The mean values for each site was scaled using the UK population of sea anglers. The lower population estimate was 1.1 m, the upper £2 m anglers. The (implied) average per angler for the one off payment to protect all 20 sites is £95.38 (ie option value). Even allowing for the distance decay function, the population of Scottish sea anglers probably should have been used to scale mean values. The Table below re-scales the totals for all 20 sites using the population of 125,200 Scottish sea anglers and visiting anglers as estimated by Radford et al[53]. This re-scaling obviates the need for lower and upper estimates.

[53] The resident Scottish sea angler population was estimated from an omnibus survey of over 15,000 Scottish households.

Table 18.4.11 Mean WTP and Re-Scaled Totals for Scotland 20 Sites

Mean Ind WTP per site	Mean WTP all 20 sites	No Restriction (£000)	No Dredging or Trawling (£000	No fishing at all (£000	No Dr/Tr/Anch/ Mooring (£000
£4.77	£95.38	£11,950,909	£13,646,800	£14,056,545	£13,237,055

The above values are one-off payments (ie capital values) and this study is initially denominated in annual flows. The UK Treasury guidance for appraising environmental evaluations suggests a discount rate of 3.5% and a 20 year time horizon. On this basis, £0.070175 (or £70.18) would be the annual sum receivable every year for 20 years which would be equivalent to a lump sum of £1.00 (or £1,000 today) receivable today.[54] The table below converts these one-off payments to annual values.

Table 18.4.12 Annual Mean WTP Values

Mean Ind WTP per site	Mean WTP all 20 sites	No Restriction (£000)	No Dredging or Trawling (£000	No Commercial Fishing at all.	No Dr/Tr/Anch/ Mooring (£000
£0.33	£6.70	£838,655	£957,664	£986,418	£928,910

This aggregate value does not seem to be very sensitive to changes in the restrictions and by implication chages in the quality of sea angling. The estimate which has most relevance for the 1NM and 3NM restrictions is £957,664. The 1NM and 3NM restrictions around the entire Scottish coast would have a greater impact on RSA than the MPA network because of the relative size of the areas involved and the restrictions imposed. The minimum current option user value for RSA in Scotland would therefore be £957,664.

18.4.6 The Potential Change to Anglers' Option (User) Value in Scotland.

Previously in assessing the possible consequences for income and employment and consumers' surplus, we estimated the impact of 50%, 25% and 10% improvements in the flow of user values. There is less justification for scaling option values in this way. Indeed, the estimates from Kenter et al did not change significantly. Kenter et al[55] stated

> *"our approach is designed in a way that is very similar to any insurance; first participants are asked to estimate the current worth of the goods in question (by implicitly asking them how far they would be willing to travel to them in a CE), and then they are asked how much they would be willing to contribute towards insuring these goods (in the CVM)".*

On this basis it might be argued that as the quality and value of the angling experience increases, the insurance premium that users would be willing to pay would also increase. This is reasonable provided that the increased value is subject to the same risk. However, the purpose of the MPA network (and the 0-1 NM and 0-3NM policy options) is to offer ecosystem protection and reduce environmental risk. In this instance, if they are successful the policy options both increase value and

[54] In other words £70.18 receivable every year for 20 years compounded at 3.5% would realise a sum of money which discounted to the present value would be worth £1000.00. If there was no risk then we should be indifferent between £1000.00 now and £70.18 receivable every year for 20 years

[55] Page 40

reduced risk. Thus the increased value should increase option value (in the same way that consumers' surplus increases), whilst the reduced risk should decrease option value. On balance, it is more sensible to regard option value as an element of user value, but an element which does not increase along with consumers' surplus. This produces the following Table.

Table 18.4.13 Estimated Anglers Option Value: Scotland

Major Transformative Effect	Some Enhanced Flow	Minimal Enhanced Flow
£957,664	£957,664	£957,664

The information in the above table is sufficient to complete the option value scenario table for Scotland.

Table 18.4.14 RSA's Potential Impact Option Value (Scotland Scenarios).

Impact Scenarios: / Status quo scenarios	Major Transformative Effect	Some Enhanced Flow	Minimal Enhanced Flow
Continued Decline to zero	£957,664	£957,664	£957,664
Stability	Not Relevant	Not Relevant	Not Relevant

18.4.7 Current Anglers Option Value in IFG areas

As argued above, the minimum current option user value for RSA in Scotland would therefore be £957,664. In the absence of other information this would be distributed across IFG areas according to relative RSA activity levels. The current distribution is given below

Table 18.4.15 Distribution of Option Value Across IFG Areas

IFG	Angler Days	% of Total	Option Value
South West	749,163	48.6%	£465,812
North West	68,182	4.4%	£42,394
Outer Hebrides	80,567	5.2%	£50,095
MFNC	160,504	10.4%	£99,798
Orkney	35,827	2.3%	£22,276
East Coast	407,151	26.4%	£253,157
Shetland	38,813	2.5%	£24,133
Overall Total	1,540,206	100.0%	£957,664

18.4.8 The Potential Change in Anglers' Option (User) Value in IFG areas.

As with the estimates for Scotland it is more sensible to regard option value as an element of user value which does not increase along with consumers' surplus. This produces the following Table.

Table 18.4.16 RSA's Potential Impact Option User Value in IFGs Areas

IFG	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (50%)	Some Enhanced Flow (25%)	Minimal Enhanced Flow (10%)
South West	Continued Decline to zero	£465,812	£465,812	£465,812
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
North West	Continued Decline to zero	£42,394	£42,394	£42,394
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
Outer Hebrides	Continued Decline to zero	£50,095	£50,095	£50,095
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
MFNC	Continued Decline to zero	£99,798	£99,798	£99,798
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
Orkney	Continued Decline to zero	£22,276	£22,276	£22,276
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
East Coast	Continued Decline to zero	£253,157	£253,157	£253,157
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0
Shetland	Continued Decline to zero	£24,133	£24,133	£24,133
	Stability	Not Relevant	Not Relevant 0	Not Relevant 0

18.4.9 Total User Value for Scotland and IFG Areas

Total Net Economic Value for sea anglers is the sum of their consumers' surplus and their option values as estimated above. These two elements are combined in the tables below in the NEV/CBA summary results

18.5 RSA Summary Results

This Section presents the economic impact and NEV/CBA results for RSA for Scotland and each of the IFG areas

18.5.1 RSA Summary Results Economic Impact

Table 18.5.1 RSA's Potential Economic Impact on Scotland (2013 prices)

Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (50%)		Some Enhanced flow (25%)		Minimal Enhanced Flow (10%)	
	Jobs	Income (£'000s)	Jobs	Income (£'000s)	Jobs	Income (£'000s)
Continued Decline to zero	2,513	£59,371	2,094	£49,476	1,843	£43,539
Stability	837.5	£19,790	419	£9,896	168	£3,958

Table 18.5.2 RSA's Potential Economic Impact on IFGs (2013 Prices)

IFG AREA	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (50%)		Some Enhanced flow (25%)		Minimal Enhanced Flow (10%)	
		Jobs	Income (£'000s)	Jobs	Income (£'000s)	Jobs	Income (£'000s)
South West	Continued Decline to zero	1640	£29,668	1366	£24,724	1202	£21,756
	Stability	547	£9,889	273.3	£4,945	109	£1,978
North West	Continued Decline to zero	122	£2,179	101	£1,815	89	£1,597
	Stability	41	£727	20.3	£363	8	£145
Outer Hebrides	Continued Decline to zero	176	£3,250	146	£2,709	129	£2,384
	Stability	59	£1,083	29.3	£542	12	£217
MF&NC	Continued Decline to zero	257	£5,139	214	£4,283	188	£3,769
	Stability	86	£1,713	42.8	£857	17	£343
Orkney	Continued Decline to zero	69	£1,263	58	£1,053	51	£926
	Stability	23	£421	11.5	£211	5	£84
East Coast	Continued Decline to zero	822	£20,173	685	£16,811	603	£14,794
	Stability	274	£6,724	137.0	£3,363	55	£1,345
Shetland	Continued Decline to zero	75	£1,393	63	£1,160	55	£1,022
	Stability	25	£465	12.5	£232	5	£93

18.5.2 Summary Results RSA: NEV/CBA

Table 18.5.3 RSA's Potential Impact Net Economic Values (Scotland Scenarios)

Impact Scenarios: / Status quo scenarios	Major Transformative Effect	Some Enhanced Flow	Minimal Enhanced Flow
Continued Decline to zero	£32,200,460	£26,993,327	£23,869,047
Stability	£10,414,266	£5,207,133	£2,082,853

Table 18.5.4 RSA's Potential Impact Net Economic Values (IFG Areas)

	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (50%)	Some Enhanced Flow (25%)	Minimal Enhanced Flow (10%)
South West	**Continued Decline to zero**	£16,084,906	£13,481,723	£11,919,814
	Stability	£5,206,365	£2,603,182	£1,041,273
North West	**Continued Decline to zero**	£1,453,189	£1,218,057	£1,076,977
	Stability	£470,265	£235,133	£94,053
Outer Hebrides	**Continued Decline to zero**	£1,728,187	£1,448,505	£1,280,696
	Stability	£559,364	£279,682	£111,873
MFNC	**Continued Decline to zero**	£3,298,997	£2,765,797	£2,445,877
	Stability	£1,066,400	£533,200	£213,280
Orkney	**Continued Decline to zero**	£765,277	£641,444	£567,143
	Stability	£247,667	£123,834	£49,533
East Coast	**Continued Decline to zero**	£8,040,907	£6,742,948	£5,964,173
	Stability	£2,595,917	£1,297,958	£519,183
Shetland	**Continued Decline to zero**	£829,011	£694,864	£614,377
	Stability	£268,293	£134,146	£53,659

19 RECREATIONAL DIVING (RD)

19.1 Background

Ever since recreational diving began in the 1950's Scotland has been one of the most accessible and popular areas for UK divers and is recognised across Europe and beyond as a premier cold water dive venue. The variety of diving experiences across Scotland is a big attraction with a plethora of historic and more recent wrecks, sea cliffs, gullies teeming with colour, offshore pinnacles and reefs. The waters are clear and the coastal topography of the islands and the west coast means there is always shelter available with deep water close inshore. Added attractions are the long hours of summer particularly in the more northern islands. The water is cold in mid winter but much warmer than other sites on the same latitude.

One of the most notable locations is Scapa Flow, Orkney, which is considered to be one of the top three diving sites in the world[56]. Charter boat operators in Scotland, particularly in Orkney, have regular charters from clubs and groups in Canada, America, France, Germany and Holland. Other sites attracting divers from all over the UK are St Abbs and Eyemouth off the Berwickshire coastline, the island of the Inner Hebrides and sites on the East coast from North of Dundee. Most dive in the shallow coastal zone up to 50metres deep, though some dive deeper in water to around 130 metres to observe wrecks and cultural heritage artefacts. On balance more activity takes place on the west coast with the varied experience and shelter offered by the island and sea lochs.

Scuba diving in Scotland is supported by a fleet of charter vessels ranging from day boats and larger vessels that offer cabin accommodation for longer dive excursions, such as to St Kilda. In addition, at the key venues there are dive schools, dive centres and shops whilst most centres of population have local dive clubs.

In their contributions to the consultation on the National Marine Plan the British Sub Aqua Club (BSAC) wrote:

> *"We are pleased to see recognition of Scotland as a world class diving location and to find mention of some of many sites enjoyed by scuba divers and snorkelers. We would support further work to establish the extent and economic impact of diving in Scotland to ensure that it is fully considered in marine planning and development".*

With respect to the quality of Scottish diving BSAC stated:

> *"It is apparent to us in reviewing the cases presented for potential locations for the foundation of Scotland's First Coastal and Marine National Park that virtually the entire coastal area of Scotland is worthy of such recognition. Even the East Coast area south of the Moray Firth only warrants the dismissal it receives because of the overwhelming excellence of some of the other areas*

[56] Interview with Safety and Development Officer, British Sub Aqua Club HQ, Jan 2014

(e.g. it has the benefit of the cultural heritage of the herring fisheries, Stevenson's first lighthouse on the Bell rock, internationally important sand eel grounds in the Forth and Tay estuaries, etc.).

We believe a remarkably bold step would be to declare the entire coast, islands and territorial waters of Scotland the first (and only) Coastal and Marine National Park. However, as expressed above we are concerned at overstretching resources may impact on the success of such a wide ranging approach and that such costs and logistics may make this difficult to achieve".

Within the diving community there is a belief that the increase of bottom trawling and dredging has led to deterioration in the quality of diving. Visibility is one of the most important factors for diver's enjoyment of dive sites. In the short term diving activity often ceases in the vicinity of scallop dredging and to a lesser extent nephrop trawling. There can be a long wait for water to clear, particularly if there is a low tidal flow. Even after the water has cleared the quality of the diving experience has been compromised through the sea bed damage. In the longer term divers have been reporting deterioration in visibility over the last few years. In particular they report an increase of suspended particles in the water column and less rewarding marine observation through the sea bed impact of demersal trawling and dredging[57].

In Orkney last year there were 10 dive charter boats operating around Scapa Flow where mobile demersal gear cannot cope with the underwater obstructions. The charter operators are however limited in their scope to offer sea search diving and flora and fauna observation outside the refuge of Scapa Flow. The diving community takes the view that restoration of the Scottish inshore ecosystem should substantially improve the quality of Scottish diving. In this context BSAC noted in its consultation:

"we consider that certain types of fishing are inconsistent with both the objectives of the Strategic Framework for Inshore Fisheries in Scotland and with any proposed Marine Park and the future of marine biodiversity in Scotland. Divers are in a unique position to bear witness to the damaging effects of scallop dredging on the marine environment that is out of all proportion to its economic and even short term benefits".

Analytically, our approach to RD mirrors that used to evaluate RSA. The first task, therefore, is to identify numbers and activity levels. In common with most such studies the chosen unit is the "activity day" i.e. diving days. For the purposes of this study we assume that when a day or part of a day involves sub-aqua the total expenditure in that day is associated with sub aqua.

19.1.1 Numbers and Activity Levels.

There has been no study which has specifically addressed UK diving in an effort to establish where the activity takes place, how much they spend or the economic value of the activity. It is therefore necessary to piece together various pieces of evidence to derive the variables necessary to undertake an economic impact analysis or a NEV/CBA evaluation.

This is a difficult task for Scotland as a whole. Disaggregating to the level of individual IFG areas is highly problematic. Indeed, the view might be taken that the

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[57] Interview with Safety and Development Officer, British Sub Aqua Club HQ, Jan 2014.

end product is too contrived for decision making purposes. In which case the exercise should at least highlight the evidence currently available, enlighten the current debate and facilitate a broader stakeholder engagement with the issues. More importantly, the exercise will identify the evidence that is needed and how that evidence should be assembled to deliver a logically coherent evaluation.

It should also be recognised that whilst the estimates are contrived, it might not be sensible to seek to refine them further. This would be the case if the difference between costs and benefits were so large that no amount of refining could change the policy implications. Precision is desirable but only necessary when costs and benefits are finely balanced.

There are number relevant studies and sources on diving. The extensive and detailed work of Kenter et al is important and their sample of 1261 UK divers is much larger than their sample of UK sea anglers (see above). On page 52, they provide the following information on the frequency of participation measure in days out

Table 19.1.1 Frequency of Annual Participation (Diver Days)

	1 or 2	3 to 7	8 to 14	15 to 21	More than 21
% of Divers	4.00%	14.00%	23.00%	31.00%	28.00%

It is also stated that the mean number of days out was 47 days for the 28% of divers who participated more than 21 days. The table below estimates the total number of days using mid-points of the above ranges and UK diving populations of 150,000, 200,000 and 250,000.

The figure of 200,000 UK divers was based on their personal correspondence with the British Sub Aqua Club. In their analysis Kenter et al used 150,000 thousand as the lower and 250,000 as the upper end of the range.

Table 19.1.2 Total UK Diver Days

Frequency	1 or 2	3 to 7	8 to 14	15 to 21	More than 21	Total
% of Divers	4%	14%	23%	31%	28%	100%
150,000 divers	9000	105000	362250	837000	1974000	3,287,250
200,000 divers	12,000	140,000	483,000	1,116,000	2,632,000	***4,383,000***
250,000 divers	15,000	175,000	603,750	1,395,000	3,290,000	5,478,750

From the above table the mean number of diving days *in the UK* is **22** for the UK population of divers and they spend a total of 4.383m days diving. This is from a large sample of 1,261 UK divers, albeit self-selected. The relevant issue is the proportion of those days in Scotland.

The BMF Water sports and Leisure Participation Survey is undertaken every year and, until 2010, sub aqua and snorkelling was included in their omnibus survey of over 12,000 households. Their 2009 survey reported estimates there were 444,868 who participated in sub-aqua and snorkelling. They also provide Min and Max estimates based on a 90% confidence level. (BMF et al, 2009).

Table 19.1.3 UK Diver Population Estimates

No of participants for 2009	Min 90% of Number of participants	Max 90% Number of participant
444,868	377,000	513,000

The BMF survey also provided participation rates by ITV regions

Table 19.1.4 Participation Rates home and abroad by Residence –ITV Regions 2009

London East and South East	Wales, West and South West	Midlands	North West, North East	Borders Scotland	Northern Ireland	All regions
179,228	52,036	67,844	119,283	17,282	9,196	444,868

A BMF survey also reported a majority of participants (54.2%) participate exclusively abroad. Some will be scuba divers who have a preference for the warm water experience. Others will be holiday makers engaging in snorkelling from the shore.

If the proportion participating exclusively abroad (54.2%) was uniform across the UK, the geographical distribution of UK divers would be given by the Table below

Table ***19.1.5 Diver Participation at home by Residence –ITV Regions 2009***

London East and South East	Wales, West and South West	Midlands	North West/ North East/ Yorkshire	Border/ Scotland	Northern Ireland	All regions
82,086	23,832	31,073	54,632	7,915	4,212	203,750

The UK population of divers who participate in the UK falls to 203,750. This is very reassuring close to the BSAC estimate of UK divers used by Kenter et al.

Table 19.1.6 Frequency of Participation in the UK

Never	Once	2-5	6-12	13-25	More than 25	Total	Base	Mean
54.20%	9.40%	17.20%	9.60%	8.60%	2.70%	100%	97	4.5
153,521	81,588	131,600	44,822	17,445	15,892	291,348	97	

In the above calculation, the actual participation rate of those participating more than 25 times was taken into account when calculating the overall average. If the foreign only divers are removed we are left with a small base of 44 divers. The average number of events for that sample is 9.8. An event could be a full week or two week excursion or a day trip to a local venue. The BMF survey is therefore not directly comparable with the more reliable activity data (mean 22 diver days) from Kenter et al

Based on the BMF survey work the estimated Scottish diver population is 7,915. This is derived from a small base of 44 divers across the UK and it is necessary to triangulate this estimate with other evidence. Our interviews with Scottish Sub Aqua Club, the Sub Aqua Association and the British Sub Aqua Club revealed a combined Scottish membership of 3,946 (rounded to 4,000) implying that 50% of the 7,915

Scottish divers belonged to a diving club. This is believed to be high. Since the membership numbers are well anchored, the population figure of 7,915 could be low. In our correspondence with the BSAC, they provided an estimate of 10,000 to 15,000 resident Scottish divers who dive in Scotland. For illustrative purposes, if we assume a population of 12,000 Scottish Divers, this would suggest a club membership of 33%. The BMF survey revealed a dive club membership ratio across the UK of 46% (base of 97). Not wishing to produce an over-estimate it is sensible to take 10,000 as the Scottish population. Apart from club membership the other reliable indicator is the average number of diver days (22) from the Kenter et al survey. The following table summarises.

Table 19.1.7 Participation Rates and UK Diver Days Residence ITV Regions 2009

	London East and South East	Wales, West and South West	Midlands	North West/ North East/ Yorkshire	Border/ Scotland	Northern Ireland	All regions
Divers	82,086	23,832	31,073	54,632	10,000	4,212	205,835
Diver Days	1,805,892	524,304	683,60 6	1,201,904	220,000	92,664	4,528,370

It is difficult to determine how many days in Scotland were by non Scottish UK residents, and how many of the 220,000 diving days by Scottish residents were undertaken in the rest of the UK. In correspondence with the BSAC, we were informed that, given the diving quality in Scotland, relatively few Scottish resident divers would regularly dive elsewhere in the UK. In contrast many other UK residents would travel to dive in Scotland. BSAC estimated between 12,000 and 20,000 English/Welsh/NI divers would visit Scotland over the course of a year and the average number of days they dived in Scottish waters was between 7 and 14 days.

This produces a wide estimate range of between 84,000 and 280,000 other UK diving days in Scotland. The mid-point estimate would be 180,000. In discussion with charter operators on Orkney, we were informed that around 3,000 diving days were taken by overseas visitors. This would imply the following distribution of diving activity.

Table 19.1.8 Diving Days in Scotland by Origins

	Residents Scotland	UK Visitors	Overseas visitors	Total
Diver Days	220,000	180,000	3,000	403,000

Thus, this study estimates around 403,000 diving days across the whole of Scotland.

19.2 Diving Expenditure

With respect to expenditure, in correspondence with BSAC it was estimated that UK visitors to Scotland would spend between £100 and £170 per day for a charter boat and £60 to £140 on shore based diving depending on location.

The Scottish Enterprise Borders study of St Abbs found that diving expenditure varied substantially between those staying overnight and those on a day (or evening) trip and also between those using a dive boat and those going from the shore. The Table below gives the expenditure per activity day at St Abbs.

Table 19.2.1 Diving Expenditure at St Abbs (2013 prices)

AVERAGE EXPENDITURE PER TRIP (DAY AND OVERNIGHT DIVERS)			
	Day	**Overnight**	**Combined**
Travel / Fuel to St Abbs / Eyemouth	£7.97	£7.51	£7.76
Fuel at St Abbs / Eyemouth (e.g. for boat)	£14.44	£8.77	£11.84
Car Parking	£4.73	£8.43	£6.43
Food and Drink	£7.62	£44.46	£24.57
Air	£5.09	£9.47	£7.11
Equipment Hire	£3.24	£3.34	£3.29
Boat Hire	£19.86	£46.55	£32.14
Launching Fees	£0.69	£2.19	£1.39
Other	£0.46	£3.81	£2.00
Total (Excluding Accommodation)	£64.10	£134.55	£96.51
Accommodation	£0.00	£27.95	£12.85
Trips	£14,481.87	£12,337.32	£26,820.25
Gross Expenditure	£868,792.34	£1,876,209.05	£2,745,002.46

Source: Scottish Enterprise Borders (2007)

The daily expenditure figures are higher than for most recreational activities but sub-aqua is recognised as an expensive sport (on a par with skiing). The typical diver is a male in the 30-50 age group who will have disposable income available.

For Lyme Bay study Rees et al estimated the mean expenditure per diver per day diving from a club boat was £65.18 in 2013 prices compared to £64.10 at St Abbs. In Lyme Bay dive businesses and charter boats appear to add around £24.58 to the day and shore based diving about £18.17 less. In St Abbs, after adjusting for day and overnight variation the figures are similar.

The average diver day expenditure varies significantly with the location, type of diving and length of trip. The minimum, which would apply to Scottish resident divers would be £65.00 per day (excluding accommodation). The mid-range BSAC's estimate for UK visiting shore based divers is £100 and £140 per day for visiting charters. The expenditure of overseas visitors would be much greater but most of the additional spending would be on travel. Some of this travel expenditure such as ferry fares, some flight expenditure would impact on Scotland. In the absence of primary research £180 per day would be a conservative figure.

It would be helpful to establish the relative size of these market segments. Websites, particularly the Scottish Sub Aqua club website provides a list of 29 specialist dive charter vessels, which were allocated them to the IFG regions as below. This was based on their home port where the direct, indirect and induced effects of angler expenditure are most likely to impact. Most of these will have live-aboard facilities, others will offer a complete package with accommodation on-shore. Some operate across two IFG areas, particularly between Orkney and Shetland with the Orkney based vessels taking divers to Shetland sites and Oban based boats visiting sites in the South West and North West.

The average number of divers per trip is 10, with weekly trips lasting 6 days. The season is between 20 and 25 weeks. We have assumed a modest daily expenditure of £140 for these specialist charters. For Orkney the average was raised to £150 to reflect the preponderance of overseas visitors

Table 19.2.2 Specialist Charter Vessels

	Boats	Diving Days per Day (10)	Diving Days per week (6)	Seasonal Diver Days (22 weeks)	Seasonal Expenditure (£140 per day)
South West	10	100	600	13,200	£1,848,000
North West	4	40	240	5280	£739,200
Outer Hebrides	2	20	120	2640	£369,600
MF&NC	1	10	60	1320	£184,800
Orkney	10	100	600	13,200	£1,980,000
East Coast	2	20	120	2640	£369,600
Shetland	0	0	0	0	£0
Total	29	290	1740	38,280	£5,491,200

In addition there are other charter vessels which cater occasionally for diving day trips along with whale, bird and other wildlife watching, sea angling and coastal pleasure excursions. In the absence of more primary research, the diving component of this occasional market is difficult to establish. The total number of charter days including the occasional diver is probably 40,000.

The Table below attaches estimates of angler expenditure to each of the identifiable diver categories. The resident divers will include divers who dive locally and could accumulate 50-60 diving days annually and would have a relatively low daily costs as their overhead costs would be spread further. Included in this category would be a proportion who take expensive 5-7 day charters. An average of £80 would not be unreasonable. As stated above, UK visitors pay £100 for shore trips and £140 for charters. Given the relative frequencies of diving and chartering an overall average of £110 would be appropriate. The Table below summarises.

Table 19.2.3 Diver Expenditure in Scotland

	Residents Diving in Scotland	UK Visitors Diving in Scotland	Overseas Visitors Diving in Scotland
Diver Days	220,000	180,000	3,000
Expenditure	£80	£110	£180
Total	£17,600,000	£19,800,000	£540,000
		Overall Total	£37,940,000

Overall, 403,000 diver days and £38m seems an appropriate estimate for diver activity and expenditure in Scotland.

19.3 The Current Economic Impact of RD to Scotland

Unfortunately we do not have sufficient information to track categories of expenditures through models of local economies. We do know the direct, indirect and induced effects of sea angler expenditure. There are many similarities between the two activities. They occur in the same coastal areas because they broadly seek the same characteristics of sheltered water, cliff faces, rough ground and wrecks. They buy the same kind of services such as travel, accommodation, charter vessels, food and drink. Neither group has to pay access charges. The differences are in the higher equipment costs and gas supply costs of RD. It would not be unreasonable to assume that RD and RSA would have similar impacts. This argument could not be easily made for say RSA and other activities such as golf, deer hunting or skiing. If we process RD expenditure in the same way that we processed RSA, the £38m would have the following impact

Table 19.3 Economic Impact of Recreational Diving (2013 prices)

Currently Supported		Net Impact	
Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
795 (FTE's)	£18,794	423 (FTEs)	£9,992

This above table shows that currently RD support 795 Full Time Job Equivalents (FTE's) and £18.8m of annual Scottish household income in the form of wages, self-employment income, rents and profits. This means that if RD completely ceased in Scotland then 795 jobs and £18.8m of income (i.e. GVA) would be lost. However, a proportion of the expenditure of divers would likely be diverted elsewhere within Scotland and would create income and employment in other sectors. Despite this there would still be a Net Loss of at least 423 FTEs in Scotland and annual loss of £10m in GVA. These estimates seem reasonable.

19.4 The Potential Economic Impact of RD to Scotland

In Section 3.2 we described two status quo trajectories and three indicative outcomes of the policy options. For the 0-3 NM restriction we define a Major Transformative Effect as a 50% increase in RD activity levels of all types. We assumed a linear relationship between activity levels and income and employment effects.

Charter operators were clear that restrictions on mobile demersal gear would enable them to offer a broader range of diving experiences and improved quality of their existing offerings. This same would apply to other types of RD. Whereas the existence of fish to catch is a pre-requisite of RD, the quality of RD is less sensitive to fish biomass or diversity. On the other hand the diving experience is compromised through issues around visibility and the visual absence of sea bed flora and fauna. We know that the absence (or increased availability of fish) does impact on RSA because we have observed these kinds of changes both over time and through cross sectional variations in RSA participation.

Even allowing for the visual dimension of RD, it is unlikely that that a major transformative effect would deliver the same 50% increase in diver activity levels across Scotland. If we were to return to pre 1984 condition there would very likely be an increase in Scottish diving. For illustrative purposes we assume increases of 20%, 10% and 5% would be more realistic.

For decision making the more relevant estimate is net balance of jobs and income lost in RD over the number of jobs and income lost elsewhere as expenditure is diverted. We only consider the net impact.

Table 19.4.1 Economic Contribution 20% Increase in RD

	Net Impact	
	Jobs	**Income (£'000s)**
Current Impact	423	£9,992
Additional Impact	85	£1,998
Total	508	£11,990

Table 19.4.2 Economic Contribution 10% Increase in RD (2013 prices)

	Net Impact	
	Jobs	**Income (£'000s)**
Current Impact	423	£9,992
Additional Impact	42.3	£999
Total	465	£10,991

Table 19.4.3 Economic Contribution 5% Increase in RD (2013 prices)

	Net Impact	
	Jobs	**Income (£'000s)**
Current Impact	423	£9,992
Additional Impact	21.2	£500
Total	444	£10,492

In the case of RSA we had two scenarios. One possibility was the decline would continue, the other was a position of stability. In the case of RD continued decline is not realistic since demersal fish stocks are not a necessary input to create a diving experience. There is the prospect of some decline through the impact of demersal trawls. It seems sensible to assume a status quo scenario of stability. In these circumstances only the additional impact is relevant

Table 19.4.4 RD's Potential Economic Impact on Scotland (2013 prices)

Impact Scenarios: / **Status Quo Scenarios:**	**Major Transformative Effect (20%)**		**Some Enhanced flow (10%)**		**Minimal Enhanced Flow (5%)**	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
Stability	85	£1,998	42.3	£999	21.2	£500

19.5 The Current Economic Impact of RD to IFG Areas

It is necessary to allocate activity levels (403,000) and expenditure (£38m) across the seven IFG's. There are a number of criteria that could be used. The attractiveness of the area as a dive venue is obviously important, especially for non-Scottish divers. The population of the IFG area will also have an effect. In some respects angler and divers seek similar marine characteristics. The exception is possibly that proportionately more diver days will be in Orkney and more sea angler days Dumfries and Galloway. The Table below uses the distribution of RSA effort as a basis for estimating RD effort across IFG's.

Table 19.5.1 RD Expenditure Across IFG's

IFG	% of RD Days	Pro Rata RD Expenditure	Adjusted Expenditure
South West	48.6%	£18,483,368	£18,224,888
North West	4.4%	£1,682,188	£1,682,188
Outer Hebrides	5.2%	£1,987,751	£1,987,751
MFNC	10.4%	£3,959,959	£3,959,959
Orkney	2.3%	£883,925	£2,000,000
East Coast	26.4%	£10,045,239	£10,045,239
Shetland	2.5%	£957,595	£100,000
Overall Total	100.0%	£38,000,025	£38,000,025

As expected Orkney is under represented since the Orkney charter market is estimated to be £1,980,000 (see above). There is only one domestic dive club on Orkney and it would be reasonable to propose that total diver expenditure was £2m. Shetland is over-estimated since the charter fleet is based in Orkney. The South West is possibly over-estimated. The final column shows the adjusted estimates. If we assume that every pound spent by a diver in an IFG area would have broadly the same impact a pound spent by an angler in the same area we can calculate a scaling factor (assuming underlying relationships are linear).

Table 19.5.2 RD Adjustment Factor

IFG	Adjusted RD Expenditure	RSA Expenditure[58]	Scaling Factor
South West	£18,224,888	£76,375,740	23.86%
North West	£1,682,188	£5,715,598	29.43%
Outer Hebrides	£1,987,751	£9,819,845	20.24%
MFNC	£3,959,959	£12,321,287	32.14%
Orkney	£2,000,000	£3,099,823	64.52%
East Coast	£10,045,239	£39,769,837	25.26%
Shetland	£100,000	£3,420,383	2.92%
Total	£38,000,025	£150,522,514	

Applying these adjustments to each IFG area's RSA impact produces the following results for RD's current net economic impact.

Table 19.5 3 RD's Current Net Economic Impact

	Would be Lost (RSA)		Would be Lost (RD)	
	Jobs	Income (£'000s)	Jobs	Income
South West IFG	1093	£18,510	261	£4,416,883
North West IFG	81	£1,359	24	£399,974
Outer Hebrides	117	£2,028	24	£410,511
MF&NC IFG	171	£3,206	55	£1,030,382
Orkney	46	£788	30	£508,416
East IFG	548	£12,586	138	£3,179,027
Shetland	50	£869	1	£25,407

[58] 2013 prices

19.6 The Potential Economic Impact of RD to IFG Area

To identify the potential impact of RD to each IFG, we applied the 20%, 10% and 5% enhancement. As argued above we have dispensed with the decline to zero trajectory for RD. We are therefore only concerned with the enhancement element and not the preservation dimension.

Table 19.6 RD's Potential Economic Impact on IFGs (2013 Prices)

IFG	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (20%)		Some Enhanced flow (10%)		Minimal Enhanced Flow (5%)	
		Jobs	Income (£'000s)	Jobs	Income (£'000s)	Jobs	Income (£'000s)
South West	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	52.2	£883,377	26.1	£441,688	13.05	£220,844
North West	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£79,995	2.4	£39,997	1.2	£19,999
Outer Hebrides	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£82,102	2.4	£41,051	1.2	£20,526
MF&NC	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	11	£206,076	5.5	£103,038	2.75	£51,519
Orkney	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	6	£101,683	3	£50,842	1.5	£25,421
East Coast	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	27.6	£635,805	13.8	£317,903	6.9	£158,951
Shetland	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	0.2	£5,081	0.1	£2,541	0.05	£1,270

19.7 Estimating RD's NEV/CBA Contribution

With respect to RSA we estimated the current magnitude and the change in NEV. With respect to RD, it has been argued that the decline to zero status quo scenario was not relevant. Therefore, if the change in divers' consumer surplus and option (user) value can be estimated directly, there is no requirement to estimate the current contribution magnitude. This simplifies the exercise.

19.7.1 RD's Potential Contribution: Consumers' Surplus Scotland

As explained previously Kenter et al did not estimate current consumers' surplus (i.e. Net WTP), they estimated gross WTP. They also estimated how gross WTP for existing visits would change with management measures. Provided divers actual WTP does not change then the increase in Gross WTP approximates to the increase divers consumers' surplus stemming from their current, but now improved, diving activity. Kenter et al did not estimate how many more trips would be made because diving was better, nor of course the additional consumers' surplus associated with these trips. Despite this, the Kenter's diving estimates are the best direct source available and they are derived from a larger sample of divers than anglers.

Table 19.7.1 Annual Diver User Values (Kenter et al, 2012)

	Visits (000s)		Mean WTP per visit	No Restriction		No Dredge or Trawls		No fishing at all		No Dr/Tr/Anch/Moor	
	Low	Upp		Low	Upp	Low	Upp	Low	Upp	Low	Upp
TOTAL	462	772		33.5m	55.8m	33.5m	55.8m	35.5m	59.1m	36.3m	60.5m
MEAN per site (20)	23	39	67.45	1,675	2,791	1,675	2,791	1,774	2,956	1,816	3,027

The problem is that the estimated gross WTP of between £33 m and £55.8 m does not change if dredging and trawling were restricted (see Table above). It does increase by £2 m-£3.3 m if potting and gillnetting are included as restricted activities and by a further £2.8 m-£4.7 m if no anchoring or mooring was introduced as a restriction.

This is perplexing since it is inconceivable that divers would not be better off with no dredging and trawling. The BSAC submission to the Scottish Governments consultation (see above) makes this quite clear. Our interviews with key diver stakeholders confirmed this. It is equally surprising that divers would be better off if they were not allowed to moor or anchor their own or their chartered vessels. In the circumstances we cannot after all make use of the Kenter et al estimates of the change in divers' consumer surplus.

With respect to RSA, the existing anglers' consumers' surplus was increased indicatively by 50%, 25% and 10%. This was possible because an estimate of anglers' consumer surplus was available. We have no such estimate for divers.

One possibility would be to ignore the change in RD's consumers' surplus. Compared with ignoring the consumer's surplus of RSA, this might not be a significant omission. It was previously argued that recovery of demersal stocks were not quite as pivotal for RD as for RSA. Divers can still have rewarding experiences by diving on wrecks, and other marine artefacts. It is reasonable to conclude that divers' consumer surplus but not by as much as their angling counterparts. When analysing the impact of RD on income and employment, the indicative changes were 20%, 10% and 5% to reflect that the diving experience is less sensitive to changes in biomass and biodiversity. Also, there are 74% fewer diving activity days (403,000) than angler days (1,540,206)..

Against that background the only course available was to adjust the estimated change in RSA consumers' surplus to account for the RD lower activity (26%) and greater insensitivity to environmental change (20% 10% and 5%, compared with 50%, 25% and 10%). Thus the RD values were first reduced to 26% of the relevant RSA value. Then the major transformative effect was adjusted by the ratio (20% / 50%) The other two scenarios were similarly adjusted. The Table below presents the adjusted RSA Table **18.4.6**.

Table 19.7.2 RD's Potential Consumers' Surplus (Scotland Scenarios)

Impact Scenarios: / Status quo scenarios	Major Transformative Effect (20%)	Some Enhanced Flow (10%)	Minimal Enhanced Flow (5%)
Continued Decline to zero	Not Relevant	Not Relevant	Not Relevant
Stability	£1,089,971	£544,985	£272,493

19.7.2 RD's Potential Contribution: Consumers Surplus IFG Areas

The same exercise can be applied to the change in divers' consumer surplus for the IFG areas. The activity level scaling factors for each IFG are given in the Table below

Table 19.7.2 RSA/RD Scaling IFG Scaling Factors

IFG	Activity Levels Scaling Factor
South West	23.86%
North West	29.43%
Outer Hebrides	20.24%
MFNC	32.14%
Orkney	64.52%
East Coast	25.26%
Shetland	2.92%

The below adjusts the RSA Table **18.4.9**, to reflect the different population sizes and divers' lower sensitivity. The Table below is the result of applying these factors and the lower sensitivity levels of 20%, 10% and 5%

Table 19.7.3 RD's Potential Impact Consumers' Surplus in IFGs Areas

	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (20%)	Some Enhanced Flow (10%)	Minimal Enhanced Flow (5%)
South West	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£55,360	£27,680	£13,839
North West	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£45,286	£22,643	£11,321
Outer Hebrides	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£137,096	£68,548	£34,274
MFNC	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£63,918	£31,959	£15,979
Orkney	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£262,291	£131,146	£65,572
East Coast	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£3,134	£1,567	£783.
Shetland	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£268,293	£134,146	£53,659

19.7.3 Estimating RD's Potential Contribution: Option Values

With respect to option values and RSA, it was argued that option value might increase as the quality and value of the angling experience increased. Therefore the insurance premium that users would be willing to pay would also increase. This was reasonable provided that the increased value is subject to the same risk. However, the purpose of the MPA network (and the 1NM and 3NM restriction) is to offer ecosystem protection and reduce environmental risk and this would reduce the risk premium. Since we increased value and reduced risk it was more sensible to regard option value as an element of user value which does not increase along with consumers' surplus. This argument applies to RD.

Thus, the current magnitude of RD option value is not relevant, because we do not envisage a status quo scenario where RD declines continually. At the same time the change in option value is not probably relevant because we cannot be certain that it would respond like RD's consumers' surplus as the marine environment improved.

The result of these considerations is that, on balance, RD's option value is not particularly relevant and best excluded from the analysis to avoid an overestimation of the benefits from the 1NM and 3NM restrictions.

19.8 RD Summary Results

This Section presents the economic impact and NEV/CBA results for RD for Scotland and each of the IFG areas

19.8.1 RD Summary Results Economic Impact

As explained above the status quo trajectory of continued decline is not relevant for both Scotland as a whole and each of the IFG areas. Some would argue that this is erring on the cautious side, because continued trawling and dredging will have adverse effects on RD. For example Kenter et al claim that the MPA network will deliver between £33 and £56 million in diver (gross) user benefits annually through protection of existing dive sites. This is a legitimate claim if the status quo trajectory will eventually result in no diving whatsoever. The correct estimate probably lies between these two positions. This study seeks to avoid overestimating the benefits from restrictions on commercial fishing, hence the stance adopted here.

Table 19.8.1 RD's Potential Economic Impact on Scotland (2013 prices)

Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (20%)		Some Enhanced flow (10%)		Minimal Enhanced Flow (5%)	
	Jobs	**Income (£'000s)**	**Jobs**	**Income (£'000s)**	**Jobs**	**Income (£'000s)**
Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
Stability	85	£1,998	42.3	£999	21.2	£500

Table 19.8.2 RD's Potential Economic Impact on IFGs (2013 Prices)

IFG	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (20%)		Some Enhanced flow (10%)		Minimal Enhanced Flow (5%)	
		Jobs	**Income**	**Jobs**	**Income**	**Jobs**	**Income**
South West	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	52.2	£883,377	26.1	£441,688	13.05	£220,844
North West	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£79,995	2.4	£39,997	1.2	£19,999
Outer Hebrides	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£82,102	2.4	£41,051	1.2	£20,526
MF&NC	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	11	£206,076	5.5	£103,038	2.75	£51,519
Orkney	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	6	£101,683	3	£50,842	1.5	£25,421
East Coast	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	27.6	£635,805	13.8	£317,903	6.9	£158,951
Shetland	Continued Decline to zero	Not Relevant		Not Relevant		Not Relevant	
	Stability	0.2	£5,081	0.1	£2,541	0.05	£1,270

19.8.2 RD Summary Results NEV/CBA

As explained, the current magnitude of RD option value is not relevant, because we do not envisage a status quo scenario where RD declines continually. The change in option value is not probably relevant because we cannot be certain that it would respond like RD's consumers' surplus as the marine environment improved. Since option value is not relevant the NEV of RD collapses to RD's consumers' surplus. For completeness, the tables below are the simply the relabelled consumer's surplus results

Table 19.8.3 RD's Potential Impact Net Economic Values (Scotland Scenarios)

Impact Scenarios: / Status quo scenarios	Major Transformative Effect (20%)	Some Enhanced Flow (10%)	Minimal Enhanced Flow (5%)
Continued Decline to zero	Not Relevant	Not Relevant	Not Relevant
Stability	£1,089,971	£544,985	£272,493

Table 19.8.4 RDs Potential Impact Net Economic Values (IFG Areas)

Area	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (20%)	Some Enhanced Flow (10%)	Minimal Enhanced Flow (5%)
South West	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£55,360	£27,680	£13,839.90
North West	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£45,286	£22,643	£11,321.55
Outer Hebrides	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£137,096	£68,548	£34,274.10
MFNC	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£63,918	£31,959	£15,979.35
Orkney	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£262,291	£131,146	£65,572.81
East Coast	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£3,134	£1,567	£783.42
Shetland	**Continued Decline to zero**	Not Relevant	Not Relevant	Not Relevant
	Stability	£268,293	£134,146	£53,659

20 THE BASELINE: GENERAL PUBLIC NON-USER VALUES

In managing inshore fisheries for the benefit of society as a whole it is necessary to embrace the interests of all stakeholders. It is well established that a proportion of the human population has an altruistic concern for the natural world which is independent of their use of it. This is usually known as the Existence Value.

Whilst the general public are not indifferent about the quality of marine environment, their preferences cannot be expressed in the market place, and unless government intervenes they will be ignored in resource allocation decisions. In other words there are missing markets which result in sub-optimal outcomes.

Because there is no actual expenditure involved there is no economic impact dimension to measure. All that can be measured is the change in human welfare. A measure of how worse off an individual might be is the amount they are willing to sacrifice (i.e. WTP) in order to protect or improve the marine environment. The relevance of monetised non-user values for public sector decision making is now widely accepted and is incorporated in the form of guidance in the Treasury Green Book and other Government assessment documentation.

Conceivably, even those engaged in RSA and RD could perceive a reduction in their well being from simply knowing that marine biodiversity has been decreasing. For this to be a genuine Existence Value, this reduction would have to be completely separate from the impact of environmental change on their fishing or diving operating largely through changes in fish stock abundance.

Whilst at a theoretical level we can distinguish between use and non use values, in applied work it is extremely difficult to separate these. This might particularly be the case for a country such as Scotland where a large proportion of the population live close to the sea and may engage in more informal passive use of the marine environment. In applied work, very detailed sampling would be required to avoid the capturing the more passive use values. Given this we prefer to term assessment of the values held by the general public as General Public Non User Value (GPNUV).

The complete exclusion of these values in the context of this study would be controversial and would undermine the credibility of the work and decisions that it might inform. The relevant question is therefore how they should be incorporated. In an ideal world, primary research would be undertaken. Because of resource constraints, it is necessary to use benefit transfer.

20.1 Benefit Transfer

McVittie and Moran (2010) is the only relevant study. They undertook a stated preference choice experiment to estimate the non-user benefits derived by UK residents from implementation of the proposed MCZs and MPAs.

For Scotland, Wales and Northern Ireland, approximately 150 respondents each were sampled (75% coastal, 25% non-coastal).They were presented with a choice experiment involving policy outcomes, which are spatially remote from respondents who were thus probably non-users for the broadly defined policy outcomes.

It should be noted that about 3% of the UK population is a diver, a sea angler or both. The sample might therefore have picked up users who, because they interact directly with near shore fish stocks (i.e. RSA and RD). They might declare a WTP which incorporates both their direct use (of near shore fish stocks) and non-use values related to their broader altruistic concerns for the marine environment. If this occurred, then mean WTP willingness to pay (ie GPNUV) will be inflated. This study will therefore have double counted RSA and RD user values. Given the 3% participation rate double counting of their user value is probably not an issue.

The sample might also have picked up users who interact indirectly with near shore fish stocks, (Other Marine Recreational Activity (OMRA)). They might declare a willingness to pay that incorporates their indirect use of near shore fish stocks as well as their non-user values. With 75% of respondents from coastal locations, McVittie and Moran (2010) might have picked up some OMRA user value. This is not a problem because we are unable to estimate any of the OMRA user value.

The prices in the table below represent mean willingness to pay in £ per household per annum. Respondents were presented with two baseline policy attributes. One expressed in biodiversity terms the other in terms of environmental benefits flow. They were also presented with an increase in each of the two baseline attributes. Both of the increased levels were valued relative to the baseline (continued loss of biodiversity or environmental benefits). The difference between the two can also be calculated by subtracting the value of one from the value of the other.

Table 20.1.1 Mean WTP Individual Country Samples (£/household/annum).

Policy Outcome	England	Scotland	Wales	Northern Ireland
Halt loss of biodiversity	£69.49	£20.92	£107.39	£33.90
Increase biodiversity	£69.16	£23.76	£61.04	£38.22
Halt loss of environmental benefits	£30.79	£16.16	£139.08	£18.35
Increase environmental benefits	£34.27	£19.45	£158.53	£30.65

As an example, in the Scottish sample, the mean implicit price for “halt loss of marine biodiversity” (for the UK wide network of MCZ's) is £20.92 per household per annum, but this only increase by £2.84 to £23.76 for an increase in biodiversity.

From the table above, there are significant differences between countries, with Scottish households WTP much less to stop the continued decline.

There would also appear to be indifference between degrees of improvement. McVittie and Moran point out that for many individuals the loss of something has a bigger negative impact than the positive impact from an equivalent gain, but that scope insensitivity may also apply.

Table 20.1.2 Aggregate Annual Non-Market Benefits for Policy Attribute Levels (£M)

	England	Scotland	Wales	Northern Ireland	Total
Number of households (M)	21.73	2.31	1.24	0.67	25.95
Halt loss of biodiversity	£1,510.	£48.30	£133.20	£22.70	£1,714
Increase biodiversity	£1,502.	£54.90	£75.70	£25.60	£1,658
Halt loss of environmental	£669.	£37.30	£172.50	£12.30	£891
Increase environmental	£744.	£44.90	£196.60	£20.50	£1,006

The work of McVittie and Moran has demonstrated that the Scottish general public would benefit if biodiversity loss was halted and biodiversity increased. These benefits are captured in the amount they are collectively willing to pay to achieve these outcomes.

There are a number of difficulties in using the above results for benefit transfer. Firstly, with respect to aggregate values, the WTP is by Scottish residents for UK wide preservation or improvement. Scottish WTP for Scottish improvement should be less, though the scope insensitivity noted by McVittie and Moran and Kenter et al suggests that might not be too much of a problem. On balance, uncritical benefit transfer will certainly raise the possibility of overestimation of the benefits from the 0-1 NM or 0-3 NM restrictions.

Second, the purpose of the MPZ / MPA networks is quite different from the 0-1 NM and 0-3 NM being considered by this study[59]. The 0-1 NM and 0-3 NM restrictions are essentially based on the functional significance of the near shore. The decision to assess these particular options may be based in part on a suspicion that the increased use of mobile demersal gear in near shore, particularly in nursery areas, might be responsible for the observed reductions in geodiversity, biodiversity, and the biomass of benthos species and other stocks including some other shellfish and demersal species. If mobile gear is having these impacts, and in the threat is ongoing, the general public would be willing to pay for ecosystem protection and eventual recovery. Although the 0-1 NM and 0-3 NM restrictions are not aimed at protecting and enhancing biodiversity and geodiversity for their own sake, they could deliver these outcomes. It is being argued that in the minds of the general public the near shore restrictions would have an impact, in terms of preservation and enhancement which would be much greater that the impact of the MPAs (see Section 3.5.1).

[59] Sites in Scotland are considered for MPA designation if key features are present. They include: a).Features for which Scotland is considered to be a stronghold or to be of exceptional scientific importance or to be characteristic of Scotland's marine environment b) Features considered to be under threat. This includes biodiversity features which might be under threat such as habitats and species on the OSPAR Threatened and Declining list, and geodiversity features under threat such as active marine landforms, relict geological and geomorphological features c) Ecological resources or geomorphological processes which are functional significance for the overall health and diversity of such places for feeding, breeding, resting, nurseries, juveniles and/or spawning, or sediment supply and provides. For full description see http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/mpaguidelines

Third, there is the question of whether to focus on biodiversity or the flow of environmental benefits. The former is preferred since it is more consistent with genuine GPNUV, rather than the user values or user option value implicit in benefit flows.

The greater error would be to completely exclude non-user values. On that basis, this study assumes that the orders of magnitude revealed by McVittie and Moran are probably relevant. Unfortunately, there is no basis on which they can easily be finessed to better transfer them. In any event, finessing, which would probably have to assume underlying relationships, could not embrace the apparent scope insensitivity.

Given these considerations it is assumed that the Scottish non-user value is around £48m per annum and that increased biodiversity will increase values by £6.6m per annum. These are used to provide an illustrative estimate of the magnitude of general public values for Scotland and for the IFG areas.

Finally, it should be appreciated that the very high estimate (£48m) is only relevant when the status quo scenario is "continued decline to zero."

20.2 General Public Non-User Value for Scotland

The status quo scenarios of continued decline and stability are retained. Given the scope insensitivity, there is no adjustment of £6.6m improvement element. It is however recognised that there is an argument to suggest that WTP to pay for a biodiversity improvement should vary with the magnitude of the improvement. One problem is deciding on whether the £6.6m represents the Major Transformative Effect and the other two scenarios are fraction of this. Alternatively, the £6.6m could be the Minimal Enhancement. Given this anchoring problem, as well as the other benefit transfer difficulties it was felt that, on balance, variations in the general public's WTP would introduce an element of spurious accuracy.

Table 20.2 General Public Potential Net Economic Values (Scotland Scenarios)

Impact Scenarios: / Status quo scenarios	Major Transformative Effect	Some Enhanced Flow	Minimal Enhanced Flow
Continued Decline to zero	£54.6m	£54.6m	£54.6m
Stability	£6.6m	£6.6m	£6.6m

20.3 General Public Non-User Value for IFG Areas

The allocation of the Scottish values needs to be apportioned according to population size. It has been necessary to identify the population size of IFG areas. This was done by allocating data zones to the nearest IFG and then summing.

Table 20.3 IFG Populations

IFG	Population	%
South West	2,258,654	44.6%
North West	40,850	0.8%
Hebrides	26,450	0.5%
MF&NC	297,853	5.9%
Orkney	19,220	0.4%
East	2,399,213	47.4%
Shetland	21,960	0.4%
Total	5,064,200.00	100.0%

The relative population sizes were used to allocate the Scottish general public values across the IFGs

Table 20.4 General Public Potential Net Economic Values IFGs

IFG	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (£'000s)	Some Enhanced Flow (£'000s)	Minimal Enhanced (£'000s)
South West	**Continued Decline to zero**	£24,352	£24,352	£24,352
	Stability	£2,944	£2,944	£2,944
North West	**Continued Decline to zero**	£440	£440	£440
	Stability	£53	£53	£53
Outer Hebrides	**Continued Decline to zero**	£285	£285	£285
	Stability	£34	£34	£34
MFNC	**Continued Decline to zero**	£3,211	£3,211	£3,211
	Stability	£388	£388	£388
Orkney	**Continued Decline to zero**	£207	£207	£207
	Stability	£25	£25	£25
East Coast	**Continued Decline to zero**	£25,867	£25,867	£25,867
	Stability	£3,127	£3,127	£3,127
Shetland	**Continued Decline to zero**	£237	£237	£237
	Stability	£29	£29	£29

21 THE MODEL

21.1 Introduction

In Sections 4 and 5 the two economic approaches of Economic Impact Analysis (EIA) and Net Economic Value / Cost-Benefit Analysis (NEV/CBA) were outlined. An essential characteristic of both is the monetisation of economic concepts such as Net Economic Value, Gross Value Added (GVA) and Full-Time Equivalents (FTEs) so that they can be added and subtracted to identify the net effects of a policy initiative.

In order to evaluate a policy proposal, forecasts about policy impacts are required. Unfortunately most of the key forecasts are not available. As an example, there is no concrete evidence about the likelihood and speed of marine ecosystem recovery if a 0-1 or 0-3NM restriction is implemented. Similarly we only have the informed opinion of local Fishery Officers on which to base estimates of the numbers of mobile operators who will give up fishing and the likely destinations of their licences. At a more mundane level the extra costs for those mobile operators continuing to fish but outside the restricted area is not known, neither are the associated displacement effects.

Various scenarios were created to deal with this uncertainty. These have been constructed to encapsulate the different possible policy impacts and how these might alter the outcome of the economic evaluations. As well as a sensitivity analysis, this study goes further and presents a model designed to enable users of the model to vary the assumptions themselves, produce their own sensitivity analysis and explore how changes affect the balance of estimated costs and benefits.

21.2 Economic Impact Analysis

A key element in the EIA analysis is the multipliers. These capture the direct, indirect and induced effects. In 2002, the Fraser of Allander Institute carried out extensive research into the forward and backward supply chains in the fishery sector and the resulting multipliers (Fraser of Allander, 2002). The key relationships linking employment in the sector and the resulting employment in processing and in supply are given below

Table 21.2 Employment Multipliers

	Employment Effect* (FTEs)		Employment Multiplier+
Demersal	14.2	15.63	2.1
Shellfish	45	11.14	1.25
Pelagic	4	14.28	4.56
Sea	17.9	14.34	1.8
Fish Processing	12.8	14.05	2.1

The figures in the first column indicate the employment generated per £1 m output of the fish catching sector. Thus additional landings of shellfish worth £1 m would, on average, be associated with 45 full time jobs on board shellfish vessels. The figures in the second column show the associated employment in the supply of services and materials to the sector plus those employed in processing the output of that sector. The table above informs us that there would be 11.14 jobs elsewhere in the shellfish supply chain. Thus each job in the shellfish catching sector would be associated another 0.25 FTEs elsewhere. The ratio of the total jobs (56.14) to the initial employment (45) is known as the employment multiplier. Thus if a creel boat employs, on average, 1.8 men then the total number employed as a result of an extra creel boat will be 1.8*1.25 (the shellfish employment multiplier).

The multiplier for Pelagic is very high. Output per head in the catching sector is high, hence the small number of jobs created by £1m of landings. In the modern pelagic fleet a haul valued at £1m is not uncommon. Such a haul consists of 4-5million fish all of which need to be gutted and a high percentage filleted. Despite highly mechanised/automated plants the labour required is still substantial. Hence we have a high ratio of processing employment to catching sector employment.

The figure for shellfish is low because creel and pot caught langoustines, lobsters and crabs are normally live and are shipped direct to the tables and fresh markets throughout Europe and beyond. Trawled Nephrops tend to be smaller and dead on arrival in port where they are processed locally as Scampi. As a result, any move from trawl to creel is likely to reduce the shellfish employment multiplier.

In the absence of further research, for this project we are using the 1.25 multiplier for creels and divers and the average 1.8 multiplier for trawls and dredges and the demersal employment multiplier 2.1 for the developing line industry.

The Fraser of Allander estimates capture the induced effect on employment. They may overestimate employment effects if income is saved. Also, the multiplier for small areas is generally less than for large areas such Scotland as a whole, as reported in the above table. Without defining what is meant by an IFG area and extensive further research on the processing power and induced effects in each of the IFG area it is not possible to improve on the Fraser of Allander estimates for Scotland. Consequently we use the Scotland values as discussed above.

For the recreational activities the multipliers used for the IFGs are specific to the local areas (see Radford et al 2009) and cover both indirect and induced effects.

21.3 The Model

The model is designed to enable the analysis of any combination of:

- IFG
- Type of restriction (0-1NM or 0-3nm)
- Status quo scenarios
- Policy impact scenarios
- The timing of marine ecosystem recovery
- Reaction of mobile operators will react to each restriction (e.g. fish outside the restricted zone, retire from fishing, convert to static gear)
- Inclusion or exclusion of Options Value
- Inclusion or exclusion of GPNUV

21.4 Reporting Results

The model generates results over two time horizons. The first time horizon is 20 years. This means that policy benefits or costs arising after 20 years are completely discounted. This introduces a bias because the policy costs are incurred from year 1, but some significant policy benefits (recreational and general public benefits) are conditional on ecosystem recovery. If ecosystem recovery takes 15 years, only 5 years of these benefits would be captured. The second time horizon which captures all the policy costs and benefits is unlimited. The discussion below focuses on the 20 year time horizon.

The model reports its summary results for EIA in the form of the change in FTEs generated for 1year, 10 years and 20 years ahead. Income changes were also estimated but are considered less reliable and are not reported.

The NEV estimates is the discounted flow of NEV for the whole 20 year period. The discount rate is the Treasury recommended rate of 3.5%. All figures are "real" (projected inflation is not included) and prices, in real terms, are assumed to be constant. For the Discounted Cash Flow calculations, estimates of value in years 2-9 and 11-19 are obtained by interpolation.

21.5 The Sectors and Model Assumptions

The model is split into 4 sections reflecting the four broad stakeholder groups.

21.5.1 Commercial Fishing in the Model

Within the commercial fishing section there are separate but linked sub-sections relating to nephrop trawlers, demersal trawlers, dredgers, creel boats, professional divers and line fishermen. In each case the benchmark for total activity in the sector is calculated using the current estimates of catch value within 12 NM. Although the IFG territory extends only to 6 NM, the 1 NM or 3 NM restrictions will have consequences for local fleets' revenue and costs in the 6-12 NM zone. In effect the impact boundary is the 12 NM limit and the assumption is that the proposed restrictions will have negligible impact of revenue and costs of fishing effort beyond 12 NM. The detailed catch and revenue benchmark estimates for 0-12NM for each IFG were presented in previous sections of this report.

The following protocols and assumptions were used in the EIA and CBA/NEV analysis of each IFG.

- The reactions of the mobile operators (trawlers and dredgers) are defined in three options. These are to retire, to convert to creels or to continue fishing outside the zone. There were three responses which are outlined in the Table below

		Response 1 ("Carry on")		Response 2 ("Mix")		Response 3 ("Change")	
		Year 1	Year 10	Year 1	Year 10	Year 1	Year 10
Trawlers	Convert	5%	10%	10%	15%	15%	25%
	Retire	5%	10%	7%	15%	10%	10%
	Continue	90%	80%	83%	70%	75%	65%
Dredgers	Convert	0%	8%	5%	5%	10%	20%
	Retire	5%	5%	7%	7%	10%	10%
	Continue	95%	87%	88%	88%	80%	70%

- The impact on the mobile operators is modelled by an estimated change associated with each option. Those converting to creels were assumed to generate earnings equal to full-time creel vessels. The average capital cost of converting was calculated at £33,500. Vessels continuing were assumed to experience a 10% increase in running costs.

- The change in the number of vessels determines the catching sector jobs lost (or gained) and, together with the multipliers discussed above, the total number of jobs lost (or gained).

- It is necessary to assume that all relationships and therefore all ratios are constant. In the absence of specific research, this assumption is unavoidable. It is recognised that this assumption may not always be ideal. For example, vessels that leave the industry are probably less efficient than those that remain.

- For reasons explained in Section 4, with respect to commercial activities the change in Net Economic Value approximates to the estimated change in profit, except if there is substantial unemployment in the IFG. In which case, current wage rates may overestimate the benefits from reductions in the opportunity cost of using labour on trawlers and dredgers. In practice, as reported in Section 7, fishing communities do not face exceptional unemployment problems, and in some segments recruitment problems have required the use of migrant labour.

- It is unreasonable to believe that those made unemployed, will be unemployed in perpetuity. It is therefore assumed there is re-employment and retirement and that this initial job loss impact declines quickly and the impact in year 10 would be zero (assuming no further redundancies).

- As explained in Section 3, it is assumed that the baseline scenario of continued decline to zero for inshore shellfish catches and remaining inshore demersal stocks is not relevant and its use would over-inflate policy benefits.

- It is assumed that the licences and sea area vacated by trawlers and dredgers will be taken up directly or indirectly by creelers and divers. This issue is discussed further in Section 23.

- The removal of scallop dredgers from beds close to the shore provides major opportunities for scallop hand divers. This will grow gradually partly because of a shortage of small boat with shellfishing entitlement, mitigated in part by a contraction of the part time creelers. Within 10 years the model assumes around half of the value of scallops currently caught within 1NM or 3NM will be landed. It is expected that less than half the number will be landed, but these are expected to be larger, less damaged and more valuable.

- It is assumed that the inshore hand lining catch will increase from year 10. The current proportion of demersals caught within 1 and 3 NM was estimated. It was assumed that under a major transformative effect demersal inshore stocks would return to 1983 levels. These two pieces of information were used to estimate the potential value of landings within 1 and 3 NM. It was assumed static gear would take between 2% of 10% of this potential. The associated jobs and value is then calculated from the revenue generated by the activity. Pro rata adjustments were made for the other impact scenarios

- Imposing limits should reduce gear conflict. Conflicts are not spread equally between the 1NM and 3NM limits nor by IFG area (see Section 16). The model thus accounts for these differences.

- Having estimated the change in jobs, incomes and NEV (i.e. profits) for the commercial fleet, the jobs, incomes and values for sea angling and sub aqua are then extracted from the tables according to the chosen environmental and response levels. These estimates are then added to those for commercial fishing. This is explained below.

21.5.2 Recreational Sea Angling in the Model

In Section 18, we estimated the following potential economic impact on Scotland and each of the IFG's of RSA. The table below presents these results for two baseline scenarios and three possible policy impacts

RSA's Potential Economic Impact on IFGs (2013 Prices)

Area	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (50%)		Some Enhanced flow (25%)		Minimal Enhanced Flow (10%)	
		Jobs	Income (£'000s)	Jobs	Income (£'000s)	Jobs	Income (£'000s)
Scotland	Continued Decline to zero	2,513	£59,371	2,094	£49,476	1,843	£43,539
	Stability	837.5	£19,790	419	£9,896	168	£3,958
South West	Continued Decline to zero	1640	£29,668	1366	£24,724	1202	£21,756
	Stability	547	£9,889	273.3	£4,945	109	£1,978
North West	Continued Decline to zero	122	£2,179	101	£1,815	89	£1,597
	Stability	41	£727	20.3	£363	8	£145
Outer Hebrides	Continued Decline to zero	176	£3,250	146	£2,709	129	£2,384
	Stability	59	£1,083	29.3	£542	12	£217
MF&NC	Continued Decline to zero	257	£5,139	214	£4,283	188	£3,769
	Stability	86	£1,713	42.8	£857	17	£343
Orkney	Continued Decline to zero	69	£1,263	58	£1,053	51	£926
	Stability	23	£421	11.5	£211	5	£84
East Coast	Continued Decline to zero	822	£20,173	685	£16,811	603	£14,794
	Stability	274	£6,724	137.0	£3,363	55	£1,345
Shetland	Continued Decline to zero	75	£1,393	63	£1,160	55	£1,022
	Stability	25	£465	12.5	£232	5	£93

We also estimated the potential contribution to Scotland's and the IFGs NEV as described in the table below. These "user values" include consumers' surplus and option values.

Area	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (50%)	Some Enhanced Flow (25%)	Minimal Enhanced Flow (10%)
Scotland	Continued Decline to zero	£32,200,460	£26,993,327	£23,869,047
	Stability	£10,414,266	£5,207,133	£2,082,853
South West	Continued Decline to zero	£16,084,906	£13,481,723	£11,919,814
	Stability	£5,206,365	£2,603,182	£1,041,273
North West	Continued Decline to zero	£1,453,189	£1,218,057	£1,076,977
	Stability	£470,265	£235,133	£94,053
Outer Hebrides	Continued Decline to zero	£1,728,187	£1,448,505	£1,280,696
	Stability	£559,364	£279,682	£111,873
MFNC	Continued Decline to zero	£3,298,997	£2,765,797	£2,445,877
	Stability	£1,066,400	£533,200	£213,280
Orkney	Continued Decline to zero	£765,277	£641,444	£567,143
	Stability	£247,667	£123,834	£49,533
East Coast	Continued Decline to zero	£8,040,907	£6,742,948	£5,964,173
	Stability	£2,595,917	£1,297,958	£519,183
Shetland	Continued Decline to zero	£829,011	£694,864	£614,377
	Stability	£268,293	£134,146	£53,659

In considering the time frame it is clear that the benthic environment and stocks will take time to recover. In Year 1 the additional RSA will be minimal but it is then expected to grow in line with the recovery. However, we also allow for two different recovery rates; a 10 year and a 20 year recovery.

As far as the sea angler is concerned the major advantage of limit imposition is to protect nursery areas that will allow the development of a sizeable stock of mature fish. It is possible that the commercial sector will exploit these stocks before sea anglers have their opportunity. This is less likely than in the past. Compared with the early 1980's there is greater control over the number of vessels, the gear they can use, number of days they can fish and the amount of fish they can catch.

Whilst the biology is complex, a rough guide is the bigger the area the bigger the likelihood of success. We have allowed for this by assuming the options value for the 1NM to be one third of the value assessed above. For sea angling we have assumed any growth in sea angling with a 1 NM limit to be 50% of that assessed in Section18 (which applies to the 3NM area). Again it is easy to adjust for different assumptions

21.5.3 Recreational Diving in the Model

In Section 18 we estimated the following potential economic impact on Scotland and each of the IFG's of RSA. As it transpires the continued decline scenario was not relevant for RD, because stocks of fish or other living organisms are not a necessary ingredient of RD

Area	Impact Scenarios: / Status Quo Scenarios:	Major Transformative Effect (20%)		Some Enhanced flow (10%)		Minimal Enhanced Flow (5%)	
		Jobs	**Income)**	**Jobs**	**Income**	**Jobs**	**Income**
Scotland	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	85	£1,998,000	42.3	£999,000	21.2	£500,000
South West	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	52.2	£883,377	26.1	£441,688	13.05	£220,844
North West	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£79,995	2.4	£39,997	1.2	£19,999
Outer Hebrides	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	4.8	£82,102	2.4	£41,051	1.2	£20,526
MF&NC	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	11	£206,076	5.5	£103,038	2.75	£51,519
Orkney	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	6	£101,683	3	£50,842	1.5	£25,421
East Coast	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	27.6	£635,805	13.8	£317,903	6.9	£158,951
Shetland	**Continued Decline to zero**	Not Relevant		Not Relevant		Not Relevant	
	Stability	0.2	£5,081	0.1	£2,541	0.05	£1,270

We also estimated the potential contribution to Scotland's and the IFGs NEV as described in the table below. These "user values" include consumers' surplus and option values.

RDs Potential Impact Net Economic Values (IFG Areas

Area	Impact Scenarios: / Status quo scenarios:	Major Transformative Effect (20%)	Some Enhanced Flow (10%)	Minimal Enhanced Flow (5%)
Scotland	Continued Decline to zero Stability	Not Relevant £1,089,971	Not Relevant £544,985	Not Relevant £272,493
South West	Continued Decline to zero Stability	Not Relevant £55,360	Not Relevant £27,680	Not Relevant £13,839.90
North West	Continued Decline to zero Stability	Not Relevant £45,286	Not Relevant £22,643	Not Relevant £11,321.55
Outer Hebrides	Continued Decline to zero Stability	Not Relevant £137,096	Not Relevant £68,548	Not Relevant £34,274.10
MFNC	Continued Decline to zero Stability	Not Relevant £63,918	Not Relevant £31,959	Not Relevant £15,979.35
Orkney	Continued Decline to zero Stability	Not Relevant £262,291	Not Relevant £131,146	Not Relevant £65,572.81
East Coast	Continued Decline to zero Stability	Not Relevant £3,134	Not Relevant £1,567	Not Relevant £783.42
Shetland	Continued Decline to zero Stability	Not Relevant £268,293	Not Relevant £134,146	Not Relevant £53,659

For sub aqua we assume that with increased water clarity there will be a boost immediately and then growth. We estimate that initial increase will be 25% of the current activity and that the 3NM gear restriction will produce the values above and that the 1NM ban will be 50% as effective in helping sub-aqua grow and in the satisfaction that brings. As argued previously the options value associated with Sub-Aqua is probably zero for both 1NM and 3NM bans.

21.5.4 General Public preferences.

General Public Potential Net Economic Values

	Impact Scenarios: 21.5.4.1 / Status quo scenarios:	Major Transformative Effect (£'000s)	Some Enhanced Flow (£'000s)	Minimal Enhanced (£'000s)
Scotland	Continued Decline to zero Stability	£54,600 £6,600	£54,600 £6,600	£54,600 £6,600
South West	Continued Decline to zero Stability	£24,352 £2,944	£24,352 £2,944	£24,352 £2,944
North West	Continued Decline to zero Stability	£440 £53	£440 £53	£440 £53
Outer Hebrides	Continued Decline to zero Stability	£285 £34	£285 £34	£285 £34
MFNC	Continued Decline to zero Stability	£3,211 £388	£3,211 £388	£3,211 £388
Orkney	Continued Decline to zero Stability	£207 £25	£207 £25	£207 £25
East Coast	Continued Decline to zero Stability	£25,867 £3,127	£25,867 £3,127	£25,867 £3,127
Shetland	Continued Decline to zero Stability	£237 £29	£237 £29	£237 £29

The value placed by the public to prevent further loss of biodiversity was £48m and only £6.6m of an improved marine environment. It was argued that there was probably significant scope insensitivity hence the values do not change across the rows. The status quo scenario is therefore quite crucial.

21.6 Running the Model

The Figure below shows the front page of the model. As can be seen a number of assumptions have been made about profit rates, the typical number of FTEs on each type of vessel, fuel costs, wage rates etc.

At this level the user can modify any of the parameters and select scenarios. Entry will generate output, specifically estimates of Jobs (the Impact) and of the Net Economic Value. The actual calculations occur in Sheet2 for the basic aggregation and DCF for the discounted cash flow calculations of the NEV. The sheet marked recreation contains the basic data on Angling and Sub-Aqua.

In an attempt to capture the main competing views a total of 72 permutations (36 for each limit choice) are available.

OPTIONS MODEL Mark4			
IFG	8		
Limit Planned (nm)	1		
Trawlers			
Trawler Profit Rate	12%		Seafish
Trawler Jobs	3.0		Seafish
Dredger Jobs	3.8		
Onshore Ratio	0.8		Anderson & Myer
Creel Jobs	2.2		FOs
Scallop Profit	25%		Seafish
Creel Profit	20%		Seafish
Capital Cost Conv	£33,500		Calculated
Fuel Cost Increase as percent of profit	**5%**		Assumption
Relocation Loss (Bad Weather, Poorer Fishing)	5%		Assumption
Shadow Wage	£25,000		Assumption
Wage	£25,000		Assumption
Time taken to return to current levels of employment(Years)	10		Assumption
Scenarios			
Environment (1 = Decline,2=Stable)	2		
Policy Impact (1= Major; 2= Not fully Reversible, 3=little impact	3		
Policy Response (1=Carry On, 2=Mix,3=Change	3		
Recreation Development Speed(1=Yr10 Complete, 2=yr20 complet	2		
OPTIONS AND NON USER VALUES			
Include Option Value (1=yes, 2=no)	2		
Include Existence Value (1=yes, 2=no)	2		
OUTPUTS	YR1	YR10	YR20
JOBS FISHING	-340	-103	-90
JOBS ALL	-337	-51	15
NEV FISHING	-£59,979,135		
NEV Fishing and Recreation	-£50,151,429		

Fig 1: Section of Front Page of the Worksheet

	1 SW 1nm	3nm	2 NW 1nm	3nm	3 OH 1nm	3nm	4 N&M 1nm	3nm	5 Ork 1nm	3nm	6 E 1nm	3nm	7 Sh 1nm	3nm	8 1nm	3nm
Demersal Trawl	£16,396	£33,652	£500,466	£843,280	£36,142	£66,300	£261,720	£870,801	£14,104	£42,192	£634,161	£844,988	£902,677	£2,351,745	£2,365,666	£5,052,958
Nephrops Trawl	£3,826,773	£7,982,763	£1,715,653	£4,079,830	£589,004	£1,179,844	£1,029,877	£2,111,361	£120,734	£181,535	£1,159,676	£2,874,939	£2,686	£19,037	£8,444,403	£18,429,309
Pelagic Trawl	£76,674	£82,842	£30,371	£38,616	£755	£264,965	£0	£14,030	£0	£0	£3,924,544	£4,070,060	£2,058,859	£9,533,519	£6,091,203	£14,004,032
Pelagic Lines	£4,908	£8,659	£11,756	£16,582	£1,465	£2,093	£94,066	£161,502	£0	£0	£85,490	£211,484	£4,351	£30,454	£202,036	£430,775
Other Trawl	£1,580	£5,428	£2,370	£6,285	£1,263	£1,992	£256,590	£612,430	£924	£0	£109,880	£370,038	£11,379	£49,335	£383,985	£1,045,508
Dredge	£1,794,507	£3,264,326	£390,357	£675,770	£295,592	£489,684	£115,188	£517,808	£72,557	£213,471	£55,611	£187,474	£1,630,509	£2,619,773	£4,354,319	£7,968,306
Pots	£5,781,644	£8,782,936	£5,497,227	£9,039,012	£2,826,294	£5,381,431	£1,691,805	£2,272,146	£2,576,206	£2,711,843	£1,770,972	£3,936,595	£952,175	£1,436,068	£21,096,323	£33,560,029
Hand Dive	£962,661	£1,211,562	£291,617	£359,727	£235,828	£358,291	£63,707	£101,995	£734,387	£879,470	£58,934	£127,196	£0	£0	£2,347,134	£3,038,242
Total	£12,465,142	£21,372,167	£8,439,816	£15,059,102	£3,986,343	£7,744,602	£3,512,952	£6,662,073	£3,518,911	£4,028,511	£7,799,268	£12,622,775	£5,562,636	£16,039,931	£45,285,068	£83,529,160

	Total Cost		Avoided Cost	
	<1nm	<3nm	<1nm	<3nm
IFG1	£208,139	£324,916	£142,411	£222,311
IFG2	£153,002	£390,502	£117,853	£300,792
IFG3	£10,413	£28,083	£4,860	£13,105
IFG4	£0	£59,506	£0	£36,837
IFG5	£9,715	£11,537	£4,858	£5,768
IFG6	£37,722	£97,607	£18,861	£48,804
IFG7	£0	£12,144	£0	£6,072
Total	**£418,992**	**£924,295**	**£275,710**	**£608,215**

		Carry On		Mix		Change or Get Out	
		Yr1	Yr10	**Yr1**	Yr10	**Yr1**	Yr10
Trawlers	Change	5%	**10%**	10%	15%	15%	25%
	Leave	5%	**10%**	7%	15%	10%	10%
	Continue	90%	80%	83%	70%	75%	65%
Dredgers	Change	0%	**8%**	5%	5%	10%	20%
	Leave	5%	**5%**	7%	7%	10%	10%
	Continue	95%	87%	88%	88%	80%	70%

IFG	<10m	10-15m	>15m	Total
1	214	73	78	365
2	**157**	**44**	**33**	**234**
3	149	21	19	**189**
4	148	**19**	**45**	**212**
5	94	25	8	127
6	298	31	129	458
7	123	10	35	168
	1183	**223**	**347**	**1753**

Policy Impact Scenarios

		Major Effect	Damage not Fully Reversible	Limited Impact	No Policy Implemented
Decline to zero	Demersal	2%	0%	-2%	-4%
	Shellfish	0%	0%	0%	0%
Stability	Demersal	3%	2%	1%	0%
	Shellfish	0%	0%	0%	3%
Line Fishing	3nm	2.0%	1.0%	0.0%	
	1nm	1.0%	0.5%	0.0%	

	1	2	3
Demersal Trav	£106,661	£1,185,445	£399,386
Nephrops Trav	£12,811,102	£7,414,421	£3,826,859
Pelagic Trawl	£86,602	£115,748	£517,581
Pelagic Lines	£10,872	£18,254	£2,183
Other Trawl	£7,016	£6,285	£2,859
Dredge	£5,228,497	£858,281	£655,743
Pots	£11,279,669	£11,076,519	£8,176,832
Hand Dive	£1,350,679	£412,839	£420,614
Total	£30,881,097	£21,087,793	£14,002,056

***Fig 2: Key data on scenarios found on front page of the model*.** **These can also be amended**

22 THE RESULTS

22.1 Introduction

For each IFG area, and Scotland as a whole, we present separate tables of EIA and NEV results. The EIA and NEV results are presented for the 0-1 NM followed by the 0-3NM. The commercial fishing sector embraces all forms of commercial fishing as described by the benchmark tables reported earlier. The recreational sector includes RSA and RD.

22.1.1 Presenting the EIA results

The economic impact is presented as the change in FTEs immediately, in 10 and in 20years.

22.1.2 Presenting the NEV results

The Net Economic Values are the total annual flow and discounted at 3.5%. For the commercial fishing sector, NEV approximates to profits, since the analysis of dependency in Section 7 did not justify the use of a shadow wage rate.

Five NEV estimates are provided. The total in the first NEV column excludes the general public's GPNUV and Options Values (OV). The NEV estimates in the second column include OV but exclude GPNUV. OV is separately added because it was estimated by benefit transfer and assumptions were made about scope sensitivity. The third column includes GPNUV. There are number of reasons for separating out the GPNUV. First these values are very large and it should be understood that in some instances, it is these values which are responsible for the overall positive NEV values. Second, there are unknown, but potentially very high margins of error associated with their estimation through benefit transfer. Third, there is a displacement issue associated with some vessels continuing to use mobile gear outside the 0-1 or 0-3 NM limit. Even although their displaced activity is spread over a much larger area, this will reduce the general public values by an unknown amount. We can be certain the true value is greater than zero because it is undeniable that a significant proportion of the Scottish population is not indifferent to both the loss marine biodiversity and its enhancement. The true value could be very high since there are 2.31 million households and we are summing their GPNUV over a long time period. The greater error would be to exclude an estimate of GPNUV. Given the high margin of error and potential for environmental damage to be displaced the fourth column halves the estimate of GPNUV. The 50% reduction on GPNUV is not entirely arbitrary, since around 50% of the mobile effort is likely to be displaced and therefore impacting on the marine environment elsewhere in Scotland[60].

It should be stressed that by separating out GPNUV, and reducing it by 50%, there is no implication that the general public's welfare should have a lower weighting than, say, commercial fishing interests. The authors of this study have no remit to engage in judgements about the relative merits of different stakeholder group. This study is

[60] The displacement issue was discussed in Sections 3 and 4.

simply presenting the results and their provenance, as well as providing guidance on how they might inform decision making.

In the first four columns, NEV is estimated by discounting over a 20 year period using the Treasury recommended rate of 3.5%. This means that policy benefits or costs arising after 20 years are ignored. Normally, a finite horizon would be appropriate for a capital investment such as buildings. Capital items do not last forever and over time the usefulness of capital items can be eroded by changes in human preferences. With respect to environmental improvement the intention is create something that is renewable and sustainable ad infinitum. Thus by imposing a 20 year horizon we are in effect biasing the results against conservation. The effect of assuming a continuous stream of benefits for ever is to increase significantly the value of the proposed restrictions.

It would not be appropriate to present all 72 permutations (36 for each for 0-1NM and 0-3nm) that are available for each IFG area[61]. To indicate a range of possible values four combinations for each restriction are presented. These are a Least Favourable Outcome (LFO), a Most Favourable Outcome (MFO) and two examples of typical less extreme “middling” combinations.

The LFO outcome from society’s perspective combines:

- A status quo scenario of stability
- A minimal environmental impact of the policy.
- A large proportion of mobile operators retire and sell licences outside Scotland
- Ecosystem recovery is very slow.

The MFO outcome combines:

- A status quo scenario of continued loss of biodiversity and decline of RSA
- A major environmental impact of the policy.
- A large proportion of mobile operators continue to fish outside of 1 NM or 3 nm
- Ecosystem recovery is very fast

The parameters for the two “Typical” scenarios together with the Least and Most Favourable to change are shown in Table 22.1.1

Table 2.2 The Alternative Scenarios.

	Initial Environment	**Environment Policy Impact**	**Operators’ Response**	**Recovery Speed**
Least Favourable	Stable (2)	Minimal (3)	Convert (3)	20 yr (2)
Most Favourable	Decline (1)	Major (1)	Carry On (1)	10yr (1)
Typical 1	Stable (2)	Some (2)	Mixture of (1) and 3)	10yr (1)
Typical 2	Decline (1)	Some (2)	Mixture of (1) and 3)	20 yr (2)

[61] This does not include the additional permutations that would be produced by changing assumptions about profit levels, wage rates etc.

22.2 Results for Scotland

Table 22.2.1a. EIA for Scotland (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	YR 10	YR20
Least Favourable	Commercial Fishing	-340	-103	-90
	Recreational Sector	3	53	105
	Total	-337	-51	15
Most Favourable	Fishing	-128	122	148
	Recreational Sector	21	1342	1342
	Total	-106	1464	1490
Typical A	Fishing	-227	-14	-1
	Recreational Sector	11	252	252
	Total	-216	238	251
Typical B	Fishing	-227	-106	-80
	Recreational Sector	5	545	1089
	Total	-221	438	1009

After 20 years, on the LFO there is the possibility of only gaining a total of 15 jobs. The MFO projects net gain of 1,490 jobs.

Table 22.2.1a. NEV Results (£m) for Scotland (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£60	-£60	-£60	-£60	
	Recreation	£112	£142	£239	£154	
	All	£52	£56	£153	£105	£466
Most Favourable	**Fishing**	-£56	-£56	-£56	-£56	
	Recreation	£974	£979	£1,781	£1,380	
	All	£918	£923	£1,725	£1,324	£5,704
Typical A	**Fishing**	-£57	-£57	-£57	-£57	
	Recreation	£134	£138	£235	£187	
	All	£77	£82	£179	£130	£543
Typical B	**Fishing**	-£60	-£60	-£60	-£60	
	Recreation	£897	£902	£1,704	£1,303	
	All	£837	£842	£1,645	£1,243	£5,520

With respect to the NEV projection, the LFO suggest a basic NPV of £52m which rises to £466m if the benefits of conservation are fully evaluated. The MFO projects and GPNUV rising to £5.7bn.

Table 22.2.2a. EIA Results for Scotland (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-340	-103	-90
	Recreational Sector	3	95	189
	Total	-337	-9	99
Most Favourable	**Fishing**	-128	96	109
	Recreational Sector	21	2598	2598
	Total	-106	2694	2707
Typical A	**Fishing**	-227	-14	-1
	Recreational Sector	11	461	461
	Total	-216	447	460
Typical B	**Fishing**	-227	-132	-119
	Recreational Sector	5	1068	2136
	Total	-221	936	2017

The 3 NM restriction delivers more jobs. This arises primarily because of the bigger environmental impact, greater options value with little additional retirement of mobile operators. After 20 years, on the LFO there is the possibility of gaining a total of 99 jobs and 2,707, on the MFO. These results show that even if we assume the worst possible outcomes (LFO), there will still be employment gains. These gains will not be evenly spread across Scotland.

Table 22.2.2b. NEV Results (£m) for Scotland (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£56	-£56	-£56	-£56	
	Recreation	£128	£142	£239	£190	
	All	£71	£85	£182	£134	£589
Most Favourable	**Fishing**	-£53	-£53	-£53	-£53	
	Recreation	£1,138	£1,152	£1,955	£1,553	
	All	£1,085	£1,099	£1,901	£1,500	£6,443
Typical A	**Fishing**	-£53	-£53	-£53	-£53	
	Recreation	£169	£183	£280	£231	
	All	£116	£130	£227	£179	£739
Typical B	**Fishing**	-£57	-£57	-£57	-£57	
	Recreation	£990	-£56	-£56	£0	
	All	£933	£947	£1,750	£1,348	£6,101

With respect to the NEV projection, the LFO suggest a basic GPNUV of £71m rising to over half a billion if full weight is given to conservation values over an infinite time horizon. The MFO projects an accumulated a basic GPNUV of £1085m rising to £6.4bn. On the basis of these estimates society would be better off with the 0-3NM restriction than with the 0-1NM restriction. There is one other important feature to note. The significant difference in value between Typical A and Typical B can be traced to the status quo assumption. If it is assumed that fish stocks and the quality of the flora and fauna is in decline then there is a substantial value in preventing further decline. It should be noted though that, even with the status quo scenario of stability, the benefits from an expansion in the recreation sector, creeling, diving and line fishing still exceed the costs arising from the reduction in trawling and dredging.

22.3 South West

The South West is the area with potential for water based recreation with around 40% of the Scottish population in the adjacent areas and good transport links with the rest of Scotland and the UK.

Table 22.3.1a. EIA Results for South West (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-127	-58	-58
	Recreational Sector	2	34	68
	Total	-126	-24	10
Most Favourable	**Commercial Fishing**	-48	-6	-6
	Recreational Sector	13	872	872
	Total	-34	866	866
Typical A	**Commercial Fishing**	-85	-49	-49
	Recreational Sector	7	163	163
	Total	-78	114	114
Typical B	**Commercial Fishing**	-85	-49	-49
	Recreational Sector	3	355	709
	Total	-81	305	660

Even the most pessimistic scenario delivers a net gain in employment. The MFO projects net gain of 866 jobs. Given the population size it is not unsurprising to find very substantial increases in employment, with many more jobs being created in RSA and RD.

Table 22.3.1b. NEV Results (£m) for South West (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£23	-£23	-£23	-£23	
	Recreation	£49	£142	£239	£154	
	All	£26	£28	£71	£50	£219
Most Favourable	**Fishing**	-£6	-£6	-£6	-£6	
	Recreation	£420	£423	£781	£602	
	All	£415	£417	£775	£596	£2,565
Typical A	**Fishing**	-£49	-£49	-£49	-£49	
	Recreation	£84	£87	£130	£108	
	All	£36	£38	£81	£60	£249
Typical B	**Fishing**	-£49	-£49	-£49	-£49	
	Recreation	£428	£430	£788	£609	
	All	£379	£382	£740	£561	£2,492

With respect to the NEV projection, the LFO suggest a total NPV worth of £26 m rising to £219 m when the full value of conservation is included. The MFO projects a basic NEV of £415 m. The large population delivers very high recreational benefits. The high population also generates large GPNUV values. The MFO estimates an NEV of £2.56 billion. As can be seen below, the 0-3 NM restriction delivers even more net jobs and NEV.

Table 22.3.2a. EIA Results for South West IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-127	-58	-58
	Recreational Sector	2	61	122
	Total	-126	3	64
Most Favourable	**Commercial Fishing**	-48	-7	-7
	Recreational Sector	13	1692	1692
	Total	-34	1685	1686
Typical A	**Commercial Fishing**	-85	-49	-49
	Recreational Sector	7	299	299
	Total	-78	250	251
Typical B	**Commercial Fishing**	-85	-50	-49
	Recreational Sector	3	696	1392
	Total	-81	646	1343

The 0-3NM restriction delivers 64 additional jobs under the LFO and 1,686 under the MFO

Table 22.3.2b. NEV Results (£m) for South West IFG (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	Fishing	-£23	-£23	-£23	-£23	
	Recreation	£57	£64	£107	£85	
	All	£34	£41	£84	£63	£273
Most Favourable	Fishing	-£7	-£7	-£7	-£7	
	Recreation	£504	£511	£869	£690	
	All	£497	£504	£862	£683	£2,934
Typical A	Fishing	-£49	-£49	-£49	-£49	
	Recreation	£103	£110	£153	£131	
	All	£54	£61	£104	£82	£339
Typical B	Fishing	-£49	-£49	-£49	-£49	
	Recreation	£111	-£23	-£23	£0	
	All	£62	£69	£427	£248	£2,783

It is clear that even under the most restrictive assumptions about conservation value the benefits from restricting mobile gear in the South West IFG will exceed the costs.

22.4 North West

Table 22.4.1a EIA Results for North West IFG (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	YR 10	YR20
Least Favourable	Commercial Fishing	-64	-59	-56
	Recreational Sector	0	3	5
	Total	-64	-56	-51
Most Favourable	Commercial Fishing	-25	-36	-31
	Recreational Sector	1	66	66
	Total	-24	29	34
Typical A	Commercial Fishing	-43	-44	-42
	Recreational Sector	1	13	13
	Total	-43	-32	-29
Typical B	Commercial Fishing	-43	-48	-43
	Recreational Sector	0	26	53
	Total	-43	-21	10

After 20 years, on the LFO there is the possibility of losing a total of 51 jobs. The MFO projects net gain of 34 jobs. Compared with the adjacent South West IFG, the restrictions on mobile gear will not generate as many jobs in the area. This is because the population of only 40,000 will not support many more jobs in the recreational sector.

Table 22.4.1b NEV Results (£m) for North West IFG (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£10	-£10	-£10	-£10	
	Recreation	£1	£2	£2	£2	
	All	-£8	-£8	-£7	-£8	-£34
Most Favourable	**Fishing**	-£10	-£10	-£10	-£10	
	Recreation	£14	£15	£21	£18	
	All	£5	£5	£11	£8	£31
Typical A	**Fishing**	-£42	-£42	-£42	-£42	
	Recreation	£34	£34	£35	£35	
	All	-£7	-£7	-£6	-£7	-£33
Typical B	**Fishing**	-£43	-£43	-£43	-£43	
	Recreation	£43	£44	£50	£47	
	All	£1	£1	£8	£4	£24

On the basis of these NEV results it would appear that a 0-1NM restriction the benefits do not exceed the costs.

Table 22.4.2a EIA Results for North West IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-64	-59	-56
	Recreational Sector	0	5	9
	Total	-64	-54	-47
Most Favourable	**Commercial Fishing**	-25	-20	-17
	Recreational Sector	1	127	127
	Total	-24	107	109
Typical A	**Commercial Fishing**	-43	-44	-42
	Recreational Sector	1	23	23
	Total	-43	-21	-19
Typical B	**Commercial Fishing**	-43	-53	-50
	Recreational Sector	0	52	103
	Total	-43	-1	53

The 0-3NM restriction costs the area 47 jobs on the LFO and a gain of 109 on the MFO.

Table 22.4.2a NEV Results (£m) for North West IFG (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£7	-£7	-£7	-£7	
	Recreation	£2	£3	£4	£3	
	All	-£5	-£4	-£4	-£4	-£15
Most Favourable	**Fishing**	-£17	-£17	-£17	-£17	
	Recreation	£32	£32	£39	£35	
	All	£14	£15	£21	£18	£75
Typical A	**Fishing**	-£42	-£42	-£42	-£42	
	Recreation	£38	£39	£40	£39	
	All	-£3	-£3	-£2	-£2	-£11
Typical B	**Fishing**	-£50	-£50	-£50	-£50	
	Recreation	£57	-£10	-£10	£0	
	All	£7	£8	£14	£11	£61

The NEVs are positive for both the MFO, and the second "typical" scenario but negative for the LFO and Typical A. The low population and remoteness mean that recreational and general public values are low, whilst there are a large number of mobile operators who would be disadvantaged. Even for the 3 NM restriction the excess of benefits over costs is marginal.

22.5 Outer Hebrides

Table 22.5.1a EIA Results for Outer Hebrides IFG (0-1 NM)

		YR 1	YR 10	YR20
Least Favourable	**Fishing**	-34	-30	-30
	Recreation	0	4	7
	All	-34	-26	-22
Most Favourable	**Fishing**	-13	-11	-10
	Recreation	1	93	93
	All	-12	82	82
Typical A	**Fishing**	-23	-23	-23
	Recreation	1	17	17
	All	-22	-6	-6
Typical B	**Fishing**	-23	-26	-26
	Recreation	0	38	75
	All	-23	12	50

There are similarities between the Outer Hebrides and the adjacent North West IFG area. The Outer Hebrides have an even smaller population (26,450) and the recreational sector cannot be relied upon to support employment.

Table 22.5.1b NEV Results (£m) for Outer Hebrides IFG (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£6	-£6	-£6	-£6	
	Recreation	£1	£2	£2	£2	
	All	-£5	-£5	-£4	-£4	-£20
Most Favourable	**Fishing**	-£10	-£10	-£10	-£10	
	Recreation	£18	£19	£23	£21	
	All	£8	£8	£12	£10	£40
Typical A	**Fishing**	-£23	-£23	-£23	-£23	
	Recreation	£20	£20	£21	£20	
	All	-£3	-£3	-£3	-£3	-£16
Typical B	**Fishing**	-£26	-£26	-£26	-£26	
	Recreation	£29	£29	£34	£31	
	All	£3	£4	£8	£6	£29

The excess of benefits over costs is marginal

Table 22.5.2a EIA Results for Outer Hebrides IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-34	-30	-30
	Recreational Sector	0	7	13
	Total	-34	-23	-16
Most Favourable	**Commercial Fishing**	-13	-11	-11
	Recreational Sector	1	181	181
	Total	-12	170	170
Typical A	**Commercial Fishing**	-23	-23	-23
	Recreational Sector	1	32	32
	Total	-22	8	8
Typical B	**Commercial Fishing**	-23	-26	-26
	Recreational Sector	0	74	148
	Total	-23	48	122

With the 0-3 NM restriction there is a greater prospect of job creation. The LFO generates a net loss of 16 jobs whilst the MFO produces a net gain of 170, which is significant relative to the population of the area.

Table 22.5.2a NEV Results (£m) for Outer Hebrides IFG (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£6	-£6	-£6	-£6	
	Recreation	£2	£3	£4	£3	
	All	-£4	-£3	-£3	-£3	-£14
Most Favourable	**Fishing**	-£11	-£11	-£11	-£11	
	Recreation	£28	£28	£32	£30	
	All	£17	£18	£22	£20	£79
Typical A	**Fishing**	-£23	-£23	-£23	-£23	
	Recreation	£22	£23	£23	£23	
	All	-£1	-£1	£0	£0	-£7
Typical B	**Fishing**	-£26	-£26	-£26	-£26	
	Recreation	£34	-£6	-£6	£0	
	All	£8	£9	£13	£11	£60

Again the case for a 3NM restriction is stronger than for 1nm, but unlike the populous areas the benefits only marginally exceed the costs.

22.6 Moray Firth and the North Coast

Table 22.6.1a EIA Results for MF&NC IFG (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-46	-28	-27
	Recreational Sector	0	6	11
	Total	-46	-23	-16
Most Favourable	**Commercial Fishing**	-18	-6	-4
	Recreational Sector	3	140	140
	Total	-15	133	136
Typical A	**Commercial Fishing**	-31	-14	-13
	Recreational Sector	1	27	27
	Total	-29	13	14
Typical B	**Commercial Fishing**	-31	-58	-56
	Recreational Sector	1	56	113
	Total	-30	-2	57

From the table above, the 0-1NM restriction results in job losses under the LFO. Given the remoteness of the North Coast there is less growth in recreation based activities, compared to, for example, the South West. However, with Inverness and the towns on the Moray Firth and a population of 298 thousand the model predicts employment gains except under the pessimistic assumptions.

Table 22.6.1b NEV Results (£m) for MF&NC IFG (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£9	-£9	-£9	-£9	
	Recreation	£7	£8	£13	£10	
	All	-£2	-£1	£4	£1	£5
Most Favourable	**Fishing**	£5	£5	£5	£5	
	Recreation	£51	£51	£98	£75	
	All	£56	£56	£103	£80	£340
Typical A	**Fishing**	-£13	-£13	-£13	-£13	
	Recreation	£14	£14	£20	£17	
	All	£1	£1	£7	£4	£12
Typical B	**Fishing**	-£27	-£27	-£27	-£27	
	Recreation	£75	£75	£122	£99	
	All	£48	£48	£95	£72	£321

Even under the LFO assumptions, the benefits exceed the costs.

Table 22.6.2a EIA Results for MF&NC IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-46	-28	-27
	Recreational Sector	0	10	20
	Total	-46	-18	-7
Most Favourable	**Commercial Fishing**	-18	0	1
	Recreational Sector	3	268	268
	Total	-15	268	269
Typical A	**Commercial Fishing**	-31	-14	-13
	Recreational Sector	1	48	48
	Total	-29	34	35
Typical B	**Commercial Fishing**	-31	-32	-31
	Recreational Sector	1	110	220
	Total	-30	78	189

The 0-3NM restriction could generate 269 jobs under the MFO or lose 7 under LFO.

Table 22.6.2b NEV Results (£m) for MF&NC IFG (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£9	-£9	-£9	-£9	
	Recreation	£9	£10	£16	£13	
	All	£0	£2	£7	£4	£18
Most Favourable	**Fishing**	£1	£1	£1	£1	
	Recreation	£72	£73	£120	£97	
	All	£73	£74	£121	£98	£416
Typical A	**Fishing**	-£13	-£13	-£13	-£13	
	Recreation	£18	£19	£25	£22	
	All	£5	£6	£12	£9	£32
Typical B	**Fishing**	-£31	-£31	-£31	-£31	
	Recreation	£88	-£9	-£9	£0	
	All	£57	£59	£106	£82	£381

The NEV points in the same direction; even under some negative assumptions the benefits form the 3 NM restriction exceed the costs.

22.7 Orkney

Table 22.7.1a EIA Results for Orkney IFG (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	YR 10	YR20
Least Favourable	Commercial Fishing	-4	5	5
	Recreational Sector	0	2	4
	Total	-3	7	9
Most Favourable	Commercial Fishing	-1	5	5
	Recreational Sector	2	41	41
	Total	0	45	45
Typical A	Commercial Fishing	-2	4	4
	Recreational Sector	1	9	9
	Total	-2	13	13
Typical B	Commercial Fishing	-2	3	3
	Recreational Sector	0	16	32
	Total	-2	19	35

Unlike the North West and the Outer Hebrides, the 0-1 NM restriction in Orkney would initially lead to a fall in fishing based jobs but become positive in the fishing sector in later years as creeling expands. There is also an increase in tourist based jobs, even under a combination of the most pessimistic assumptions.

Table 22.7.1b NEV Results (£m) for Orkney IFG (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	Fishing	-£1	-£1	-£1	-£1	
	Recreation	£1	£1	£2	£2	
	All	£1	£1	£1	£1	£5
Most Favourable	Fishing	£5	£5	£5	£5	
	Recreation	£4	£4	£8	£6	
	All	£9	£9	£12	£11	£46
Typical A	Fishing	£4	£4	£4	£4	
	Recreation	-£2	-£2	-£2	-£2	
	All	£2	£2	£2	£2	£10
Typical B	Fishing	£3	£3	£3	£3	
	Recreation	£2	£3	£6	£4	
	All	£6	£6	£9	£8	£35

The NEV is small reflecting the overall size of the fishing economy. However it is positive under all combinations of assumptions.

Table 22.7.2a EIA Results for Orkney IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	YR 10	YR20
Least Favourable	Commercial Fishing	-4	5	5
	Recreational Sector	0	3	7
	Total	-3	8	11
Most Favourable	Commercial Fishing	-1	5	5
	Recreational Sector	2	75	75
	Total	0	80	80
Typical A	Commercial Fishing	-2	4	4
	Recreational Sector	1	15	15
	Total	-2	19	19
Typical B	Commercial Fishing	-2	3	3
	Recreational Sector	0	31	61
	Total	-2	34	64

The 0-3 NM restriction generates more employment than the 0-1 NM, though under the LFO the increase is marginal

Table 22.7.2b NEV Results (£m) for Orkney IFG (0-3 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	Fishing	-£1	-£1	-£1	-£1	
	Recreation	£2	£2	£2	£2	
	All	£1	£1	£2	£1	£7
Most Favourable	Fishing	£5	£5	£5	£5	
	Recreation	£8	£9	£12	£10	
	All	£13	£13	£16	£15	£63
Typical A	Fishing	£4	£4	£4	£4	
	Recreation	-£1	-£1	-£1	-£1	
	All	£3	£3	£4	£3	£14
Typical B	Fishing	£3	£3	£3	£3	
	Recreation	£5	-£1	-£1	£0	
	All	£8	£8	£11	£10	£49

The move from 0-1 to 0-3 NM does generate higher NEV estimates but the increase is not a as pronounced compared with other IFG areas.

22.8 East Coast

Table 22.8.1a EIA Results for East Coast IFG (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	YR 10	YR20
Least Favourable	Commercial Fishing	-51	-15	3
	Recreational Sector	1	17	34
	Total	-50	2	38
Most Favourable	Commercial Fishing	-20	52	89
	Recreational Sector	7	439	439
	Total	-13	491	528
Typical A	Commercial Fishing	-34	-3	15
	Recreational Sector	3	82	82
	Total	-31	79	98
Typical B	Commercial Fishing	-34	24	61
	Recreational Sector	2	178	356
	Total	-32	202	417

The East is a huge IFG that includes the cities of Aberdeen and Dundee to the North and the industrialised areas along both sides of the Forth to the South. Like the South West there is substantial potential for serious expansion of water based recreation. In most scenarios that potential more than compensates for any losses in the fishing sector.

The most pessimistic scenario delivers a net gain in employment and the MFO projects net gain of 528 jobs.

Table 22.8.1b NEV Results (£m) for East Coast IFG (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	Fishing	-£7	-£7	-£7	-£7	
	Recreation	£49	£50	£96	£73	
	All	£42	£43	£89	£66	£293
Most Favourable	Fishing	£89	£89	£89	£89	
	Recreation	£326	£327	£707	£517	
	All	£415	£416	£796	£606	£2,638
Typical A	Fishing	£15	£15	£15	£15	
	Recreation	£31	£32	£78	£55	
	All	£46	£48	£94	£71	£309
Typical B	Fishing	£61	£61	£61	£61	
	Recreation	£336	£337	£717	£527	
	All	£397	£398	£778	£588	£2,599

With respect to the NEV projection, the LFO suggests a basic GPNUV of £42m rising to £293m if options and GPNUVs are included along with an infinite time horizon. The MFO projects an £2,6bn excess of discounted benefits over discounted costs.

As can be seen below, the 0-3NM restriction delivers even more net jobs and NEV.

Table 22.8.2a EIA Results for East Coast IFG (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-51	-15	3
	Recreational Sector	1	31	62
	Total	-50	16	65
Most Favourable	**Commercial Fishing**	-20	15	34
	Recreational Sector	7	850	850
	Total	-13	865	883
Typical A	**Commercial Fishing**	-34	-3	15
	Recreational Sector	3	151	151
	Total	-31	148	166
Typical B	**Commercial Fishing**	-34	-13	6
	Recreational Sector	2	349	699
	Total	-32	337	705

Table 22.8.2b NEV Results (£m) for East Coast IFG (0-3 NM)

		Basic	**+Option Values**	**+Options & GPNUVs**	**+Options & 0.5 of GPNUVs**	**+Options & GPNUVs; Infinite Time Horizon**
Least Favourable	**Fishing**	-£7	-£7	-£7	-£7	
	Recreation	£53	£57	£103	£80	
	All	£46	£50	£96	£73	£321
Most Favourable	**Fishing**	£34	£34	£34	£34	
	Recreation	£420	£424	£804	£614	
	All	£454	£458	£838	£648	£2,801
Typical A	**Fishing**	£15	£15	£15	£15	
	Recreation	£40	£44	£90	£67	
	All	£56	£59	£105	£82	£355
Typical B	**Fishing**	£6	£6	£6	£6	
	Recreation	£412	-£5	-£5	£0	
	All	£418	£422	£802	£612	£2,723

The magnitudes of the estimates are similar magnitude to those of the South West IFG. Under the least favourable conditions both restrictions generate more jobs generate a flow of discounted benefits which greatly exceeds the costs imposed on the commercial sector. The Table below shows that these two areas are responsible for most of Scotland's NEV. Because of the greater opportunities, under the most favourable conditions, the South West contributes the larger benefit.

Table 22.8.3 Comparative NEV Results (0-3 NM)

	LFO (£m)	%	MFO (£m)	%
South West	£273	46.4%	£2,934	45.5%
East	£321	54.6%	£2,801	43.5%
All Other	-£6	-1.0%	£708	11.0%
Scotland	£589	100.0%	£6,443	100.0%

22.9 Shetland

As discussed earlier Shetland fishing is already subject to a Regulating Order which controls *inter alia* inshore trawling and dredging. As an example the large nomadic dredgers are not allowed to fish the inshore waters around Shetland. Thus any restriction would only hit the small Shetland-based dredgers.

Table 22.9.1a EIA Results for Shetland (0-1 NM)

0-1 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-14	69	72
	Recreational Sector	0	1	3
	Total	-14	70	74
Most Favourable	**Commercial Fishing**	-4	49	54
	Recreational Sector	0	38	38
	Total	-4	87	92
Typical A	**Commercial Fishing**	-8	62	65
	Recreational Sector	0	6	6
	Total	-8	69	71
Typical B	**Commercial Fishing**	-8	52	57
	Recreational Sector	0	16	32
	Total	-8	67	88

Despite the small population and therefore less scope for developing employment in the recreational sector, the most pessimistic combination of assumptions suggests that a 0-1 NM restriction would generate more employment.

Table 22.9.1b NEV Results (£m) for Shetland (0-1 NM)

		Basic	+Option Values	+Options & GPNUVs	+Options & 0.5 of GPNUVs	+Options & GPNUVs; Infinite Time Horizon
Least Favourable	**Fishing**	-£2	-£2	-£2	-£2	
	Recreation	£1	£1	£2	£2	
	All	£0	£0	£0	£0	£16
Most Favourable	**Fishing**	£1	£1	£1	£1	
	Recreation	£11	£11	£14	£13	
	All	£11	£12	£15	£13	£76
Typical A	**Fishing**	£1	£1	£1	£1	
	Recreation	£3	£3	£3	£3	
	All	£3	£4	£4	£4	£35
Typical B	**Fishing**	-£2	-£2	-£2	-£2	
	Recreation	£7	£7	£11	£9	
	All	£5	£6	£9	£7	£44

The NEV estimates are relatively low compared with the employment gains. The small population constrains the flow of benefits to sea anglers, divers and the general public.

Table 22.9.2a EIA Results for Shetland (0-3 NM)

0-3 Nautical Mile		Economic Impact (FTE's)		
		YR 1	**YR 10**	**YR20**
Least Favourable	**Commercial Fishing**	-14	69	72
	Recreational Sector	0	3	5
	Total	-14	72	77
Most Favourable	**Commercial Fishing**	-4	63	65
	Recreational Sector	0	75	75
	Total	-4	138	140
Typical A	**Commercial Fishing**	-8	62	65
	Recreational Sector	0	13	13
	Total	-8	75	77
Typical B	**Commercial Fishing**	-8	62	64
	Recreational Sector	0	32	63
	Total	-8	93	128

As with all IFG areas, the 0-3 NM restriction generates more employment

Table 22.9.2b NEV Results (£m) for Shetland (0-3 NM)

		Basic	**+Option Values**	**+Options & GPNUVs**	**+Options & 0.5 of GPNUVs**	**+Options & GPNUVs; Infinite Time Horizon**
Least Favourable	**Fishing**	-£2	-£2	-£2	-£2	
	Recreation	£2	£2	£3	£2	
	All	£0	£0	£1	£1	£19
Most Favourable	**Fishing**	£0	£0	£0	£0	
	Recreation	£15	£15	£19	£17	
	All	£15	£16	£19	£17	£93
Typical A	**Fishing**	£1	£1	£1	£1	
	Recreation	£4	£4	£4	£4	
	All	£4	£5	£5	£5	£40
Typical B	**Fishing**	-£2	-£2	-£2	-£2	
	Recreation	£10	£1	£1	£0	
	All	£7	£8	£11	£10	£56

22.10 Summary and Conclusions

The above results suggest that under the specific scenarios and using the illustrative assumptions as described throughout the report Scotland could create more jobs and generate an excess of economic benefits over costs by imposing a 0-3 NM restriction on the use of mobile gear.

The Results for the IFG's and Shetland

In practise the benefits and costs, and jobs created (or lost) are not evenly spread across Scotland. In IFG areas, such as the South West IFG area and the East Coast IFG areas, mobile gear restrictions will have highly beneficial impacts on jobs and NEV. In other areas the case for introducing mobile gear restrictions would be harder to argue.

The Table below extracts the year 20 employment estimates for the six IFGs and Shetland. The sensitivity of the results to changes in assumptions is very evident.

From the Table below, the South West, East Coast, Orkney and Shetland IFG areas would experience an increase in employment, even if the conditions described by the LFO prevailed. The South West IFG and the East Coast IFG offer the greatest potential in terms of job creation. This is because these two areas account for 44.6% and 47.4% respectively of the Scottish population[62]. The expansion of the marine recreational sector would thus create large numbers of jobs in these areas. The Moray Firth and North Coast IFG accounts for (5.8% of the population), and whilst its commercial fishery would probably lose jobs, there is the possibility of job creation in the marine recreation sector

Areas with small populations such as Outer Hebrides (0.5% of Scottish population), and the North West (0.8%) suffer from loss of employment in commercial fishing but would not attract large numbers of anglers and divers. The structure of Orkney's and Shetland commercial fishing mean their commercial fisheries do not suffer a net loss of employment but in the case of Shetland the gains in the recreational sector are modest. Orkney gains recreational employment from RD.

[62] IFG population estimates are presented in Table 20.3 in the main report.

Table 20.10.1 Economic Impact All IFGs

0-3 Nautical Miles		Economic Impact (FTE's, YR 20)						
		South West	North West	Outer Hebrides	MF& NC	Orkney	East Coast	Shetland
Least Favourable	Commercial Fishing	-58	-56	-30	-27	5	3	72
	Recreational Sector	122	9	13	20	7	62	5
	Total	64	-47	-16	-7	11	65	77
Most Favourable	Commercial Fishing	-7	-17	-11	1	5	34	65
	Recreational Sector	1692	127	181	268	75	850	75
	Total	1686	109	170	269	80	883	140
Typical A	Commercial Fishing	-49	-42	-23	-13	4	15	65
	Recreational Sector	299	23	32	48	15	151	13
	Total	251	-19	8	35	19	166	77
Typical B	Commercial Fishing	-49	-50	-26	-31	3	6	64
	Recreational Sector	1392	103	148	220	61	699	63
	Total	1343	53	122	189	64	705	128

The Table below presents the comparative NEV results for each of the IFGs and Shetland. It has been compiled by focussing on column 3 of the 0-3 NM Table above. It therefore includes OV and GPNUV which probably have high margins of error, but it does not include any policy benefits or costs that arise after 20 years.

Table 20.10.2 NEV Including OV & GPNUV for all IFGs

0-3 Nautical Miles		Options & GPNUVs (£m)						
		South West	North West	Outer Hebrides	MF& NC	Orkney	East Coast	Shetland
Least Favourable	Fishing	-£23	-£7	-£6	-£9	-£1	-£7	-£2
	Recreation	£107	£4	£4	£16	£2	£103	£3
	All	£84	-£4	-£3	£7	£2	£96	£1
Most Favourable	Fishing	-£7	-£17	-£11	£1	£5	£34	£0
	Recreation	£869	£39	£32	£120	£12	£804	£19
	All	£862	£21	£22	£121	£16	£838	£19
Typical A	Fishing	-£49	-£42	-£23	-£13	£4	£15	£1
	Recreation	£153	£40	£23	£25	-£1	£90	£4
	All	£104	-£2	£0	£12	£4	£105	£5
Typical B	Fishing	-£49	-£50	-£26	-£31	£3	£6	-£2
	Recreation	-£23	-£10	-£6	-£9	-£1	-£5	£1
	All	£427	£14	£13	£106	£11	£802	£11

From the Table above all areas apart from the North West and Outer Hebrides generate an excess of benefits over costs, even under the LFO scenario. In the case of the South West, and East there is a substantial excess of benefits over costs and to a lesser extent in the MF&NC IFG. In the case of Orkney and Shetland the excess of benefits over costs are relatively modest.

The implications of different IFGs following different approaches to the management of mobile fishing gear are considered in more detail in section 23.3.

23 OTHER ISSUES EVALUATED

23.1 Introduction

The real world is complex and even the 36 different combinations for each restriction cannot cover every eventuality. In this section we address three further issues:

- Including Mobile Pelagic Gear in the Restrictions.
- IFGs Imposing Local Mobile Gear Restrictions.
- Additional Creel Licences.

23.2 . Including Mobile Pelagic Gear in the Restrictions

Pelagic species shoal in very large quantities. Mackerel shoals over 10 miles in length are not uncommon. Shoals are located, followed, surrounded by the net and in the large modern vessels then “sucked” on board the vessel as the net is hauled. Landing is through pipe straight into the processing factory. The newer pelagic trawler is highly automated, technologically advanced, very expensive and capable of taking 1m tonnes of fish in a single tow.

Crucially, the trawls themselves have no direct impact on the sea bed and by-catch of demersal species or other species is not an issue. Since they do not have the destructive qualities of nephrop trawls and scallop dredges, the analysis has assumed that the restrictions do not apply to pelagic trawls. The case for including pelagic trawls now needs to be considered.

The vast majority of Scottish pelagic trawling occurs outside the 3 NM limit. The VMS data suggested £4 m occurred within 0-6 NM of the coast within the East Coast IFG area in 2011. MS compliance staff believe that these landings were not actually caught within 6 NM and that there is another explanation. It could be an (unlikely) VMS anomaly, a data entry problem somewhere in the system, or a contrived outcome associated with quota restrictions.

The only area with substantial volumes caught inshore appears to be Shetland where the VMS data suggested a number of very large inshore catches totalling over £9m in value although in other years large shoals can be caught inshore in the Western Isles.. With respect to Shetland, it was estimated that mobile demersal gear restrictions gear delivered small or negative change in jobs or NEV. The inclusion of pelagic trawls will mean that restrictions on all mobile gear would decrease employment and reduce NEV.

If Shetland is excluded, the total inshore pelagic trawling catch is put at £400,000 generating a profit of just over £100,000. This profit sum would represent the maximum annual loss of Scottish NEV if pelagic trawling was also was restricted. Most of this is associated with the West Coast Herring fishery which is extremely variable in both volume and location. Many years only a fraction (as low at 25%) of the quota is caught.

In practice, the loss to operators would be considerably lower than £400,000 because there are a number offsetting effects. If pelagic mobile effort is precluded within 3 NM, there are good substitution possibilities outside 3 NM, simply because the targeted fish are not permanently resident within 3 NM. Indeed, the trawlers were probably inside 3 NM because they have followed a shoal.

Unless fish are simply not in the area, there is little prospect that pelagic profits (i.e. NEV) would fall by £100,000. The value of their landings will probably remain constant but, if they have to steam further, the impact of the restriction will be manifest in some increase in their operating costs. Given that, excluding Shetland, most pelagic species are to be found outside 3 NM a relatively modest increase in steaming costs could be expected.

No matter how modest they are, needless cost increases should obviously be avoided. However, if pelagic trawlers are excluded from fishing within 3 NM there are some counterbalancing economic benefits. Despite very limited vessel numbers (21), the gear conflict survey still generated 10 conflict incidents with pelagic trawlers. Of these, 20% were seen as deliberate. The single pelagic respondent put the conflict value at £15,000 but, assuming the lower mean value per conflict of £6,923, the annual benefit of avoiding conflict is £69,230. From society's perspective, the least cost option for realising these benefits is to re-direct pelagic mobile effort. This is because vessels targeting shellfish are exploiting a permanently resident stock. Unlike pelagic vessels, they do not have good substitution possibilities.

There is a second benefit which is associated with RSA. Although mackerel is not a particularly prized species amongst keen sea anglers, they provide entry level anglers, family groups, youngsters and occasional anglers with a rewarding catch. Over the summer months, a shoal of mackerel in a large sea loch system can potentially improve the quality of the sea angling or the holiday breaks for large numbers of individuals. Mackerel worth £400,000 and taken by trawls within 3 NM probably represent a shoal of around 400,000 fish which are no longer available to local sea anglers. If only 10% of these fish were caught recreationally it is not unreasonable to suggest that each would add on average a £1 to the value of the recreational experience. Improved catches might encourage more return visits to coastal locations and increased visitor spending.

Overall, excluding Shetland, pelagic trawling inside 3 NM contributes very little to Scotland's NEV and probably nothing to employment. If pelagic trawling was restricted within 3NM there might be a modest increase in trawler operating costs. On the positive side, gear conflict would be reduced and the quality of RSA would increase with knock on effects on coastal income and employment.

In conclusion, if increased employment opportunities and enhancement of Scotland's NEV are desirable outcomes, there is a case for also restricting pelagic trawls from inshore areas.

23.3 Implications of Individual IFG's Restricting Mobile Gear

Thus far the analysis undertaken is of the impact of national restrictions on Scotland and on each IFG. The study has not explicitly addressed local impact of an individual IFG unilaterally imposing a mobile gear restriction. Whilst the local impact of a local measure is different from the local impact of a national policy, the differences might be relatively minor. We consider this issue below

With a nationwide restriction a trawler will either simply fish outside the restricted area or in some way cease fishing. Fishing outside 1 or 3 NM across all IFGs will continue as before.

If individual IFGs impose limits on mobile gears it seems possible that those who prefer to work in sheltered inland waters may move some effort to adjacent inland waters whilst continuing to work from their home port. For example, most of those fishing in the Sound of Mull might simply swap sides if the North West or South West IFG introduces a mobile restriction. Possibly of more significance would be transfer of operations on a weekly or longer basis to another IFG. For example boats based in the South West could transfer their effort to the Outer Hebrides, tying up, when necessary, in Castlebay or Stornoway but returning home to Oban or Luing. Thus a key question is how many would transfer. If this is likely to be widespread then individual IFG bans might be less attractive.

On the other hand, if one IFG imposes a restriction and enhances the local quality of its RSA and RD, then the area not only retains more of its anglers and divers it will attract a bigger proportion of anglers and divers from other areas. As we have seen, the key variable driving recreational values is population size.

Whether an IFG would be better off with its own unilateral restriction or as part of a nationwide restriction depends on the balance of the negative aspects of increased effort transfer and the positive aspects of increased marine recreation. IFG areas with large local populations and small numbers of mobile operators would probably be even better off with a unilateral restriction. In contrast, remote IFG areas with small local populations, large numbers of mobile operators and neighbouring IFG's offering good substitution possibilities might be better off with a nationwide restriction. We consider these issues below

23.3.1 Transfer of fishing effort between IFG's.

The first approach taken here is to assess the numbers currently fishing close to the boundary. The logic is that trawlers are unlikely to travel significant distances on a daily basis to fish in waters close to the shore in another IFG when a major penalty of a ban is the additional cost of fuel.

The first assessment is to identify the number of vessels in registered in ports close to the boundaries. The Table below gives details

Table 23.3.1Transfer of Effort: IFG Border Ports

IFG Border	PORT	OVER 10m	UNDER10m	TOTAL	%of IFG
South West	**Oban**	21	45	66	21.3%
North West	**Fort William**	1	6	7	3.1%
South West / North West Border		**22**	**51**	**73**	**13.7%**
North West / MF&NC Border		**No Ports Close**			
MF&NC	**Scrabster**	2	50	52	28.4%
Orkney	**Stromness**	4	1	5	3.1%
MF&NC –Orkney Border		**6**	**51**	**57**	**16.6%**
MF&NC	**Rosehearty**	0	6	6	3.3%
East Coast	**Fraserburgh**	75	75	150	34.6%
MF&NC Orkney		75	81	156	25.3%

In some ways this is misleading. Many vessels, particularly creelers but also including mobile operators, often operate out of what are termed Creeks. The table below gives a list of such Creeks.

Table 23.3.2 Transfer of Effort: IFG Creeks

South West	**North West**	**North&Moray**	**East**
Ardrishaig	Achiltibuie	Avoch	Aberdeen
Arran	Ardnamurchan	Brora	Anstruther
Ayr	Arisaig	Buckie	Arbroath
Ballantrae	Aultbea	Burghead	Boddam
Bruichladdich	Bracadale	Culkein& Drumbeg	Burnmouth
Bute	Broadford	Dunbeath	Burntisland
Campbeltown	Corpach	Eriboll	Cove
Carradale	Dunvegan	Gardenstown	Crail
Coll	Fort William	Helmsdale	Dunbar
Colonsay	Gairloch	Hopeman	Eyemouth
Crinan	Glenuig	Invergordon	Fraserburgh
Drummore	Kinlochbervie	Inverness	Gourdon
Dunure	Kyle	John O'Groats	Granton
Gigha	Kylesku	Keiss	Johnshaven
Girvan	Lochinver	Lossiemouth	Methil & Leven
Islay	Mallaig	Lybster	Montrose
Jura	Portree	Macduff	North Berwick
Kirkcudbright	Salen	Pennan	Peterhead
Largs & Greenock	Scalpay	Portknockie	Pittenweem
Loch Buie (Mull)	Scourie	Portmahomack	Port Errol
Loch Scridain (Mull)	Sleat	Portskerra	Port Seton
Luing	Snizort	Portsoy	St Abbs
Maidens	Strathaird	Rosehearty	St Andrews
Oban	Torridon	Sandhaven & Pitullie	St Monans
Port Askaig	Ullapool	Scrabster	Stonehaven
Port Ellen	**Outer Hebrides**	Whitehills	**Shetland**
Portpatrick	Barra	Wick	Central Mainland
Stranraer	Benbecula	**Orkney**	Lerwick
Tarbert	Bernera (Lewis)	Hoy	Northmavine
Tayinloan	Berneray (N Uist)	Kirkwall	S Mainland & Fair Isle
Tayvallich	Grimsay	Rousay	Scalloway
Tiree	Lochs	S Ronaldsay	Skerries
Tobermory (Mull)	North Harris	Sanday	Tingwall
Troon & Saltcoats	North Uist	Stromness	West Mainland
West Loch Tarbert	Portnaguran & Ness	Stronsay	Whalsay
Whithorn	South Harris	Westray	Yell, Fetlar & Unst
	South Uist & Eriskay		

The creeks close to the border are coloured. Around Cape Wrath the nearest creeks are Kinlochbervie and Loch Erribol, both over 20 Km from Cape Wrath. It seems unlikely that there would be any transfer. There are creeks in southern Orkney and creeks on the other side of the Pentland Firth. There may well be transfer across that border. Boats from the sizeable Oban fleet are also likely to cross the border as are boats from Fraserburgh and Rosehearty/Sandhaven.

To obtain some idea of the potential size of the transfer current catches close to the boundary have been examined. Wherever there is a boundary in the 3NM zones, the catch value within 3NM of that boundary is assessed. This was achieved by creating buffers along the boundaries. In the case of VMS data the vessels and catch in those buffer zones was assessed as discussed in Section 6.2.2. In the case of the ScotMap data the procedures discussed in Section 6.2.3 were used to identify catch value in the buffer zones. The figure below illustrates the border between the South

West and North West IFGs with the “Pings” representing fishing by dredgers.

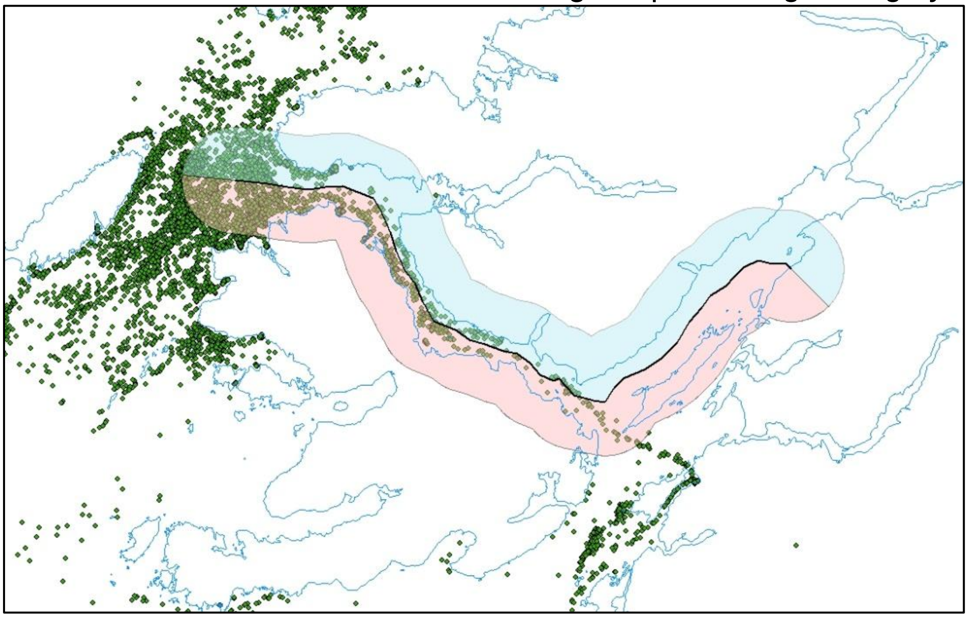

***Fig 23.3**: The Sound of Mull, IFG border and dredger VMS pings*

The tables below show the value of the catch in these buffer zones by: vessels >15m (VMS); vessels 15m and under (ScotMap); total value as a percentage of the catch in the IFG.

Table 23.3.3 Value of Catch in IFG Border Areas >15m

Border	Side	Demersal	Nephrops	King Scallops
South West / North West	North West	£86	£18,311	£140,071
	South West	£230	£42,062	£235,121
North West / MF&NC	MF&NC	£1,043	£4,736	£21,764
	North West	£240	£0	£17,913
MF&NC / Orkney	MF&NC	£5,671	£771	£39,504
	Orkney	£0	£0	£7,912
MF&NC / East Coast	MF&NC	£10,732	£12,110	£1,778
	East Coast	£12,709	£6,005	£1,387

Table 23.3.4 Value of Catch in IFG Border Areas 15m and under

Border	Side	Demersal	Nephrops	King Scallops
South West / North West	North West	£0	£21,621	£2,819
	South West	£0	£21,537	£3,808
North West / MF&NC	MF&NC	No areas identified for 15m and under		
	North West			
MF&NC / Orkney	MF&NC	£0	£0	£3,596
	Orkney	£316	£0	£2,243
MF&NC / East Coast	MF&NC	£5,050	£2,548	£0
	East Coast	£4,006	£2,216	£0

Table 23.3.5 Total IFG Border Catch and % of Border catch in IFG

Border	Side	D'rsal	%	Nephrops	%	King Scallops	%
South West / North West	North West	£86	0.0%	£18,311	0.5%	£140,071	20.7%
	South West	£230	0.7%	£42,062	0.5%	£235,121	7.2%
North West / MF&NC	MF&NC	£1,043	0.1%	£4,736	0.2%	£21,764	4.2%
	North West	£240	0.0%	£0	0.0%	£17,913	2.7%
MF&NC / Orkney	MF&NC	£5,987	0.7%	£771	0.0%	£39,504	7.6%
	Orkney	£5,050	12.0%	£0	0.0%	£7,912	3.7%
MF&NC / East Coast	MF&NC	£14,738	1.7%	£0	0.0%	£1,778	0.3%
	East Coast	£12,709	1.5%	£0	0.0%	£1,387	0.7%

These tables suggest that the transfer across boundaries if a ban was introduced by a single IFG would in most cases have an extremely limited effect.

In general, the daily movement of commercial fishing effort across IFG boundaries because of a 1 or 3 NM ban on trawling and dredging will probably be very limited. It will normally not be sensible for a Nephrops trawler to travel far enough to fish within 1 or 3NM from the shore in a neighbouring IFG. The major exception would be if the neighbouring area had a relatively unexploited hot spot.

Potentially, the 1 or 3NM restriction could have a bigger impact on scallop dredgers. They are generally more mobile because the ground they exploit needs time to recover before being dredged again. This greater mobility across IFG boundaries might mean they would spend less time in their home IFG were the home IFG to introduce a 1NM or a 3NM restriction. The problem would be especially acute in what appear to be very rich scallop beds in the Sound of Mull which is split between the South West and North West IFGs. Difficulties in policing would make the enforcement of different policies problematic.

On the basis of the expected benefits to society it would appear that the most likely areas to introduce restrictions on mobile gear would be the South West and the East. It is difficult to know the numbers that might undertake a weekly commute to a neighbouring IFG which does not have a restriction on mobile gear. The most likely would appear to be along the West Coast however it seems unlikely that small boats based in the Clyde would choose to round the Mull of Kintyre on a regular basis to fish more sheltered waters. For these boats a permanent transfer seems more likely.

Even for west Kintyre based boats regularly crossing the Minch to reach sheltered waters seems unlikely. Movements north towards Mallaig and Ullapool might occur but overall giving up or transferring to fixed gear would seem more likely. As a consequence we assume that the impact on commercial fishing in unrestricted areas (and the fish stocks in those areas) will be small.

23.3.2 Impact of Individual IFGs Restrictions on Recreational Activities

Changing IFGs by sea anglers and sub-aqua enthusiasts would be normal if the activity was better elsewhere. The marginal travel time and monetary costs of someone in the central belt switching IFGs could be quite small and relatively small improvements in the quality of sea angling and diving could be sufficient to induce a change in location. Our hypothesis is that if an IFG area is subject to a 1 or 3NM restriction this will improve the quality of the recreational experiences for these activities and hence this IFG and the area will see movement to it at the expense of IFG area who have no restrictions. A major problem is that the flow will be dependent not only upon whether the IFG in question but which other IFG areas also have a restriction. For example the transfer into a protected East IFG could be significantly determined by the presence or absence of a ban in the South West. There are some 64 combinations to be modelled for the effect of a ban in each IFG.[63]

In transport economics the flow of people or goods between areas is normally modelled by a gravity model $F_{ij}=aO_i^{\alpha}O_j^{\beta}\exp^{\delta dij}$ where F_{ij} is the flow from area i to area j, O_i are factors that determine flow from i to j, O_j the factors determining the flow from j to i, d_{ij} is the distance or time between i and j ,and a, α, β α and δ are constants to be determined. Exp is the exponential operator.

In an analogous way we can model the numbers moving for one IFG by letting F_{ij} be the recreational activity leaving i for j, O_i the population that would be available to transfer and O_j the miles of protected coastline to transfer to. As an example the additional value of activity that would flow into the South West (a physically very large area) from the East (with a large population) over a relatively short distance would be substantially higher than any additional value from Shetland to the North West. The problem is that we have no data to estimate the critical constants.

One possibility is to make assumptions about a limited number of key flows and use these to obtain some realistic parameter values. These can then be used to look at some key combinations such as both the South West IFG and the East IFG instituting bans and no others.

From the results we know that the most important variable is the population of the IFG and the IFGs have widely different population levels. The South West population is 44.6% of the total Scottish population (see Section 20.3), whilst the East is 47.4%. A nationwide restriction generates very high employment levels and very high NEV values. This is because the large recreational sector generates high positive values which are a different order of magnitude than the negative impacts on commercial fishing. A unilateral restriction could reduce employment and NEV estimates, but this would require a massive adverse impact on the commercial sector and a small percentage positive impact on the recreational sector. This is unlikely and even if it did, there is no prospect whatsoever of a unilateral restriction delivering negative values for employment or NEV. With respect to the South West IFG and the East Coast IFG there is nothing to be gained by estimating gravity models. Based on the results the same argument could be applied to the Moray Firth and North Coast IFG, though the NEV value for the 0-1NM restriction is more marginal. The position is more finely balanced for the North West. In this area the marine recreation sector is smaller but has potential. Some scenarios generate quite high FTEs, though NEV values are balanced between positive and negative values. Given the above analysis of commercial fishing substitutions, it is difficult to generalise about whether a

[63] There are 6 possibilities of 1 other with a ban, 15 with 2 others, 20 with 3 others, 15 with 4 others and 6 with 5 others. To this we add the effect of no others and all others giving 64 possibilities.

unilateral restriction would increase or decrease estimated FTE and NPV values. The case for 0-3NM mobile restrictions is stronger for the Outer Hebrides on employment grounds, but there are insufficient grounds for generalisation about the impact of unilateral restrictions. Orkney's marine recreation, primarily RD has an enviable reputation and the nationwide restriction delivers high estimates for employment. The unilateral restriction would most probably deliver even more employment. Given these considerations, only the North West would require the development of gravity models.

23.4 Additional Licences for Creeling

A restricted licensing system might constrain delivery of all the potential benefits from restricting mobile effort in inshore areas. The extent to which creelers can expand into the notional territory vacated by mobile operators depends on their ability to obtain the relevant licence with shellfish entitlement.

One important part of the model is that creeler numbers are limited by the availability of licences, not by the fishing resource or potential fishermen. The model assumes that there will be some loss of licences for the more powerful trawlers but some gain not only by transfer between trawlers and creelers but also more efficient utilisation of the existing licence stock, such as those attached to vessels fishing part-time.

The availability of licenses is effectively constraining the expansion of creeling and the creation of jobs in that segment. We examined the consequences of making more licences available. This was done by modifying the model introducing an assumption that the number of new creelers will be 150% of the number of trawlers leaving the sector. Although this will lead to a slight positive demand for fishermen the processing sector will be adversely affected and the numbers overall in the fishery sector will still decline. The overall result is a relatively small increase in welfare and a much more substantial increase in employment in the industry. Since there is little prospect of more licences becoming available we do not report the results

24 Interpreting the Results

The fish stocks in Scottish waters are owned by everyone collectively and should be managed on behalf of the public. This study was instructed to embrace the philosophy that policy options should be evaluated in terms of their impact on the public and not just the commercial fishing sector. The purpose of this study is not to advocate a particular course of action. It is simply concerned with identifying who gains and who loses as a consequence of the proposals and calculating by how much. As such, this study is primarily producing estimates for others to use.

It is nonetheless appropriate briefly to address the context within which the results might be used and interpreted to help avoid their innocent or culpable misuse.

24.1 Reliability of the Estimates

Before discussing the issue of reliability, it is appropriate briefly to review the process and highlight areas of relative weakness. The first stage was a benchmarking exercise which presents an account of how Scottish inshore fisheries (to be consistent with IFG boundaries, defined as 0-6 NM) are currently prosecuted. Specifically, the benchmarking estimates inshore catches by species type, by gear type, by distance zone by IFG area.

As well as benchmarking the commercial fishing sector, the study also presented a detailed description of the diverse stakeholder groups whose income, employment and/or general well-being might be affected by the proposed restrictions.

As a predominantly desk study the reliability of the benchmark estimates is largely driven by the existing body of knowledge. The evidence base used to construct the benchmark estimates is patchy.

The most reliable estimates are probably those relating to the commercial fishing sector where data from VMS, Scotmap and the Gear Conflict Survey were used. These benchmark estimates were scrutinised for anomalies by every Fishery Office in Scotland. Whilst there are issues relating to non-response, particularly in relation to the Gear Conflict Survey, it is doubtful whether further research effort could be justified in terms of the improved precision of commercial fishery benchmarks.

The available secondary information on RSA in Scotland is extensive and probably robust enough to withstand the repackaging necessary to reflect the geography of the IFGs. The information on RD was more piecemeal and some benchmark estimates were influenced by expert opinion. However, because the activity itself is less significant the higher level of uncertainty surrounding the RD benchmark estimates was acceptable. With respect to other marine recreational activity, the existing body of knowledge was simply not capable of supporting a benchmark exercise, despite the potentially large number of participants. We note the possibility of the GPNUV capturing some recreational use values.

Given the benefit transfer process, there are issues around the estimates of the current Options Value and General Public Non-User Values. There are concerns about whether the estimates are robust enough to withstanding the manipulations required by the benchmark exercise (which estimates *current magnitudes* of OV and

GPNUV for Scotland and the IFGs) and the subsequent analysis of the policy options.

It should be appreciated that building on the benchmarking, the policy analysis does two things. Firstly it has to decide whether the benchmark estimates (ie current magnitudes) are relevant. If we assume a status quo scenario of “stability” current magnitudes are completely ignored. They only become a candidate for inclusion if we assume a status quo scenario of “decline to zero”. In fact, only the current magnitude estimates for RSA, OV for RSA and GPNUV are included in the “decline to zero” scenario. Thus, unreliable benchmark estimates never influence the “stability” scenarios and some (current magnitudes of RD and OV of RD) do not feature appear in the decline to zero scenarios.

Second the policy analysis has to estimate the sensitivity of the current magnitudes to changes in the marine ecosystem. We reached the following conclusions:

- Based on how RSA responded to declines in fish stock availability, it is reasoned to be highly sensitive to changes in fish stock availability (between 50% and 10% depending on the policy impact scenario).
- RD is less responsive and less significant, and only ever features in the stability scenarios). Its sensitivity is between 20% and 5% depending on the policy impact scenario).
- The OV for RSA and RD was assumed to be largely insensitive to changes in the marine environment it and drops out of the stability scenarios.
- The change in GPNUV was estimated by McVittie and Moran (2010)

The table below summarises.

Policy Impact Scenarios

		Major Transformative Effect	**Environmental Change not Fully Reversible**	**Limited Impact**
Status quo scenarios	**Continued Decline to zero**	RSA + 50% of RSA OV of RSA GPNUV +£6.6m pa[64]	RSA + 25% of RSA OV of RSA GPNUV +£6.6m pa	RSA + 10% of RSA OV of RSA GPNUV +£6.6m pa
	Stability	50% of RSA 20% of RD £6.6m pa of GPNUV	25% of RSA 10% of RD £6.6m pa of GPNUV	10% of RSA 5% of RD £6.6m pa of GPNUV

Overall, apart from commercial fishing and to a lesser extent RSA, the unreliability of some of the benchmark estimates and estimates of their sensitivity is fully acknowledged. However, the implications for the reliability of the policy evaluation depend on how these ‘less reliable’ estimates are used and the extent to which they influence the final result.

[64] For Scotland as a whole, as estimated by McVittie and Moran (2010)

24.2 The Range of Estimates

As stated previously any economic evaluation is based on comparison about what might happen with and without the policy initiative. This requires predictions about how the marine environment and stakeholders groups would respond to the proposed restrictions on mobile gear. The problem is that the NEV/CBA and EIA results are sensitive to the assumptions one makes. A single set of results for a given IFG would be predicated on a particular status quo scenario a policy impact scenario as well as many assumptions about stakeholder and marine ecosystem response. A single set of results would have a spurious level of accuracy and probably should not be allowed to influence policy.

This study does not therefore seek to provide a single economic evaluation. Instead, the study has developed a model which allows informed users to vary the assumptions and parameters for themselves, and thereby explore how these changes impact the results. For example, the study provides estimates relating to illustrative scenarios where the restrictions on mobile gear produce a change in the marine environment and scenarios where they do not. This enables those involved in the debate to see whether transformation of the marine environment is a necessary condition for delivering additional jobs, or generating an excess flow of policy benefits over policy costs.

Whilst a single set of results are probably irrelevant, an indicative set of results which embrace the extremes provides a more convincing insight. This report therefore has chosen to present indicative sets of results for Scotland as a whole and for each IFG area.

Significantly, the indicative results for each IFG are bookended by the MFO and LFO outcomes. Not expectedly, this has produced a wide range with some MFOs being a factor of 10 times the LFO. Rather than being a cause for concern, the wide range should be a re-assurance that the evaluation process has captured the uncertainty associated of an economic evaluation which is reliant on informed judgements about the future.

The problem with presenting the analysis for each IFG as an indicative set of results is that the implications for policy can be equivocal if the range of results straddles positive and negative estimates.

24.3 The Equivocal Results and their Implications

Results ranging across positive and negative values are generated for:

- Employment and NEV estimates relating to mobile restrictions applying to 0-1 NM and 0-3 NM for the North West IFG.
- Employment and NEV estimates relating to mobile restrictions applying to 0-1 NM and 0-3 NM for the Outer Hebrides.
- Employment estimates relating to mobile restrictions applying to 0-1 NM and 0-3 NM for MFNC where marginal negative employment estimates were generated for the LFOs.

Whilst the overall balance is heavily weighted towards positive values, there might still be some reluctance to implement mobile gear restrictions. This is because the costs imposed on the mobile sector are possibly less uncertain than the gains elsewhere.[65] There might be an understandable reluctance to trade jobs which exist now for jobs which, under some circumstances, might not be created in sufficient numbers to replace the jobs lost.

A case can be made for further research efforts to try and reduce this uncertainty, particularly around the LFO estimates which create the unease. This research should focus on the stakeholder groups which have the greatest impact on the results and be targeted on the key assumptions and parameters which relate to them.

In the case of Orkney and Shetland, the estimates for employment and NEV are all positive but only marginally positive and have a relatively narrow range. Before being used to inform policy it would probably be sensible to also regard these two areas as being worthy of further targeted research.

With respect to Scotland as a whole all the indicative results are positive. However, the analysis predicts that the North West and Outer Hebrides could conceivably deliver negative contributions to employment and NEV. A Scottish wide restriction on mobile gear that included these areas might therefore deliver less employment gains and a lower NEV contribution than more selective restriction. Until further research reveals otherwise, the Scottish wide results should also be regarded as equivocal in terms of informing the case for introducing a Scotland wide restrictions on mobile gear.

24.4 The Results: South West, East Coast and MF&NC

Normally, we would expect that, over time, the Scottish population would be better off with a more productive marine environment which supports a greater biodiversity and biomass and delivers a greater flow of environmental service benefits. Indeed, it would be difficult to argue that Scotland as a whole would be better off if inshore marine biodiversity and biomass were to be further compromised.

Taking a broad overview, the proposed restrictions on mobile gear mean that nephrops and scallops will still be caught within 0-1 NM or 0-3 NM, albeit in smaller quantities using more labour intensive static gear and hand-diving[66]. This switching of gear type is expected to improve environmental quality and deliver more economic benefits to broader sections of the population. Some sections of the population would be better off simply knowing that parts of the marine environment are protected and improving. Others might be better off because of improvements in their marine recreational activity. Others would be better off because of the income and employment created by the spending of participants in marine recreation. It would therefore be a major surprise if the policy evaluation were to result in negative values for either the jobs created across Scotland or the change in Scotland's NEV.

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[65] If the probabilities were known, we could have provided expected value estimates which weight costs and benefits according to the probability of their occurrence. However, this is obviated by the use of the model to produce a whole range of results, each based on a different set of assumptions.

[66] It is possible that fish stocks may recover sufficiently to support a commercial line fishery.

By the same reasoning, we expect that areas with high populations would not produce negative estimates. Thus, with respect to the South West and East Coast results, even the LFO cannot generate negative values for NEV or the change in employment. According to our categorisation, these two areas account for 92% of the Scottish population. If Scotland, as a whole would be better off, we can expect a similar result for these two areas. The MF&NC which accounts for about 5% has similar NEV results, but could conceivably deliver a small decrease in employment under the LFO assumptions.

24.5 Implications: South West and East Coast Results.

A significant excess of policy benefits over policy costs implies there is a current resource misallocation. If corrected, in the South West and East Coast IFG areas, we would expect the flow of benefits to exceed the costs (with any policy initiative there will always be some losers). Given this, even if the gainers were to fully compensate all the mobile operators, the gainers would still be better off. On the basis of the benefits exceeding losses, the 1NM but particularly the 3NM restriction, offers the *potential* to make everyone better off[67]. Moreover, if the losers are somehow more than fully compensated then everyone is *actually* better off.

Thus, one clear implication of the results is that the gear restriction is an opportunity to correct a resource misallocation and (potentially or actually) to improve the wellbeing of all stakeholders.

In passing, it should be appreciated that this excess of benefits over costs is the reason why societies as a whole generally welcome, say, new technology, despite the fact that new technology makes someone somewhere worse off. Essentially, societies embrace new technology because of the opportunity to make everyone better off, should it wish to do so. Since decision makers are tasked with managing fisheries in the public interest, they might be persuaded about the overall merit of a 1NM or 3NM restriction simply because (like new technology) it could make everyone better off and therefore be preferable to the status quo.

With respect to the employment issue, it is highly regrettable that some jobs, directly or indirectly, dependent on mobile gear will be lost. However, it would appear that, for the South West and East Coast, restricting mobile gear use creates, in the longer term, many more jobs than it loses. Thus, rather than creating employment, in some coastal areas the current deployment of mobile gear might be constraining economic and employment growth.

24.5.1 South West and East Coast: Defending the Status Quo[68]

There are four obvious defences that might be offered for not correcting the resource misallocation and maintaining the status quo. These are briefly addressed below.

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[67] The authors are not competent to offer comment or guidance as to whether trawlers and dredgers should be compensated.

[68] This discussion relates only to scenarios where benefits exceed costs and where more jobs would be created than lost. When gains and losses are finely balanced there is less scope for a discussion that avoids interpersonal comparisons.

24.5.1.1 Sympathy for the mobile segment

Since no-one likes to see anyone being made worse off, local politicians and officials might express concerns for the mobile sector's desire to earn a living and to continue with current practice. These feelings are understandable, well-meaning and may be deeply held; they will be shared by very many others.

Despite the excess of benefits over costs, a continued preference for the status quo arising simply from an innate sympathy for the mobile sector is an admission that, in this instance, inshore fisheries might not be managed in the wider public interest.[69]

24.5.1.2 Disadvantaging low income groups / fragile communities

The argument here is that whilst many more jobs might be created than lost, the jobs lost are in fragile coastal communities. The implicit suggestion is that a job lost in a coastal community is worth more than a job elsewhere. We examined the economic dependency of fishing communities and concluded that there was nothing exceptional about fishing communities that would require an exceptional response. Also, a significant proportion of the jobs created will be in coastal areas in creeling, hand diving, lining and servicing marine recreation. Employment in some communities regarded as fragile could expand rather than contract.

In a similar vein, it might be argued that the mobile gear restrictions disadvantage lower income and vulnerable groups (e.g. trawler and dredger crew) while improving the lives of creelers, hand-divers, local hoteliers or higher earning wildlife enthusiasts, divers and sea anglers. This could be factually correct though we were not asked to examine the income distribution dimension. However, it might be is better to introduce the gear restriction and use the resulting benefits to compensate trawler crews; thereby making everyone better off.

Against a background of high NPV and FTE estimates, a preference for the "business as usual" option would possibly constrain the economic development of coastal communities.

24.5.1.3 Uncertainty

A status quo defence could be based on uncertainty. A major source of uncertainty is about how the ecological system is going to respond to the 1 NM or 3 NM prohibition of mobile effort. Similarly, we cannot be entirely sure how the inshore ecosystem would develop if Marine Scotland continued to adopt a strategy of "business as usual".

Given this biological uncertainty, some might be tempted to suggest that we should wait until scientific advice better supports the case for gear restriction (i.e. "we first need to do the science"). It is relevant to know that, since societies prefer less risk of biodiversity loss, there is a cost associated with the on-going environmental risk inherent in the "waiting for science" option.

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[69] Or the interests of the static gear, hand diving, and lining segments.

Biological uncertainty only matters where an excess of gains over losses is dependent on a positive transformation of the ecosystem. It is possible that a switch of fishing effort from mobile to static gear might, *of itself*, generate more gains than losses. In which case, there is no need to do the science. Inspection of the results for the "Commercial Fishing" sector reveals that there are a number of scenarios where this could happen[70]. In these scenarios, implementation of the gear restriction generates an immediate excess of gains over losses, plus the benefits from reduced environmental risk and the added bonus of a future flow of benefits predicated on the (uncertain) ecosystem transformation. Thus, biological uncertainty and the need for more science only become relevant if the excess of gains over losses is dependent on ecosystem change. The choice between implementing gear restrictions now or waiting and undertaking more science can be summarised in the payoff matrix below

Table 224.2 Pay-Off Matrix

	The system will transform	**The system will not transform**
Wait, undertake more science and then implement if appropriate	• Science Costs incurred (-ve) • On-going risk of status quo exploitation levels (-ve) • Forego the excess of benefits over costs whilst waiting (-ve)	• Science Costs incurred (-ve) • On-going risk of status quo exploitation levels (-ve) • Avoid the excess of costs over benefits whilst waiting (+ve)
Implement now	• Science Costs avoided (+ve) • On-going risk eliminated (+ve) • Generate an excess of benefits over costs from year 1(+ve)	• Science Costs avoided (+ve) • On-going risk eliminated (+ve) • Generate an excess of costs over benefits until realisation that the environment will not transform (-ve)

In scenarios where the gains over losses are dependent on ecosystem change ***and the system does transform***, it is better to have implemented than to have waited for scientific knowledge to predict this outcome.[71] This is because we get the net gains sooner, plus an immediate reduction of environmental risk and there are no

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[70] The relevant row is the first row of the results table for each IFG area.

[71] This discussion presupposes that further research is capable of delivering a conclusion that the marine ecosystem will recover. Given the complexities and uncertainties about how marine ecosystems react to stimuli, it is highly unlikely that any marine ecologist would give an unequivocal reponse. It is more likely that further research would simply reduce some of the uncertainty and highlight the need for more research.

marine science costs. The “waiting for science” option would have been a policy error, which could have resulted in the further damage to the ecosystem which might have taken years to rectify. Thus, if the system does transform and the benefits are predicted to exceed the costs, implementation is always better than waiting.

In scenarios where the predicted gains over losses are dependent on ecosystem change ***and the system does not transform*** then the losses from imposing the gear restriction would exceed the gains. Implementation of the gear restriction would be a policy error to be corrected through removal of the restriction. On the positive side, by implementing we have saved the marine science costs[72], plus the gear restriction would have removed a perceived environmental risk, albeit one whose (temporary) removal did not deliver the expected environmental transformation. Whether it would have been better to wait, or to implement, depends on the relative magnitude of the science costs, the environmental risk, the time period involved and the excess of costs over benefits. There are, however, other issues to be considered. Firstly, this discussion assumes that further scientific research is capable of delivering a conclusion that the marine ecosystem will not transform. The case for waiting is less convincing, if this capability does not exist. In other words, it might be better to implement, observe the outcome and then correct the policy error. On the other hand, the policy error might not be easily rectified in terms of recovering the previous status quo. Whilst status quo recovery is not conditional on ecosystem change, policy induced changes to the inshore mobile fleet segment might be irreversible.

Viewed overall, if we immediately implement the gear restriction the worst possible outcome is that there is a (temporary) excess of losses over gains, with the possibility that the previous status quo may not be fully recoverable. This is counterbalanced by reduced environmental risk and a saving on science costs. If we wait for scientific knowledge the worst possible outcome is that we have to wait longer for the net gains, we have incurred marine science costs, the results may be inconclusive and the ecosystem could have suffered further damage.

In circumstances where estimated employment gains are high, and, estimated benefits are a significantly higher order of magnitude than the expected value of costs (i.e. high NEV) it might not seem rational to wait five, ten or twenty years until marine science has advanced sufficiently to reduce the uncertainty about the inshore ecosystem response.

Another source of uncertainty relates to the accuracy of economic estimates. This was discussed above and we have identified the equivocal results where further targeted research might be helpful. We have also explained that the unreliable benchmark estimates (eg OV abd GPNUV) often have little significance for the analysis of policy, or can simply be ignored through appropriate scenario selection. Even when we assume the LFO, we still have positive values for the South West and

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[72] Science costs could be incurred if MSS is asked to check on the progress of ecosystem transformation. On the grounds that ecosystem transformation could be regarded as a means to an end, an alternative approach would be to by-pass ecosystem monitoring and focus on the progress of economic and behavioural change among the various stakeholder groups.

East Coast. With respect to the South West and the East Coast, the existence of some uncertainty is, of itself, a weak justification for preferring business as usual.[73]

24.5.1.4 The Possibility of a Better Policy Measure

It could be argued that an IFG wide restriction is too crude to deal with the geographical and biological variability across large IFG areas such as the South West and East Coast. There might be other policy initiatives that could emerge from within the IFGs. These initiatives would have to be fully evaluated, in much the same way as this study has evaluated the 0-1 NM and 0-3NM proposals.

The issues here are very similar to the question addressed above of whether we should wait and undertake more science before implementing the mobile gear restriction. In this case the question is whether we should delay implementation whilst waiting for other policy options to emerge and be evaluated. If we delay, we forego the additional NEV and jobs the gear restriction would deliver. On the other hand, another policy option might emerge which delivers even more NEV and jobs.

The obvious point to make is that a better policy might not emerge. Also, if a better policy does emerge it might not be mutually exclusive with an IFG wide restriction. Even if the policy was mutually exclusive the IFG wide restriction could be rescinded (just as it was in 1984).

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[73] It is worth stating that the proposal to restrict mobile gear within 1 or 3 NM of the shore in the South West and East Coast is probably consistent with the Precautionary Principle which was enshrined in principle 15 of the Rio Declaration emerging from the 1992 Rio Conference on the Environment and Development. The Rio formulation states that: *"in order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".* In April 1999, the European Council adopted a resolution urging the European Commission "to be in the future even more determined to be guided by the precautionary principle in preparing proposals for legislation."

25 Creel Limits.

25.1 Introduction

In 2013, Marine Scotland published the outcome of a consultation on new controls in the nephrops and crab and lobster fisheries[74]. The conclusion was that there was no appetite for the imposition of **national creel limits** and that, given the lack of evidence, there is no proposal to introduce them. The consultation concluded that, at the local level, creel or other limits may have a role to play. At the same time, the majority of IFG's management plans have indicated a desire for local creel limits, as well as some other gear restrictions.

The IFG Management Plans do not provide details of how creel limits would operate and the purpose of this section is to examine the key questions that need to be addressed when developing a creel limit regime. This discussion is required because when developing a Creel Management Regime (CMR) the devil is in the detail. Seemingly minor changes in the architecture of a CMR could alter incentive effects which may produce unintended outcomes. These could be highly significant and very long lasting.

It should be appreciated, given the broad aim of this Section, the discussion is necessarily generalised since it does not relate to any particular IFG area, management aim, shellfish species or time frame. Thus potential outcomes which might seem relatively unimportant in one IFG area might be highly significant elsewhere. If mentioned is made of an IFG area it is only as an example. It is for users of this section to contextualise the analysis and issues to reflect their IFG area.

25.2 The Need for Creel Management

There are two rationales for managing creel effort. The first is because of the need to prevent overcapacity developing. This is the precautionary rationale. The second rationale is base on appreciation that fishing effort (or fishing mortality is presently excessive and should be reduced. This is the effort reduction rationale.

25.2.1 Precautionary Rationale

Most fisheries need to be managed to prevent overcapacity developing. Overcapacity arises because fishermen will seek to enter fisheries which are profitable and, if fisheries are unmanaged, effort levels only stabilise when profit from the fishery have been reduced to the level where entry to the fishery is no longer an attractive prospect. At which point, the biomass has been diminished and is being exploited by excessive levels of fishing effort.

[74] http://www.scotland.gov.uk/Publications/2013/10/1091/3

The overcapacity problem has a number of symptoms. Profits from the fishery may be minimal and will certainly be less than the Maximum Economic Yield. Fish biomass is lower than the biomass required to deliver Maximum Economic Yield or Maximum Sustainable Yield and can be at levels which make the stock vulnerable to collapse through disease or ecosystem change. With overcapacity, operators will probably be keenly aware that they are competing in a race to catch fish. They may regularly experience territorial congestion and gear conflict, especially when targeting stocks which are immobile, such as nephrops, lobster, king scallops and velvet crab. With respect to shellfish, the competition for territory can create incentives to leave gear in situ to prevent others fishing an area. At the same time, there is no incentive to engage in husbandry activity such as postponing capture until shellfish have reached a size which would command higher prices per Kg.

There is nothing innate about Scottish creeling for shellfish which would suggest that these fisheries would be somehow immune from the overfishing problem. Indeed, this study's survey of gear conflict did find evidence of quite widespread conflict between static gears. The general point is that fishery managers need to be alert to the possibility of excessive static effort emerging, particularly at key hot spots.

It is also worth considering what might happen if some mobile effort was removed from within 1NM or 3NM. In the very short term, more sea bed would be available for the existing population of static operators. Indeed, it is believed that mobile gear needs to exploit a larger area of sea bed and catch more nephrops and scallops than static gear to produce a given profit sum. Thus, if five trawlers were to relocate, the sea bed area they previously fished might support more than five creeling vessels.

With some mobile effort removed, catch per unit of the existing static effort should rise. The average size of nephrops landed should also rise. This is because a higher proportion of smaller nephrops, which otherwise would be killed by mobile gear, can escape though the creel mesh. In addition, territorial congestion and gear conflict should diminish. In some locations these improvements could significantly enhance the profitability from using static gear. In the medium to longer term, these improvements will attract additional static effort. Whilst the fishery should be capable of supporting some new effort, in some IFG areas there is the possibility of excessive static effort emerging. In part, this would come from some mobile operators becoming creelers, but there is also a reservoir of licences held by part time, seasonal and casual operators which could be used to expand full time static effort.

In the longer term, the replacement of inshore mobile effort with an unmanaged expansion of static effort is potentially risky. That risk is particularly acute when one area imposes a mobile gear restriction whilst neighbouring areas do not. In these circumstances, the mobile free area would probably attract static effort from neighbouring operators. Whilst, the mobile free area should be able to cope with some additional static effort, it would be sensible to have a CMR in place to ensure that the expected benefits from restricting mobile gear are realised.

Precautionary creel management should result in existing operators receiving an entitlement which legitimises their current fishing effort. Theoretically, in the short run, operators should not be worse off. In the longer run, if there is stock enhancement, operators may wish and should receive additional entitlement. Although they should be no worse off, operators will probably resist precautionary creel management. On the ground, their perception is that their fishing is profitable and profitability could increase if mobile effort is reduced. If they cannot accept the rationale, they would probably regard the proposed CMR as unnecessary and intrusive. They might even suspect MS has ulterior motives and could strongly resist the introduction of a CMR.

25.2.2 Effort Reduction Rationale

In commercial fisheries, management measures are often only introduced once overfishing has developed. In these circumstances, a CMR has to address the issue of effort reduction. Problems arise because decisions need to be made about how to ration the target level of effort among existing and potential operators. There will be resistance because, in the short run, the CMR will mean that the average operator will have to manage with fewer creels. Operators' perception is that whilst historically there were higher catches and profits, they are presently satisfactory and forced reductions in their creel numbers would be problematic.

One problem with a CMR which seeks to reduce effort is the issue of displacement. There are two dimensions to this. The first is where an IFG introduces a CMR and a neighbouring IFG does not. A proportion of precluded effort might be displaced to the neighbouring IFG. Second if CMRs are restricted to IFG areas (i.e. within 0-6 NM), a proportion of the effort precluded within 0-6 NM could be displaced outside 0-6 NM. This might not be a problem along the west coast of Scotland, where very little creeling in undertaken beyond 6 NM. The situation on the east coast is different. The brown crab fishery in particular can be prosecuted beyond 6 NM, and a CMR within 0-6 NM might displace some static gear to beyond 6 NM.

The situation is more complicated when considering the simultaneous introduction of a 0-3 NM restriction on mobile gear and a CMR within 0-6 NM. On the west coast of Scotland, if mobile effort targeting Nephrops is removed, there could be very little displacement. This is because, as discussed in Section 3, the replacement of mobile with static effort creates space and biomass for additional vessels both inside and outside 0-3 NM. On the east coast, crabs and lobster are relatively more important. Since these are not targeted by mobile gears, the removal of mobile gear to locations outside 3NM does not create as much scope for additional effort. With a 0-3 NM restriction, there might therefore be stronger displacement effects on the east coast. Compared with the west coast, on the east coast the combination of a 0-3 NM restriction on mobile gear and a CMR seeking to reduce static effort inside 0-6 NM could create more serious and complicated displacement issues.

25.3 The Need for Flexibility

Before considering particular CMRs, there is a generic issue of flexibility which needs to be addressed.

In an ideal world, a CMR should be able to deliver the levels of fishing effort (e.g. total number of creels fishing a given area) that are optimal in terms of achieving the objectives of a particular fisheries management plan. The objective(s) could be the achievement of an employment target, or the maximisation of total profit from the fishery or ensuring a target number of vessels. Irrespective of the particular objective(s), it might be necessary to iterate to achieve a near optimal level of creel effort. In other words, a creel limit is imposed and then adjusted in the light of experience. Eventually over time it is hoped that the iteration process would converge on a broadly acceptable level of effort.

There are potential problems with these iterations which should be mentioned. An issue is that the iterations might not be stable if there are unknown lags in either ecosystem adjustment and/or operators' response to changes in their costs and revenue. Also, even if the iteration was successful, unpredictable changes in legislation, market conditions or natural change in stock abundance could mean that a previously satisfactory level of effort is now either excessive or insufficient. Thus, flexibility is required on two counts; to deliver the best level of static effort, and to enable the appropriate response to unpredictable events. We might also recognise the possible need to also respond to predictable changes such as seasonal variations.

Although flexibility is highly desirable, frequent adjustments can undoubtedly create difficulties for operators. For example, an operator might invest in a vessel which is ideal for a 1,200 creel limit, then to discover the local limit has been cut to 900. This kind of uncertainty might therefore reduce the willingness to invest in vessels and gear. Despite the problems, it would be sensible to build flexibility into every CMR. It is therefore prudent that, from the outset operators fully appreciate that there might be periodic adjustment to their creel entitlements.

25.4 The Evaluation of CMRs

There are four key interrelated questions that should be addressed when designing a CMR. At the core of a CMR is the entitlement of operators (who have shellfish entitlement as a precondition) to use a particular number of creels in a defined area.

1. Should the defined area be the whole IFG area (e.g. the whole South West IFG area) or should the IFG be partitioned into smaller territories (e.g. the South West IFG could be partitioned into smaller defined territories such as upper Loch Fyne, Sound of Jura etc)?
2. How should creel entitlements initially be distributed to operators and subsequently re-allocated over time? There are various possibilities. A command and control approach could be used where entitlement is allocated according to some agreed criteria, such as track record. Re-allocation could follow the same kind of process with perhaps waiting lists being held. Retired or surrendered entitlement would then be re-allocated to those on top of the queue.[75] Alternatively, the market mechanism could be used. The market determines who gets which boat, which creel, which crew, so why not use the

[75] This would be similar to how social housing is allocated.

market mechanism to both initially allocate and re-allocate creel entitlement? It is also possible to have a mix of command and control and the market. For example the initial allocation could be through command and control, with subsequent re-allocation driven by the market, or vice versa.

3. How long should the creel entitlement last? Entitlement could be for a fixed term (e.g. one, three, five, ten years) or could be in perpetuity.
4. How should the creel entitlement be specified? Entitlement could be in the form of a maximum number of creels per vessel, with no limit on the number of vessels. Or, the entitlement to fish a maximum number of creels in a defined area may be limited to vessels satisfying a particular criterion (e.g. track record, willingness to buy). Alternatively, creels may only be used when operators have obtained creel tags which then entitle them to deploy appropriately tagged creels; untagged creels having no entitlement.

As seen from the brief outline above, there are a number of answers to each question, and when these are permutated there are a large number of conceivable CMRs. Although some combinations of characteristics might produce CMRs which are not fit for purpose, a proportion of potential CMRs are worthy of serious consideration.

When it comes to evaluating the relative merits of CMRs, this discussion faces a problem. The problem is that the relative merits of alternative CMRs can only be assessed in light of the declared policy objectives and agreed criteria. The criteria that might be used to evaluate a proposal for a fully developed CMR would be:

Effectiveness

This is the most obvious criterion. It addresses the question as to whether the CMR is actually capable of achieving its stated objectives. The objectives might relate to; stock conservation or enhancement, reducing territorial or gear conflict, increasing local employment, increasing local profitability, encourage new entrants. This will require an *ex ante* analysis of all the CMR's impacts and consideration of whether there are perverse incentive effects that might undermine effectiveness.

The Efficiency of the Objectives

Irrespective of the policy measures used, the achievement of some objectives could deliver benefits which are smaller than the costs of achieving them. For example, it would not be efficient to maximise profits for a fishery if that would result in greater costs being imposed elsewhere such as in wildlife tourism or recreational sea angling.

Least Cost

All things being equal, it is preferable to use a CMR which achieves the given objective and in the process generates the least cost. Thus, whilst a policy objective can be efficient, the CMR as designed might not be optimal. Thus, explicit consideration might be given as to whether an alternative CMR or a completely different type of policy instrument would achieve the same objectives at a lower cost.

Flexibility

As discussed above, the CMR should be capable of responding appropriately to changes in environmental conditions or market conditions. Consideration of flexibility should also probably embrace the bureaucratic layers and time required to comply with legal requirements.

Adequacy of Resources

Explicit consideration might be required as to whether MS the IFGs have the resources necessary for negotiating, coordinating, monitoring, enforcing and finessing CMRs.

Community acceptance

The success of a CMR might be dependent on the extent to which the community agrees with the policy objective and understands how the CMR will be implemented and how it may develop over time.

The outcome of an assessment about the relative merits of alternative CMRs depends on which criteria one uses and the weightings applied to each. Unfortunately, since we do not have a live case study, declared policy objectives or an agreed list of criteria, the discussion here is incapable of systematically evaluating the relative merits of alternative CMRs. Instead, the discussion below focuses on how the answers to the key questions (listed 1 to 4 above) define the characteristics and shape the outcomes of a CMR.

Whilst each of the four key questions can be explored individually, it is the combination of these characteristics that generates the incentive effects, behavioural responses and possible outcomes. Thus a characteristic (e.g. tradable entitlement)[76] which might be quite innocuous when viewed in isolation could deliver an extremely profound outcome when combined with another characteristic (e.g. a creel entitlement in perpetuity)

Each of the four questions will therefore be addressed in sequence, but given the significance of some key combinations of characteristics, the discussion below has to contain forward and backward linkages. This results in an element of unavoidable repetition.

In the absence of criteria, the discussion below should also endeavour to be non-judgemental about outcomes. In effect, the discussion should simply list and explain outcomes associated with characteristics and combinations thereof. Unfortunately, this produces a very sterile discussion which is not capable of eliminating CMRs with characteristics that generate obviously ludicrous or idiosyncratic outcomes.

This discussions adopts a pragmatic approach uses a categorisation of "advantages" and "disadvantages" of certain CMR outcomes. For instance, if under one CMR, Marine Scotland (MS) would need additional resources to implement, monitor and enforce the CMR, then other things being equal, this is regarded as a disadvantage. This is an obvious example, and there are many others, where no reasonable person would disagree with our categorisation.

[76] That particular combination might result in a few private individuals appropriating all future profits from creeling in the form of the capital value of their entitlement.

However, one group of stakeholder's advantage can be another group's disadvantage. For example, if a CMR generates higher total profits by concentrating effort into a small number of very large efficient vessels, then some stakeholders may see this as an advantage. Those enjoying larger profits would fall into this category, as would those who believe, not unreasonably, that in general it is better to catch shellfish using the most efficient static methods. Others might think it undesirable that the profits from fishing are enjoyed by a smaller number of individuals who own large vessels.

Our position is that if readers of this report do not agree with some of our categorisation, they can change the re-classify to reflect their preferences. The important point is that judgements about any particular CMR are formed on the basis of an appreciation of how changes in its characteristics change outcomes.

25.5 The Key Questions

25.5.1 Defining the Area

Question 1: Should the defined area be the whole IFG area or should the IFG be partitioned into smaller territories?

The operator's or vessel's creel entitlement (maximum creels per vessel or creel tags) could be specified for:

(i) The entire IFG area
(ii) Separate smaller territories which collectively comprise the IFG.

(i) Creel entitlement applying to the entire IFG area

Advantages

- Easy for operators to understand.
- Operators are free to fish anywhere in the IFG area and are not boxed into a particular territory.
- Compared with a partitioned IFG, the burden of administration on MS resources would be much less.

Disadvantages

- The race to catch fish remains in place because there is no restriction on the location of effort across the IFG.
- Since the spatial distribution of effort is unregulated, there is the danger of "hot spots" or "honey pots" which:
    - Attract a disproportionate amount of the IFG creel effort, so that localised overfishing becomes an issue.
    - Are characterised by gear conflicts and territorial congestion.
- There is very little incentive for husbandry, since other operators can move into and exploit the improved areas.
- Some of the IFG areas are very large, particularly the South West IFG, East Coast IFG and the Moray Firth and North Coast IFG. It might be difficult to monitor and police the CMR in these large areas.
- It creates restrictions for operators who traditionally have fished across IFG boundaries, or it requires them to have creel entitlement for more than one IFG.

(ii) Creel entitlement for separate territories within the IFG.

With this option, the IFG area is divided into separate management territories, each of which will have its own entitlement (tagged creels or maximum number of creels per vessel).

Advantages

- Provides an opportunity to more effectively manage what otherwise would be "hot spots" of overfishing and gear conflicts.
- With smaller territories, fewer operators and restricted entry of new effort, the race to fish might be tempered, especially if operators develop personal relationships. Indeed, it is more likely that with small territories operators will develop local Working Practice Agreements (WPAs) which reflect the particular features of local fishing and the personal preferences of local operators.
- With smaller defined territories, the incentives to cooperate become stronger whilst the propensity to compete is diminished. This is because, compared with competition, the rewards from cooperation are much greater when entry is restricted and non-members cannot benefit. At the extreme, with smaller territories one can envisage well developed cooperatives where members engage in various forms of cooperative activity ranging across; gear and vessel use, on-shore storage facilities, transport, purchasing of inputs, and marketing.
- Husbandry activity becomes more feasible and may even form an explicit element of the local WPA.
- Monitoring of the CMR in each territory could be easier as local intelligence would be comprehensive and better able to identify transgression.

Disadvantages

- Nomadic operators would have to have static effort entitlement across a number of territories within their IFG area.
- The separate territories need to be defined and there will be sensitivities around the drawing of some boundaries. This task becomes even more complex if there are different creel entitlements for different species categories (e.g. crabs and lobsters, nephrop).
- Operators who fish in one territory might become boxed into one territory which could "go off". Other areas may have too little effort. The required flexibility discussed above might therefore also have to embrace occasional review of territorial boundaries within the IFG area.
- Marine Scotland Compliance / IFG's would require more resources if they were responsible for managing the separate CMRs operating across a number of territories in some IFG areas.

Summary

If an IFG area is partitioned into territories, there is more control over local fishing effort. This means that gear conflicts and territorial congestion can be better managed and the spatial distribution of effort across the IFG can better aligned with fish stock distribution. It is also possible that the combination of smaller territories and entry restrictions can be self-policing and create stronger incentive effects for cooperation between operators. On the downside, separate CMR can be confusing or can create difficulties for those operators who fish across a number of territories.

In addition, unless boundaries were altered, changes in stock distribution could leave some operators stranded in unproductive territories. If the territories were not self-policed the resource costs for Marine Scotland Compliance could be significant[77]. Thus, viewed overall, partitioning provide**s** the opportunity to manage localised overfishing and conflict and it certainly creates some desirable incentive effects. The potential problems are the possible constraints on operator's range of activity and high bureaucratic costs if there is extensive element of command and control.

25.5.2 Allocation and Reallocation of Creel Entitlement

Question 2: How should creel entitlements be initially distributed to operators and subsequently reallocated over time?[78]

There are two dimensions to the allocation of creel entitlement. The first is the ***initial allocation*** of entitlement. The second dimension is the ***reallocation of creel entitlement*** between operators. A reallocation process is usually required because over time some operators receiving an initial creel entitlement will retire from fishing altogether, or may switch to mobile gear or may move out of an area. Thus, at any given time a proportion of the existing creel entitlement could become available for others to use. At the same time, there will be some operators looking to obtain the relevant creel entitlement. These would include potential entrants or those switching from mobile gear or those moving into the area. As well as reallocation associated with entry and exit of operators, it might be desirable to enable operators to adjust their creel fishing effort in response to changes in market conditions, stock abundance or personal circumstance.

It should be noted that if the creel entitlement were to last for only one year then a reallocation process would not be required because there would be an annual opportunity to reallocate entitlement. For the purposes of the discussion we shall assume that creel entitlement has a longer life span than one year. The issue of the time span of entitlement is discussed later.

With respect to both the initial allocation process of and the reallocation process, we consider two approaches. One is the ***command and control*** approach as typified by using the track record of the vessel or the operator. The second approach uses the ***market mechanism*** where operators' willingness to pay for creel entitlement is the rationing device.

Initial allocation using command and control

Essentially, operators' applications for initial creel entitlement are scrutinised and MS selects the operators who will receive the creel entitlement. The key issue about command and control is that MS needs to develop and use criteria for judging the merits of each operator's request for creel entitlement. These criteria should be

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[77] As will be discussed later a very extensive bureaucracy might be required if a highly partitioned IFG was combined with a command and control approach to managing the numbers of vessels fishing each defined territory and the allocation and re-allocation of creel entitlements.

[78] The assumption in this section is that the number of creels that operators would collectively like to use in a given area exceeds the target creel effort for the area. If this condition is not satisfied there would be no requirement to have an allocation method, as all those who wanted creel entitlement could obtain it simply by requesting.

coherent and consistent so that the outcome does not depend on the personnel who are ranking operators' applications. It will probably be necessary to have a qualifying criterion which determines the population of operators who are eligible to apply for initial creel entitlement in an area. Most probably, the initial distribution of creel entitlement would be restricted to those normally fishing creels in the area (e.g. the IFG area or, if partitioned, its territories) being managed. Though, there could be other criteria. Even this qualifying condition might create problems at the margins. Some part-time or hobby operators who only very occasionally fish an area might be eligible because they possess a licences with shellfish entitlement. Along some borders between IFG areas, some operators could conceivably catch shellfish in one IFG area, but land in another because of access to buyers. Their track record might not reflect this. At the margins almost any qualifying condition could involve some awkward judgements about a few operators.

It should be mentioned that an alternative to judging the relative merits of operator applications is to use a ballot. This generates a random outcome obviating the need to judge applications. The problem is that an operator who earns 10% of their net income from creeling an area might obtain creel entitlement at the expense of someone who currently derives 100% of their income. Compared with command and control and using the market (see below), we cannot identify any net advantage from have a random allocation. This discussion does not give any further consideration to a ballot.

Initial allocation using the market mechanism

The basis of this approach is that the creel entitlement will be allocated to those who are willing to sacrifice most, as reflected in their willingness to pay (WTP). Instead of MS judging applications through the market mechanism, operators self select. Those who are unwilling or unable to pay the price set by MS do not obtain creel entitlement. Similarly, if an auction was used, those who are unable or unwilling to outbid would not obtain entitlement. Thus, MS does not make explicit judgements about the relative deservingness of operators, though it might restrict eligible bidders to holders of shellfish entitlement and/or those with local track record.

Reallocation using command and control

With a command and control approach to reallocation, records of existing vessels and/or owners would need to be kept and adjusted when operators/vessels exit the fishery. MS would also need to ensure that operators are not allowing other operators to use their creel entitlement.[79] In addition waiting lists would need to be kept, on-going applications scrutinised against criteria and appeals processed.[80] If the IFG area is partitioned, this would be done separately for each territory.

Reallocation using the market mechanism

If the market mechanism is used, MS has no direct involvement in the reallocation process. An operator seeking creel entitlement simply purchases, borrows, swaps or

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[79] In the same way that social housing managers ensure that properties are not being sublet to others who do not satisfy the necessary criteria.

[80] In addition to length of time on the list, some waiting lists use point scoring to determine applicant's position on the list.

rents the entitlement from another operator. Although MS does not have direct involvement, it can shape the consequences of transactions in creel entitlement. It does this by setting rules and regulations governing the buying and selling of entitlement. For example, it might specify:

- The time span of creel entitlements (e.g. one year, five years or in perpetuity)
- The amount of creel entitlement a vessel or operator may own at any point in time (e.g. 1,000 creels)
- The number of vessels an operator may cover with creel entitlement at any point in time (e.g. 1 vessel per operator)

In this way, if MS desired it could prevent potentially undesirable outcomes. For example, MS might not wish one individual acquiring the entire creel entitlement for a particular territory. It might do this by specifying a five year (renewable) life span and a perhaps maximum 1,200 creels per operator.

Combinations of Mechanisms for Initial Allocation and Reallocation

The approach to the initial allocation and subsequent reallocation are interlinked. There are four possible combinations. The initial allocation and reallocation could both be command and control or both driven by the market mechanism. Alternatively, the initial allocation could be command and control and but with the reallocation being market based, or vice versa. These are summarises below:

	Initial	**Reallocation**
i	Command and Control	Command and Control
ii	Market Mechanism	Market Mechanism
Iii	Command and Control	Market Mechanism
iv	Market Mechanism	Command and Control

With respect to (iv), we simply cannot envisage a system whereby operators initially bid for creel entitlement, but if the entitlement is surrendered it is then given for free to another operator. This would be unfair to operators who have purchased entitlement. If MS were to sell surrendered entitlement then this is described by option (ii). We therefore do not give further consideration to option (iv). The remaining three options are considered below.

(i) Initial allocation and re-allocation by command and control

This is essentially an application process, where a criterion (e.g. track record) is examined and in some way operators with the better record obtain creel entitlement. Conceivably other criteria could also be used such as the age of the operator, size of vessel, willingness to employ local crew, membership of association etc. For the purpose of the discussion, we will only consider track record.

Advantages

- If track record is used this is a reasonably objective criterion.
- The basic features are easily understood.

Disadvantages

- If track record is used for the initial allocation there is the potential for disharmony around the cut-offs applying to historic length of time and borders of territory fished. These could be substantial issues if the IFG area is partitioned into many separate territories.
- This is potentially unfair for some operators. If the *vessel track record* is used for the initial allocation this would disadvantage a long standing operator who has recently changed his or her vessel. If *operator track record* was the criterion, new younger operators would be disadvantaged.
- Potential entrants to the static sector or to the IFG area/territory are disadvantaged. They will not have track record and might not receive an initial allocation. They will have to wait for retired creel entitlements to become available, and if track record determines position on a waiting list they might wait in vain.
- Operators about to retire or exit the sector would be eligible for and might receive initial creel entitlement. If they receive an initial allocation there is no strong incentive to formally surrender entitlement and enable younger operators to enter. Instead they might fish occasionally.
- With reallocation by command and control, records of existing vessels and/or owners would need to be kept up to date and adjusted when operators/vessels exit the fishery. MS would also need to ensure that operators are not allowing others to use their creel entitlement. Waiting lists would need to be kept, on-going applications scrutinised against criteria and appeals processed. If the IFG is partitioned, all this would have to be done separately for each territory. This could require a significant bureaucracy.

Summary

With a command and control regime there is the potential for disharmony, unfair outcomes and the disadvantaging of new entrants. If IFGs are partitioned there could be a requirement for a significant bureaucracy[81].

(ii) **Initial allocation by command and re-allocation by willingness to pa**y

Operators applications for initial creel entitlement are scrutinised, a selection made and the successful applicants duly informed. Thereafter, within the rules specified by MS (e.g. maximum number of creels per operator, or maximum number if vessels per operator) individual operators can buy, sell, lend or lease their creel entitlement.

An important issue here is the time span of the entitlement. As explained above, if creel entitlement was renewed annually a reallocation process would not be required because there would be an annual opportunity to reallocate entitlement. The

[81] As discussed later, there is one option which does not involve significant administration costs. This requires creel entitlement to be specified in terms of a vessel creel limit (e.g. maximum 1,200 creels per vessel in the relevant area). Unfortunately, unless vessel numbers are also controlled, then this CMR does not exert control on either total effort or its spatial distribution. As such it is therefore incapable of achieving any meaningful objective and would serve no purpose, other than window dressing. If vessels are managed and command and control is combined with partitioned IFGs the administrative burden could be substantial.

discussion about re-allocation therefore assumes that creel entitlement would last more than one year and theoretically could last in perpetuity.

Advantages

- If track record is used this is a reasonably objective criterion.
- The basic features are easily understood.
- Re-allocation by the market mechanism means there will be an incentive to sell or lease creel entitlement that is not being fully utilised, perhaps by operators considering retirement.
- Re-allocation by the market mechanism enables new entrants to obtain creel entitlement.
- Re-allocation by the market mechanism means that MS do not have to keep waiting lists or get involved with scrutiny of on-going applications and processing appeals. This could be a substantial resource saving for MS, compared with re-allocation by command and control operating across a large and heavily partitioned IFG.
- Re-allocation by the market enables individual operators to change the number of creels they use, and where they use them. They are therefore better able to respond to changes in market conditions, stock distribution and abundance. Though the extent of this flexibility would depend on any trading restrictions specified by MS, as well as on how creel entitlements are specified.
- The existence of a market means that if there was a case for increasing fishing effort MS can periodically sell creel entitlement. MS could also purchase creel entitlement and thereby remove any excessive fishing effort. The capacity of MS to engage in these on-going open market operations depends on how creel entitlement is specified and the lifespan of the entitlement.
- MS can build in flexibility. Provided the life span of creel entitlement is limited to say five or ten years. This is because, at some point in time, the existing creel entitlements would no longer be valid. Operators would have to apply for new creel entitlement. This re-issue gives MS the opportunity to adjust the borders of territories and the target level of total creel effort. MS may also tweak the criteria used to allocate creel entitlement. It might for example exclude operators who have been regularly involved in gear conflict.
- As discussed previously, if an IFG is partitioned there is a stronger incentive to form cooperatives, engage in husbandry, or have developed WPAs. With a fixed term, MS could reinforce these incentives by making the five year or ten year renewal of creel entitlement conditional on evidence of engagement in these activities. MS could also make renewal conditional on operators developing and training younger crew, perhaps gaining Modern Apprenticeships or other recognised awards.
- The five or ten year re-issue also allows MS the opportunity to correct for any unintended outcomes arising from the on-going market in creel entitlement...

Disadvantages

- As stated previously, if track record is used for the initial allocation there is the potential for disharmony especially with a large and heavily partitioned and IFG.

- The flexibility and incentive effects enabled by the fixed term of creel entitlement (e.g. 5 or 10 years) means that the allocation exercise would need to be repeated. Though, the process should not be as fraught as the initial allocation because trading operators would have been adjusting the fishing effort and establishing track record.
- With the opportunity to trade, there is the possibility that creel entitlement in an area could be acquired by one, or a small number of operators. However, we believe the incentive to acquire and accumulate creel entitlement might not be very strong. This is because, unlike, say, pelagic trawling, there are few economies of scale in creeling. Since on each vessel, each creel is handled in sequence using a single pot hauler, one six ton vessel is unlikely to be able to process as many creels as two three ton vessels. With pelagic trawling the larger the vessel the lower is the average cost of each ton of fish landed. This is because there are economies associated with bulk handling, greater engine power, large nets, more specialised machinery and crew. It is not surprising that over time there are fewer pelagic vessels, but the remaining vessels become very large and quota is accumulated by a few operators. The absence of economies of scale in creeling might act as a natural constraint on the concentration of creeling tags. If not, restrictions could be placed which prevent undesirable concentration of creel effort (e.g. a maximum of 1,200 creels per vessel)
- With the opportunity to trade, there is the possibility of the effective transfer of a public resource (nephrops, crabs and lobster) into private hands. The transfer would be permanent if the creel entitlements were in perpetuity. This permanent transfer can be forestalled if the creel entitlements have a fixed term (e.g. five or ten years)

Summary

Re-allocation by the market mechanism enables new entrants to obtain creel entitlement and existing operators the opportunity to finesse their fishing effort. MS do not have to keep waiting lists or get involved with scrutiny of on-going applications. Rules might be required to prevent undesirable market outcomes such as the accumulation of creel entitlement. Fixed term entitlements provide MS with opportunity to periodically correct for any market imperfections that may arise, respond to changes in stock conditions and incentivise operators to generate preferred outcomes. On the downside, there could be problems in administering the initial allocation, as well as the re-issue of fixed term creel entitlement.

(iii) Initial allocation and re-allocation by willingness to pay

Under this arrangement, MS would potentially play a very limited role beyond determining the target creel effort for an IFG area, or if partitioned its territories.

Advantages

- Easily understood

- Initial creel entitlement is allocated to those who want it most as reflected in their willingness to pay the price.
- With respect to the initial allocation, MS does not have to choose between operators
- With partitioning into small territories it is likely that local operators will bid more because of an unwillingness of more distant operators to bid for areas they are unfamiliar with. The eventual allocation might closely resemble the track record allocation
- As outlined above, market re-allocation:
    - Creates an incentive to sell or lease creel entitlement that is not being fully utilised
    - Enables new entrants to obtain creel entitlement
    - Obviates the need for MS to keep waiting lists or get involved with scrutiny of on-going applications and processing appeals.
    - Enables individual operators to change the number of creels they use, and where they use them.
    - Provides the opportunity for MS to engage in on-going open market operations
    - Fixed term entitlements mean that MS can periodically correct for any market imperfections, respond to changes in stock conditions and incentivise operators to generate preferred outcomes

Disadvantages

- There would be a transfer of income from the creel sector to Government (which might be used to fund the additional MS administration).
- New entrants or those who are financially constrained might not be able to pay the required price. Thus creel limits or tags are not necessarily allocated to those who most desire creel effort. Long standing local operators may be replaced by new entrants, simply because of differences in the ability to pay.
- If the creel entitlement is a fixed term (e.g. 1 year, 5 years or 10 years), there would be a recurrent transfer on income from the sector to the Scottish Government. Indeed, it is entirely possible that through the bidding process the public purse might appropriate all future profits from creeling.
- To prevent creel effort being acquired by one, or a small number of operators, restrictions might need to be introduced.
- The correct price to charge cannot be known. If the price is set too high, then some creel limits or tags will remain unsold. If the price is too low there will be excess demand and a supplementary allocation mechanism would be required, such as a ballot. This problem of pricing could be eased by inviting creelers to submit a bid for a creel limit or creel tags.
- Potentially confusing for operators fishing across IFGs or territories as they will have to purchase or bid for each territory.

Summary

Reliance on the market for the initial allocation, the re-allocation and the re-issue of fixed term entitlement substantially reduces the administrative burden on MS. At the same time, the market mechanism enables new entrants to obtain creel entitlement and existing operators the opportunity to finesse their fishing effort. Fixed term entitlements mean that MS can periodically correct for any market imperfections, respond to changes in stock conditions and incentivise operators to generate preferred outcomes. On the downside, there would be a regular and possibly substantial transfer of income from the sector to the Scottish Government. Initial creel entitlement would be allocated to those with the deepest pockets and some local operators with extensive track record may be pushed out completely. Rules might be required to prevent undesirable market outcomes.

25.5.3 Length of Entitlement

Question 3: How long should operators' entitlement to use creels last?

From the outset there needs to be clarity in the length of creel entitlement. Conceivably the entitlement could be in perpetuity or a fixed term. We consider three options

(i) Annual entitlement.
(ii) Five year fixed term
(iii) In perpetuity.

(i) Annual Renewal

Advantages

- Provides MS with flexibility and probably obviates the need to re-allocate creel entitlement.
- If the market is used to allocate initial creel entitlement, risk averse operators might prefer a one year term.

Disadvantages

- Annual uncertainty for operators might lead to less investment in vessels and gear.
- There would be uncertainty for crew which might lead to exacerbation of recruitment and retention problems.
- There is less incentive to develop and train younger crew.
- If combined with command and control allocations there is no guarantee of renewal and there would be a reduced incentive to engage in husbandry, develop WPAs or engage in cooperative activity with other operators. Similarly with the market mechanism operators would have to engage in annual bidding with no guarantee of success.
- If track record is used for renewal potential entrants get further back in the queue and have to wait for creel entitlement to be surrendered.
- There would still be a race to fish against others and against the clock as the annual term expires.
- Even with a partitioned IFG and small territories there would still be a race to fish. This is because there is little incentive to develop WPAs or cooperatives.

(ii) Five Year Renewal

Advantages

- Less uncertainty for operators and crew.

- The reduced uncertainty might lead to more investment in vessels and gear.
- Possibly better recruitment and retention of crew.
- If combined with smaller territories there is a stronger incentive to engage in husbandry, develop WPAs and engage in cooperative activity.
- The five year fixed term provided MS with an opportunity to incentivise particular forms of behaviour by requiring operators seeking renewal to provide evidence of husbandry, adhering to WPAs, cooperative activity.
- The fixed term provides the opportunity to penalise some forms of activity. For example, if a creel tag system is used, MS may decide not to renew the tags of operators those who renting them out. Instead, MS might prefer to allocate the creel tags to those who have been and using the tags (rented or otherwise) creels over the five year period.
- Administrative burden is less than the annual renewal.

Disadvantages

- Less flexibility for MS than the one year term.
- There is still some uncertainty which might deter investment in vessels and gear, especially nearing the end of the term.
- Towards the end of the term, operators might alter their fishing practices if they anticipate their creel entitlement would not be renewed. This might result in more gear conflict, more competition for territory but less husbandry.
- Operators who were successful in obtaining entitlement would probably prefer a longer term (10 years or in perpetuity).

(iii) Perpetuity

Advantages

- Less uncertainty for operators.
- Reduced administrative load for MS.

Disadvantages

- Less flexibility for MS to adjust.
- MS cannot use renewal to incentivise operators to engage in desirable fishing practices.
- If they are non-transferrable, new entrant precluded
- If allocated by track record and transferrable in perpetuity, there would be a very large transfer of wealth to the initial owners and new entrants would only receive normal profit.

Summary

The shorter the term the greater is the uncertainty for operators and MS's flexibility in managing the fishery. A fixed term provides MS with the opportunity to incentivise particular operator practices such as husbandry, developing WPA, cooperative activity, crew training. However, with annual renewal the higher level of uncertainty works against these incentive effects. If these incentive effects are important to MS, a five or 10 year entitlement would be preferred, despite the reduced uncertainty and the greater flexibility offered by annual renewal.

25.5.4 Specifying the Creel Entitlement

Question 4: How should creel entitlement be specified?

There are a number of possibilities including, but not restricted to:

- **I. A maximum number of creels per vessel combined with controls on the number of vessels.**
- **II. A maximum number of creels per vessel.**
- **III. A fixed number of creels (tags) to be shared among operators*.***

(i) Maximum number of creels per vessel, with no control on the number of vessels. Partitioning an IFG area only makes sense if the intention is to apply different vessel creel limits to each territory. However, in the absence of controls on the number of vessels in each territory, differential vessel creel limits within an IFG area would not be sensible. This is because the movement of vessels and therefore effort between territories would swamp the impact on effort of differential vessel creel limits. The discussion of option (i) below therefore assumes that an IFG would not be partitioned.

Advantages

- Easily understood.
- Relatively easy to police.
- An element of flexibility in enabled through adjustment in the IFG's vessel creel limit.

Disadvantages

- Since vessel numbers are not controlled, operators can move into the area from neighbouring IFGs. Also, subject to licences being available, operators can add more vessels to the fishery.
- There might be initial difficulties in aligning the creel limit per vessel with the policy objectives it is designed to deliver (e.g. stock conservation, increasing employment, increasing incomes).
- There is probably insufficient flexibility to cope with the need to iterate and to respond to unpredictable events such as migrants, new entrants and stock fluctuations. This is because the only available control lever is adjustment in the vessel creel limit. Unless this is regularly adjusted there is no effective control of effort in the IFG area, but regular adjustment will create uncertainty.
- In some productive locations, catch per day can be increased by hauling creels more than once per day. It is possible that some operators in some locations might increase the frequency of double hauling if the creel limit reduces the amount of creels they can use.
- Since there is no restriction on vessel numbers or location of effort, the race to fish remains in place across the IFG.
- There is very little incentive for husbandry, since other operators can exploit the improved areas.
- The vessel limit will be sub-optimal for some vessels, though this can be mitigated by allowing larger vessel size categories (e.g. > 12m) to have a higher creel limit (e.g. 1,000 creels)
- Compared with the current arrangements, Marine Scotland Compliance would have some additional administrative costs of monitoring and enforcing the vessel creel limit(s).

- Decisions need to be made about whether there should be separate creel limits for particular shellfish groups (e.g. nephrops, crabs and lobsters)

Summary

The combination of a partitioned IFG, and separate vessel creel limits for each territory and no control on vessel numbers would not be sensible and is not considered here.

An IFG wide vessel creel limit combined with no control on vessel numbers might give the impression that creeling is being managed, and would not be too expensive for MS to implement and manage. In the short term, it might have an impact on larger vessels fishing large numbers of creels. However, in the longer term, as operators adjust, it is unlikely to be capable of achieving any meaningful objective. This is because neither total effort nor its spatial distribution is capable of being managed. Thus, the option of an IFG vessel creel limit combined with no control of vessel numbers serves no purpose, other than political window dressing.

(ii) Vessel creels limit combined with controls on the number of vessels.

If there is a vessel creel limit, there should be control of vessel numbers. Controlling the number of creels and the number of vessels means that the total creel effort for any defined area is at least capable of being managed. The defined area(s) could be the whole IFG area as a single entity, or the territories of a partitioned IFG area.

Advantages

- If the IFG is not partitioned, operators can understand the CMR and how it will operate.
- If the IFG is not partitioned and a list is available of the vessels with creel entitlement for that IFG then it is relatively easy to police.
- If the IFG is partitioned and VMS is extended to the <15m fleet it would still be relatively easy to police.
- Total creel effort in each defined area(s) can be controlled.
- Flexible is enabled through adjusting (annually, every five or ten years) the borders between territories, creel numbers per vessel and/or the number of vessels.

Disadvantages

- If the limit reduces the number of creels each vessel normally handles, this might increase frequency of hauling.
- MS would have additional costs of enforcing the CMR. In the absence of VMS, this could expensive and quite complex if an IFG area was partitioned into a large number of territories each with its own vessel list and creel limits
- There might be initial difficulties in aligning the target total creel numbers in an area should sustain with the CMR’s intended policy objectives. The target creel total for a defined area would then need to be converted into a target number of vessels and a territorial vessel creel limit. This might possibly involve significant data collection and liaison between stakeholders and Marine Scotland Science.
- If the IFG is highly partitioned this will multiply the problems of determining target vessel numbers and creel limits for each of the IFG’s territories.

- If the market mechanism is not used, other command and control criteria (e.g. track record of vessel, track record of owner, business plan) will need to be used to determine which particular vessels/owners are initially provided a creel entitlement for each area(s). With a highly partitioned IFG, this process could be quite demanding on MS resources. Also, with more territories there are more borders and greater scope for disagreement and appeals surrounding vessel selection and initial entitlement allocation.
- Significant demands could also be placed on MS if a highly partitioned IFG was combined with and a command and control approach to the re-allocation of surrendered entitlement. Records of vessels and/or owners for each territory might need to be kept, as well as waiting lists. Applications will need to be scrutinised against criteria and more appeals processed.
- Whilst flexibility is desirable, this might involve, over time, adjusting; the borders between territories, the number of vessels in each territory and the territorial vessel creel limits. This can be costly and potentially fractious, particularly if an IFG is heavily partitioned and there is a reliance on command and control.
- New entrants will find it difficult to enter the fishery. They would have to wait until some creel entitlement was surrendered and they were high enough up the waiting list. The average age operators and skippers might increase.
- The vessel creel limit will be sub-optimal for some vessels. This can be mitigated by allowing larger vessel size categories to fish more creels. This increases complexity further, especially if the IFG is partitioned into small territories.
- Decisions would need to be made about whether in a given area should there be separate creel limits for particular species groups?

Summary

If there is a vessel creel limit, effective effort control requires that vessel numbers also need to be controlled. If the defined area is the whole IFG, there is some flexibility, operators understand the how the CMR works, it can be monitored and administration costs might not be excessive. Administration increases with the number of territories within each IFG. A significant proportion of this complexity and the implied MS resource costs stems from using command and control to manage individual vessels.

(iii) A fixed amount of numbered creel tags are issued to operators.

In (ii) above, Marine Scotland is managing total creel effort by adjusting vessel numbers and vessel creel limits. It might be simpler to directly manage total creel effort. Complexity and MS resource costs could be reduced if total creel effort could be controlled without the need to manage vessel numbers. This would then increase the feasibility of the highly desirable characteristic of being able to partitioning IFGs and manage effort at the level of smaller individual territories. One option which offers this possibility is creel tags.

- A total creel limit for each IFG, or if partitioned, for each territory is identified.
- A corresponding fixed quantity of numbered creel tags would be issued by MS.

- For policing purposes, the tags for each separate territory would be physically different (e.g. different colours or shape).
- Creels in use in a territory must be tagged with the appropriate tags.
- A record would be kept and updated of each operator's numbered tags. It would have to be the operator's responsibility to ensure that Marine Scotland Compliance (MSC) records are up to date, with heavy penalties for fishing with no tags, the wrong coloured tags for the territory being fished or using tags which are not recorded against the operators name within MSC**.**

Advantages

- Complexity for Marine Scotland is reduced since it would not have to determine the desired number of vessels for each IFG area or territory, or the desired vessel creel limit, or the eligibility of individual vessels to receive a creel limit, or the reallocation of retired creel effort.
- Total creel effort in each management area (the entire IFG area or defined territories within the IFG) is controlled.
- A tag system is relatively easy to police compared with policing vessel eligibility to fish an area and their creel limits. The only checking required is that the operator is using creels with a number recoded against the operator. Large areas can be policed quite easily.
- Flexible would have to be through the recalling or issuing tags and by adjusting the boundaries of territories.

Disadvantages

- Operators may take time to adjust
- With a limited number of tags, operators might compensate by increasing the frequency of hauling.
- There will be difficulties in aligning the initial number of creel tags with the policy objectives. If an IFG is partitioned into small territories, very good local information will be required to determine the total number of tags for each area.
- An up to date record would need to be kept of the tags used by each operators. This might require an operator penalty for failing to inform Marine Scotland Compliance of changes to operator's tag record. If a five year renewal was in operation, and MS was minded not to renew the tags of those who are renting them to others, it would have to keep a record of who is using the tags. Such a record would enable MS to re-allocate the creel tags to those who have been and using the tags (rented or otherwise) creels over the five year period.
- Operators who move about within the IFG, or who straddle the borders of territories might have to obtain tags for each territory, or endure restrictions on their operating range.
- Compared with the present situation Marine Scotland Compliance would have additional administrative costs of monitoring, enforcement and maintenance of operator records. This could be quite complex if an IFG area was partitioned into a large number of territories each with its own tags.
- Decisions would need to be made about whether in a given area should there be separate tags for particular species groups.

Summary

Creel tags liberate MS from needing to manage vessels, though MS would need to keep records of tag ownership.

25.6 Conclusion

If an IFG area is partitioned into territories, gear conflicts and territorial congestion can be better managed and fishing effort across the IFG better aligned with fish stock distribution. Smaller territories can also be self-policing and create stronger incentive effects for husbandry, development of WPA's and cooperation between operators. The potential problems of partitioning are the constraints on operator's range of activity and high bureaucratic costs if there is extensive element of command and control.

Compared with managing vessels, the issuing of creel tags reduces administrative costs and makes partitioning more feasible, though MS would need to keep a record of tag ownership.

Allowing tags to be traded facilitates new entrants and prevents operators from becoming boxed in. Rules might be required to prevent undesirable outcomes that the tag market might produce.

A fixed term provides MS with the desired flexibility and the opportunity to incentivise particular operator practices such as husbandry, developing working practice agreements, cooperative activity and crew training. A fixed term also enables MS to redress any unintended and undesirable outcomes in the creel tag market. Because annual renewal works against these incentive effects, a five or 10 year entitlement would be preferred. There will be some unavoidable difficulties developing and using criteria to initially allocate creel tags. There will also be an on-going requirement for operators to inform MS of which creel tags they are using, with appropriate sanctions on operators whose tag records are inaccurate.

26 APPENDICES

26.1 Appendix 1: References

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26.2 Appendix 2: Table: Deprivation of Coastal Communities

HOME_PORT	DRIVE_TIME	PUBLIC_TRA	ACCESS_RAN	CRIME_RAN	EDUCATION_	EMPLOYMENT	HEALTH_RAN	HOUSING_RA	INCOME_RAN	MULTIPLE_D	OVER10	UNDER10	ALL
ABERDEEN	well provide	well provided	well provided	very depriv	deprived	average	deprived	very deprived	average	average	3	41	44
ANSTRUTHER	average	well provided	well provided	average	average	well provided	well provided	average	well provided	well provided	3	9	12
ARBROATH	very well pro	well provided	very well provid	deprived	deprived	deprived	deprived	average	deprived	deprived	1	9	10
ARISAIG	very deprive	very deprived	very deprived	very well pr	very well provided	well provided	well provided	very deprived	average	average	0	5	5
AYR	well provide	well provided	well provided	deprived	average	deprived	deprived	average	deprived	deprived	39	30	69
BALLANTRAE	very deprive	very deprived	very deprived	very well pr	deprived	deprived	average	well provided	average	deprived	2	3	5
BENBECULA	very deprive	very deprived	very deprived	deprived	well provided	average	deprived	well provided	well provided	average	1	4	5
BERNERA	very deprive	very deprived	very deprived	very well pr	well provided	average	average	well provided	deprived	deprived	1	9	10
BROADFORD	very deprive	very deprived	very deprived	average	average	average	deprived	deprived	average	deprived	0	8	8
BUCKIE	well provide	average	well provided	deprived	average	average	average	well provided	average	average	23	37	60
BUTE	well provide	well provided	well provided	deprived	average	deprived	average	deprived	deprived	deprived	2	6	8
CAMPBELTOWN	well provide	well provided	well provided	deprived	average	deprived	deprived	average	deprived	deprived	27	38	65
CARRADALE	very deprive	very deprived	very deprived	very well pr	well provided	deprived	well provided	deprived	average	average	8	2	10
CASTLEBAY	very deprive	very deprived	very deprived	well provid	average	average	deprived	very deprived	average	deprived	4	19	23
CENTRAL MAINLAND (SHETLAND)	very deprive	very deprived	very deprived	well provid	average	very well provided	well provided	very well prov	very well prov	well provided	1	5	6
CRAIL	deprived	average	deprived	very well pr	very well provided	well provided	very well prov	very well prov	well provided	very well provid	0	6	6
DRUMMORE	very deprive	very deprived	very deprived	very well pr	average	deprived	well provided	deprived	deprived	deprived	0	5	5
DUNROSSNESS FAIR ISL	very deprive	very deprived	very deprived	very well pr	well provided	very well provided	very well prov	very well prov	very well prov	well provided	0	8	8
DUNVEGAN	very deprive	very deprived	very deprived	very well pr	average	well provided	well provided	deprived	well provided	average	0	10	10
EYEMOUTH	very well pro	well provided	very well provid	deprived	deprived	deprived	deprived	average	deprived	deprived	9	6	15
FORT WILLIAM	deprived	deprived	deprived	deprived	deprived	average	deprived	average	average	deprived	1	6	7
FRASERBURGH	very well pro	well provided	well provided	deprived	deprived	deprived	deprived	well provided	deprived	deprived	75	75	150
GARDENSTOWN	very deprive	well provided	deprived	average	average	well provided	well provided	well provided	deprived	average	8	3	11
GIRVAN	very well pro	well provided	well provided	deprived	deprived	deprived	deprived	average	deprived	deprived	0	5	5
GOURDON	very deprive	average	deprived	well provid	well provided	well provided	well provided	very well prov	well provided	well provided	2	7	9
GRIMSAY	very deprive	very deprived	very deprived	very well pr	well provided	very well provided	average	deprived	average	average	4	8	12
HOY	very deprive	very deprived	very deprived	very well pr	average	average	well provided	very deprived	well provided	deprived	1	5	6
ISLAY	very well pro	very well provided	very well provid	well provid	deprived	average	deprived	deprived	average	average	3	12	15
JOHN O'GROATS	very deprive	very deprived	very deprived	very well pr	well provided	well provided	average	well provided	well provided	average	1	9	10
JOHNSHAVEN	very deprive	very deprived	very deprived	well provid	average	well provided	average	average	well provided	average	0	8	8
KINLOCHBERVIE	very deprive	very deprived	very deprived	very well pr	well provided	well provided	well provided	well provided	average	average	6	9	15
KIRKCUDBRIGHT	well provide	average	well provided	well provid	very well provided	average	well provided	well provided	well provided	well provided	17	5	22
KIRKWALL	well provide	deprived	average	deprived	well provided	well provided	average	average	well provided	well provided	20	46	66
KYLE	very well pro	very well provided	very well provid	deprived	average	deprived	deprived	well provided	deprived	deprived	3	14	17
LERWICK	average	average	average	deprived	well provided	well provided	deprived	average	well provided	well provided	20	53	73
LOCH SCRIDAIN	very deprive	very deprived	very deprived	very well pr	average	very well provided	very well prov	very deprived	well provided	well provided	2	6	8
LOCHINVER	very deprive	very deprived	very deprived	very well pr	well provided	average	well provided	deprived	well provided	average	2	8	10
LUING	very deprive	very deprived	very deprived	very well pr	very well provided	well provided	very well prov	deprived	well provided	well provided	2	6	8
LYBSTER	very deprive	very deprived	very deprived	very depriv	very deprived	deprived	deprived	average	deprived	very deprived	1	4	5
MACDUFF	well provide	well provided	well provided	deprived	deprived	deprived	average	well provided	average	average	13	5	18

MALLAIG	deprived	well provided	average	average	very well providec	well provided	average	deprived	well provided	well provided	19	17	36
METHIL	very well pro	well provided	very well provid	very depriv	very deprived	very deprived	deprived	average	very deprived	very deprived	0	6	6
MONTROSE	well provide	average	well provided	deprived	average	average	average	well provided	deprived	average	0	9	9
OBAN	well provide	well provided	well provided	deprived	average	average	deprived	deprived	average	average	21	45	66
PETERHEAD	well provide	average	well provided	deprived	deprived	average	average	average	average	deprived	49	43	92
PITTENWEEM	well provide	well provided	well provided	well provid	well provided	well provided	very well prov	average	well provided	well provided	7	56	63
PORTREE	well provide	average	well provided	deprived	average	deprived	very deprived	well provided	average	deprived	13	48	61
PORTSOY	deprived	well provided	average	average	deprived	average	average	well provided	average	average	1	4	5
ROSEHEARTY	very deprive	very deprived	very deprived	deprived	average	average	well provided	average	average	average	0	6	6
SANDAY	very deprive	very deprived	very deprived	very well pr	average	average	very well prov	very deprived	average	deprived	1	6	7
SCALLOWAY	well provide	very well provided	well provided	very well pr	average	average	deprived	deprived	well provided	well provided	4	18	22
SCALPAY	very deprive	very deprived	very deprived	very well pr	well provided	well provided	average	deprived	deprived	deprived	0	10	10
SCRABSTER	well provide	average	well provided	deprived	average	well provided	well provided	very well prov	well provided	well provided	2	50	52
SOUTH HARRIS	very deprive	very deprived	very deprived	very well pr	well provided	average	well provided	deprived	average	deprived	1	11	12
SOUTH LOCHS	very deprive	very deprived	very deprived	very well pr	average	average	very deprived	deprived	well provided	deprived	0	9	9
SOUTH RONALDSAY	very deprive	very deprived	very deprived	very well pr	average	well provided	average	deprived	well provided	average	2	4	6
SOUTH UIST/ERISKAY	very deprive	very deprived	very deprived	very well pr	well provided	well provided	well provided	deprived	average	average	3	18	21
ST ANDREWS	well provide	well provided	well provided	well provid	well provided	very well provided	very well prov	deprived	very well prov	very well provid	0	10	10
STORNOWAY	deprived	deprived	deprived	deprived	average	average	deprived	well provided	deprived	deprived	23	53	76
STROMNESS	well provide	average	well provided	well provid	well provided	well provided	well provided	deprived	well provided	well provided	4	1	5
TARBERT	well provide	very well provided	very well provid	average	average	average	well provided	average	well provided	well provided	5	9	14
TINGWALL	very deprive	very deprived	very deprived	very well pr	well provided	very well provided	well provided	well provided	very well prov	well provided	4	6	10
TOBERMORY	very deprive	deprived	very deprived	very well pr	well provided	well provided	very well prov	average	well provided	well provided	3	6	9
TORRIDON	very deprive	very deprived	very deprived	very well pr	well provided	very well provided	very well prov	deprived	very well prov	well provided	3	11	14
TROON	well provide	well provided	well provided	average	well provided	average	deprived	well provided	average	average	10	0	10
ULLAPOOL	very well pro	well provided	very well provid	average	well provided	well provided	well provided	average	average	well provided	24	8	32
WEST MAINLAND	very deprive	very deprived	very deprived	very well pr	very well providec	very well provided	very well prov	average	very well prov	well provided	1	10	11
WESTRAY	very deprive	very deprived	very deprived	very well pr	average	well provided	very well prov	very deprived	well provided	average	3	17	20
WHALSAY	very deprive	very deprived	very deprived	very well pr	average	very well provided	very well prov	very well prov	well provided	well provided	13	14	27
WHITEHILLS	very deprive	deprived	very deprived	well provid	average	average	well provided	very well prov	average	average	4	2	6
WICK	well provide	average	well provided	deprived	deprived	deprived	very deprived	well provided	deprived	deprived	3	7	10
YELL	very deprive	very deprived	very deprived	very well pr	well provided	very well provided	very well prov	average	well provided	average	1	6	7

26.3 Appendix 3: Deprivation Scores for Each Fishing Port

Summary Deprivation Scores for Each Fishing Port

HOME PORT	Transport & Access	Education	Employment & Income	Health & Housing	Crime	Multiple Deprivation	Boats
ABERDEEN	2.0	4.0	3.0	4.5	5.0	3.0	44
ANSTRUTHER	2.3	3.0	2.0	2.5	3.0	2.0	12
ARBROATH	1.3	4.0	4.0	3.5	4.0	4.0	10
ARISAIG	5.0	1.0	2.5	3.5	1.0	3.0	5
AYR	2.0	3.0	4.0	3.5	4.0	4.0	69
BALLANTRAE	5.0	4.0	3.5	2.5	1.0	4.0	5
BENBECULA	5.0	2.0	2.5	3.0	4.0	3.0	5
BERNERA	5.0	2.0	3.5	2.5	1.0	4.0	10
BROADFORD	5.0	3.0	3.0	4.0	3.0	4.0	8
BUCKIE	2.3	3.0	3.0	2.5	4.0	3.0	60
BUTE	2.0	3.0	4.0	3.5	4.0	4.0	8
CAMPBELTOWN	2.0	3.0	4.0	3.5	4.0	4.0	65
CARRADALE	5.0	2.0	3.5	3.0	1.0	3.0	10
CASTLEBAY	5.0	3.0	3.0	4.5	2.0	4.0	23
CENTRAL MAINLAND (SHETLAND)	5.0	3.0	1.0	1.5	2.0	2.0	6
CRAIL	3.7	1.0	2.0	1.0	1.0	1.0	6
DRUMMORE	5.0	3.0	4.0	3.0	1.0	4.0	5
DUNROSSNESS FAIR ISLE	5.0	2.0	1.0	1.0	1.0	2.0	8
DUNVEGAN	5.0	3.0	2.0	3.0	1.0	3.0	10
EYEMOUTH	1.3	4.0	4.0	3.5	4.0	4.0	15
FORT WILLIAM	4.0	4.0	3.0	3.5	4.0	4.0	7
FRASERBURGH	1.7	4.0	4.0	3.0	4.0	4.0	150
GARDENSTOWN	3.7	3.0	3.0	2.0	3.0	3.0	11
GIRVAN	1.7	4.0	4.0	3.5	4.0	4.0	5
GOURDON	4.0	2.0	2.0	1.5	2.0	2.0	9
GRIMSAY	5.0	2.0	2.0	3.5	1.0	3.0	12
HOY	5.0	3.0	2.5	3.5	1.0	4.0	6
ISLAY	1.0	4.0	3.0	4.0	2.0	3.0	15
JOHN O'GROATS	5.0	2.0	2.0	2.5	1.0	3.0	10
JOHNSHAVEN	5.0	3.0	2.0	3.0	2.0	3.0	8
KINLOCHBERVIE	5.0	2.0	2.5	2.0	1.0	3.0	15
KIRKCUDBRIGHT	2.3	1.0	2.5	2.0	2.0	2.0	22
KIRKWALL	3.0	2.0	2.0	3.0	4.0	2.0	66
KYLE	1.0	3.0	4.0	3.0	4.0	4.0	17
LERWICK	3.0	2.0	2.0	3.5	4.0	2.0	73
LOCH SCRIDAIN	5.0	3.0	1.5	3.0	1.0	2.0	8
LOCHINVER	5.0	2.0	2.5	3.0	1.0	3.0	10
LUING	5.0	1.0	2.0	2.5	1.0	2.0	8

LYBSTER	5.0	5.0	4.0	3.5	5.0	5.0	5
MACDUFF	2.0	4.0	3.5	2.5	4.0	3.0	18
MALLAIG	3.0	1.0	2.0	3.5	3.0	2.0	36
METHIL	1.3	5.0	5.0	3.5	5.0	5.0	6
MONTROSE	2.3	3.0	3.5	2.5	4.0	3.0	9
OBAN	2.0	3.0	3.0	4.0	4.0	3.0	66
PETERHEAD	2.3	4.0	3.0	3.0	4.0	4.0	92
PITTENWEEM	2.0	2.0	2.0	2.0	2.0	2.0	63
PORTREE	2.3	3.0	3.5	3.5	4.0	4.0	61
PORTSOY	3.0	4.0	3.0	2.5	3.0	3.0	5
ROSEHEARTY	5.0	3.0	3.0	2.5	4.0	3.0	6
SANDAY	5.0	3.0	3.0	3.0	1.0	4.0	7
SCALLOWAY	1.7	3.0	2.5	4.0	1.0	2.0	22
SCALPAY	5.0	2.0	3.0	3.5	1.0	4.0	10
SCRABSTER	2.3	3.0	2.0	1.5	4.0	2.0	52
SOUTH HARRIS	5.0	2.0	3.0	3.0	1.0	4.0	12
SOUTH LOCHS	5.0	3.0	2.5	4.5	1.0	4.0	9
SOUTH RONALDSAY	5.0	3.0	2.0	3.5	1.0	3.0	6
SOUTH UIST/ERISKAY	5.0	2.0	2.5	3.0	1.0	3.0	21
ST ANDREWS	2.0	2.0	1.0	2.5	2.0	1.0	10
STORNOWAY	4.0	3.0	3.5	3.0	4.0	4.0	76
STROMNESS	2.3	2.0	2.0	3.0	2.0	2.0	5
TARBERT	1.3	3.0	2.5	2.5	3.0	2.0	14
TINGWALL	5.0	2.0	1.0	2.0	1.0	2.0	10
TOBERMORY	4.7	2.0	2.0	2.0	1.0	2.0	9
TORRIDON	5.0	2.0	1.0	2.5	1.0	2.0	14
TROON	2.0	2.0	3.0	3.0	3.0	3.0	10
ULLAPOOL	1.3	2.0	2.5	2.5	3.0	2.0	32
WEST MAINLAND	5.0	1.0	1.0	2.0	1.0	2.0	11
WESTRAY	5.0	3.0	2.0	3.0	1.0	3.0	20
WHALSAY	5.0	3.0	1.5	1.0	1.0	2.0	27
WHITEHILLS	4.7	3.0	3.0	1.5	2.0	3.0	6
WICK	2.3	4.0	4.0	3.5	4.0	4.0	10
YELL	5.0	2.0	1.5	2.0	1.0	3.0	7

HOME PORT	Transport & Access	Education	Employment & Income	Health & Housing	Crime	Multiple Deprivation	Boats
ABERDEEN	2.0	4.0	3.0	4.5	5.0	3.0	44
ANSTRUTHER	2.3	3.0	2.0	2.5	3.0	2.0	12
ARBROATH	1.3	4.0	4.0	3.5	4.0	4.0	10
ARISAIG	5.0	1.0	2.5	3.5	1.0	3.0	5
AYR	2.0	3.0	4.0	3.5	4.0	4.0	69
BALLANTRAE	5.0	4.0	3.5	2.5	1.0	4.0	5
BENBECULA	5.0	2.0	2.5	3.0	4.0	3.0	5
BERNERA	5.0	2.0	3.5	2.5	1.0	4.0	10

BROADFORD	5.0	3.0	3.0	4.0	3.0	4.0	8
BUCKIE	2.3	3.0	3.0	2.5	4.0	3.0	60
BUTE	2.0	3.0	4.0	3.5	4.0	4.0	8
CAMPBELTOWN	2.0	3.0	4.0	3.5	4.0	4.0	65
CARRADALE	5.0	2.0	3.5	3.0	1.0	3.0	10
CASTLEBAY	5.0	3.0	3.0	4.5	2.0	4.0	23
CENTRAL MAINLAND (SHETLAND)	5.0	3.0	1.0	1.5	2.0	2.0	6
CRAIL	3.7	1.0	2.0	1.0	1.0	1.0	6
DRUMMORE	5.0	3.0	4.0	3.0	1.0	4.0	5
DUNROSSNESS FAIR ISLE	5.0	2.0	1.0	1.0	1.0	2.0	8
DUNVEGAN	5.0	3.0	2.0	3.0	1.0	3.0	10
EYEMOUTH	1.3	4.0	4.0	3.5	4.0	4.0	15
FORT WILLIAM	4.0	4.0	3.0	3.5	4.0	4.0	7
FRASERBURGH	1.7	4.0	4.0	3.0	4.0	4.0	150
GARDENSTOWN	3.7	3.0	3.0	2.0	3.0	3.0	11
GIRVAN	1.7	4.0	4.0	3.5	4.0	4.0	5
GOURDON	4.0	2.0	2.0	1.5	2.0	2.0	9
GRIMSAY	5.0	2.0	2.0	3.5	1.0	3.0	12
HOY	5.0	3.0	2.5	3.5	1.0	4.0	6
ISLAY	1.0	4.0	3.0	4.0	2.0	3.0	15
JOHN O'GROATS	5.0	2.0	2.0	2.5	1.0	3.0	10
JOHNSHAVEN	5.0	3.0	2.0	3.0	2.0	3.0	8
KINLOCHBERVIE	5.0	2.0	2.5	2.0	1.0	3.0	15
KIRKCUDBRIGHT	2.3	1.0	2.5	2.0	2.0	2.0	22
KIRKWALL	3.0	2.0	2.0	3.0	4.0	2.0	66
KYLE	1.0	3.0	4.0	3.0	4.0	4.0	17
LERWICK	3.0	2.0	2.0	3.5	4.0	2.0	73
LOCH SCRIDAIN	5.0	3.0	1.5	3.0	1.0	2.0	8
LOCHINVER	5.0	2.0	2.5	3.0	1.0	3.0	10
LUING	5.0	1.0	2.0	2.5	1.0	2.0	8
LYBSTER	5.0	5.0	4.0	3.5	5.0	5.0	5
MACDUFF	2.0	4.0	3.5	2.5	4.0	3.0	18
MALLAIG	3.0	1.0	2.0	3.5	3.0	2.0	36
METHIL	1.3	5.0	5.0	3.5	5.0	5.0	6
MONTROSE	2.3	3.0	3.5	2.5	4.0	3.0	9
OBAN	2.0	3.0	3.0	4.0	4.0	3.0	66
PETERHEAD	2.3	4.0	3.0	3.0	4.0	4.0	92
PITTENWEEM	2.0	2.0	2.0	2.0	2.0	2.0	63
PORTREE	2.3	3.0	3.5	3.5	4.0	4.0	61
PORTSOY	3.0	4.0	3.0	2.5	3.0	3.0	5
ROSEHEARTY	5.0	3.0	3.0	2.5	4.0	3.0	6
SANDAY	5.0	3.0	3.0	3.0	1.0	4.0	7
SCALLOWAY	1.7	3.0	2.5	4.0	1.0	2.0	22
SCALPAY	5.0	2.0	3.0	3.5	1.0	4.0	10

SCRABSTER	2.3	3.0	2.0	1.5	4.0	2.0	52
SOUTH HARRIS	5.0	2.0	3.0	3.0	1.0	4.0	12
SOUTH LOCHS	5.0	3.0	2.5	4.5	1.0	4.0	9
SOUTH RONALDSAY	5.0	3.0	2.0	3.5	1.0	3.0	6
SOUTH UIST/ERISKAY	5.0	2.0	2.5	3.0	1.0	3.0	21
ST ANDREWS	2.0	2.0	1.0	2.5	2.0	1.0	10
STORNOWAY	4.0	3.0	3.5	3.0	4.0	4.0	76
STROMNESS	2.3	2.0	2.0	3.0	2.0	2.0	5
TARBERT	1.3	3.0	2.5	2.5	3.0	2.0	14
TINGWALL	5.0	2.0	1.0	2.0	1.0	2.0	10
TOBERMORY	4.7	2.0	2.0	2.0	1.0	2.0	9
TORRIDON	5.0	2.0	1.0	2.5	1.0	2.0	14
TROON	2.0	2.0	3.0	3.0	3.0	3.0	10
ULLAPOOL	1.3	2.0	2.5	2.5	3.0	2.0	32
WEST MAINLAND	5.0	1.0	1.0	2.0	1.0	2.0	11
WESTRAY	5.0	3.0	2.0	3.0	1.0	3.0	20
WHALSAY	5.0	3.0	1.5	1.0	1.0	2.0	27
WHITEHILLS	4.7	3.0	3.0	1.5	2.0	3.0	6
WICK	2.3	4.0	4.0	3.5	4.0	4.0	10
YELL	5.0	2.0	1.5	2.0	1.0	3.0	7

26.4 Appendix 4: Number of Vessels in Each Scottish Port

Home Port	>10m	<10m	Total
ABERDEEN	3	41	44
ANNAN	4	0	4
ANSTRUTHER	3	9	12
ARBROATH	1	9	10
ARDNAMURCHAN	0	1	1
ARDRISHAIG	0	4	4
ARISAIG	0	5	5
AYR	39	30	69
BALLANTRAE	2	3	5
BARRA	0	2	2
BENBECULA	1	4	5
BERNERA (LEWIS)	1	9	10
BODDAM	0	2	2
BRACADALE	1	1	2
BROADFORD	0	8	8
BUCKIE	23	37	60
BURGHEAD	0	1	1
BURNTISLAND	0	2	2
BUTE	2	6	8
CAMPBELTOWN	27	38	65
CARRADALE	8	2	10
CASTLEBAY	4	19	23
CENTRAL MAINLAND (SHETLAND)	1	5	6
COLL	1	1	2
CRAIL	0	6	6
DRUMMORE	0	5	5
DUNBAR	3	0	3
DUNBEATH	0	2	2
DUNROSSNESS AND FAIR ISLE	0	8	8
DUNURE	1	3	4
DUNVEGAN	0	10	10
ERRIBOL	0	2	2
EYEMOUTH	9	6	15
FORT WILLIAM	1	6	7
FRASERBURGH	75	75	150

GAIRLOCH	2	0	2
GARDENSTOWN	8	3	11
GIGHA	0	2	2
GIRVAN	0	5	5
GOURDON	2	7	9
GRANTON	2	0	2
GREENOCK	0	4	4
GRIMSAY	4	8	12
GRUINARD-AULTBEA	1	0	1
HELMSDALE	0	3	3
HOLY ISLAND	1	1	2
HOPEMAN	2	0	2
HOY	1	5	6
INVERNESS	0	1	1
ISLAY	3	12	15
ISLE OF WHITHORN	0	4	4
JOHN O GROATS	1	9	10
JOHNSHAVEN	0	8	8
JURA	0	1	1
KEISS	0	4	4
KINLOCHBERVIE	6	9	15
KIRKCUDBRIGHT	17	5	22
KIRKWALL	20	46	66
KYLE	3	14	17
KYLESKU	0	1	1
LARGS	0	1	1
LERWICK	20	53	73
LOCH BUIE (MULL)	1	1	2
LOCH GLENDCOUL-CULKEIN	0	1	1
LOCH SCRIDAIN (ISLE MULL)	2	6	8
LOCHINVER	2	8	10
LOSSIEMOUTH	3	1	4
LUING	2	6	8
LYBSTER	1	4	5
MACDUFF	13	5	18
MALLAIG	19	17	36
METHIL AND LEVEN	0	6	6
MONTROSE	0	9	9
NORTH ARRAN	0	2	2

NORTH BERWICK	0	1	1
NORTH HARRIS	0	2	2
NORTH UIST	3	12	15
NORTHMAVINE	1	2	3
OBAN	21	45	66
PETERHEAD	49	43	92
PITTENWEEM	7	56	63
PORT ELLEN	1	1	2
PORT ERROLL	0	2	2
PORT SETON	4	0	4
PORTAVOGIE	2	2	4
PORTKNOCKIE	0	3	3
PORTNAGURAN	0	2	2
PORTPATRICK	0	2	2
PORTREE	13	48	61
PORTSKERRA	0	1	1
PORTSOY	1	4	5
ROSEHEARTY	0	6	6
ROUSAY TO SHAPINSAY	0	2	2
SALEN	0	1	1
SANDAY	1	6	7
SANDHAVEN AND PITULLIE	0	1	1
SCALLOWAY AND ISLES	4	18	22
SCALPAY	0	10	10
SCOURIE	0	2	2
SCRABSTER	2	50	52
SHETLAND	0	1	1
SLEAT	0	2	2
SNIZORT	2	1	3
SOUTH HARRIS	1	11	12
SOUTH LOCHS	0	9	9
SOUTH RONALDSAY	2	4	6
SOUTH UIST & ERISKAY	3	18	21
ST ABBS	1	0	1
ST ANDREWS	0	10	10
ST MONANCE	0	3	3
STONEHAVEN	1	2	3
STORNOWAY	23	53	76
STRANRAER	0	3	3

STRATHAIRD	1	4	5
STROMNESS	4	1	5
STRONSAY	2	3	5
TARBERT	5	9	14
TAYINLOAN	0	3	3
TAYVALLICH	1	2	3
TINGWALL	4	6	10
TIREE	0	2	2
TOBERMORY (ISLE OF MULL)	3	6	9
TORRIDON	3	11	14
TROON	10	0	10
ULLAPOOL	24	8	32
UNSPECIFIED SCOTTISH PORT	0	1	1
WEST LOCH TARBERT	0	1	1
WEST MAINLAND (SHETLAND)	1	10	11
WESTRAY	3	17	20
WHALSAY AND SKERRIES	13	14	27
WHITEHILLS	4	2	6
WICK	3	7	10
YELL AND FETLAR	1	6	7
TOTAL	**570**	**1186**	**1756**

26.6 Appendix 5: Gear Conflict Questionnaire: Fishermen

INTRODUCTION

Your assistance is essential and we thank you for participating. Please be assured that your responses are completely confidential and only aggregated results will be reported. Thus, no individuals or vessels will be identifiable in any report.

Gear conflict is a complex issue and this questionnaire might not cover some aspects which you feel Marine Scotland should be aware of. If so, towards the end of the questionnaire there is the opportunity to provide more detailed and personal comments on ANY aspect of gear conflict. These comments will only appear in publicly available material with your explicit permission.

As you progress through the questions, if you encounter one for which you cannot provide a completely accurate answer, please persevere and provide the best estimate you can.

***1. Did you fish in Scottish waters at any time during 2012 (Jan. to Dec. 2012).**

○ Yes

○ No (If "no", you will be directed to the end of the survey)

YOUR VESSEL AND GEAR.

The next two questions are about your vessel and gear used during 2012 (Jan. to Dec.)

***2. During 2012, what length was the vessel you operated?**

- ◯ 0-10 metres
- ◯ over 10 metres up to and including 15 metres
- ◯ over 15 metres up to and including 20 metres
- ◯ over 20 metres up to and including 25 metres
- ◯ over 25 metres up to and including 30 metres
- ◯ over 30 metres

***3. During 2012, what type of fishing gear did you primarily use?**

- ◯ Demersal trawl
- ◯ Scallop dredge
- ◯ Nephrop trawl
- ◯ Pelagic trawl
- ◯ Nephrop pots/creels
- ◯ Other shell fish pots/creels
- ◯ Pelagic and other lines
- ◯ Scallop hand diving
- ◯ Other shellfish hand diving

Other (please specify)

____

WHERE YOU FISHED IN 2012

The next two questions ask about where you fished in 2012. Please provide the best estimates you can.

***4. As best you can, please try and estimate the NUMBER OF DAYS you fished in each IFG area (plus Shetland) and other Scottish water. (Refer to the map and note that IFG areas only extends 6 n.miles from the shore).**

Clyde and the West (South West IFG) [ ]

Skye and North West (North West IFG) [ ]

Western Isles (Outer Hebrides IFG) [ ]

Orkney (Orkney Management Group) [ ]

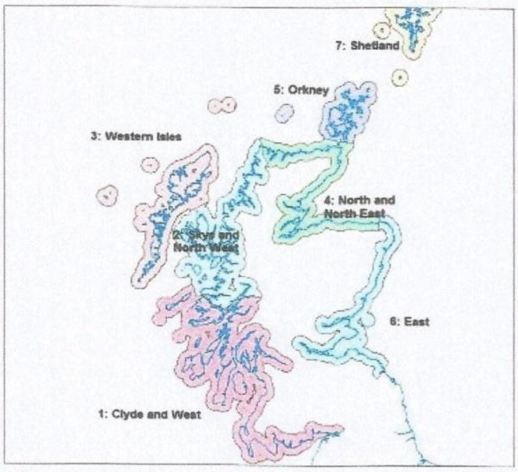
North and North East (Moray Firth and North Coast IFG) [ ]

East (East Coast IFG) [ ]

Shetland Area [ ]

Scottish waters other than the above areas (e.g. outside six miles) [ ]

IFG / Fishery Areas



5. As best you can, please try and estimate the PERCENTAGE OF YOUR TOTAL 2012 FISHING EFFORT in the following distance zones:

% of total fishing 0-1 nautical mile from shore [ ]

% of total fishing fishing 1-3 nautical miles from shore [ ]

% of total fishing fishing 3-6 nautical miles from shore [ ]

% of total fishing fishing 6-12 nautical miles from shore [ ]

% of total fishing fishing beyond 12 nautical miles from shore [ ]

YOUR GEAR CONFLICT IN SCOTTISH WATERS IN 2012

For the purposes of this survey, gear conflict refers to physical contact between your gear and someone else's gear.

***6. During 2012, did you experience gear conflict ANYWHERE in Scottish waters**

◯ Yes

◯ No (If "no" you will be directed to the end of the survey)

7. How does the total number of gear conflicts you experienced in Scottish waters in 2012 compare with previous years?

- ◯ Substantially more than in previous years
- ◯ Slightly more than in previous years
- ◯ About the same
- ◯ Slightly less than in previous years
- ◯ Substantially less than in previous years
- ◯ Don't know

8. How do you think the total number of gear conflicts this year (2013) will compare with the total for 2012?

- ◯ Substantially more than 2012
- ◯ Slightly more than 2012
- ◯ About the same
- ◯ Slightly less than 2012
- ◯ Substantially less 2012
- ◯ Don't know

9. What percentage of your gear conflict incidents did you report to Fishery Officers or other Marine Scotland staff?

Percentage of 2012 gear conflicts reported to Marine Scotland. [ ]

10. With reference to 2012, please estimate the FINANCIAL COST to your business of all gear conflicts. Please include lost profit whilst being unable to use damaged gear, repair and replacement costs, legal bills etc.

Financial cost of all gear conflicts in 2012 [ ]

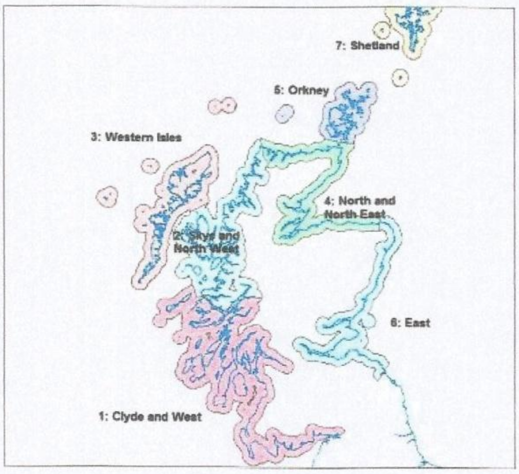
LOCATION AND NUMBER OF GEAR CONFLICT

We now need to know how often and where your gear conflicts are occurring.

11. As best you can, please try and estimate the NUMBER OF DAYS you experienced gear conflict in these areas during 2102.

Clyde and the West (South West IFG)	
Skye and North West (North West IFG)	
Western Isles (Outer Hebrides IFG)	
Orkney (Orkney Management Group)	
North and North East (Moray Firth and North Coast IFG)	
East (East Coast IFG)	
Shetland Area	
Scottish waters other than the above areas (e.g. outside six miles)	

IFG / Fishery Areas



12. As best you can, please try and estimate the PERCENTAGE OF YOUR TOTAL GEAR CONFLICTS occurring in the following distance zones during 2012:

% of total gear conflicts occurring 0-1 nautical mile from shore	
% of total gear conflicts occurring 1-3 nautical miles from shore	
% of total gear conflicts occurring 3-6 nautical miles from shore	
% of total gear conflicts occurring 6-12 nautical miles from shore	
% of total gear conflicts occurring 12 nautical miles from shore	

GEAR TYPES IN CONFLICT

We need better information on the gear types which are in conflict.

13. Please indicate the distance zones and the "other person's gear types" which resulted in you experiencing gear conflict during 2012. You can tick as many boxes as necessary.

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving
0-1 nautical mile from shore	☐	☐	☐	☐	☐	☐	☐
1-3 nautical miles from shore	☐	☐	☐	☐	☐	☐	☐
3-6 nautical miles from shore	☐	☐	☐	☐	☐	☐	☐
6-12 nautical miles from shore	☐	☐	☐	☐	☐	☐	☐
beyond 12 nautical miles from shore	☐	☐	☐	☐	☐	☐	☐

14. For those distance zones where you experienced gear conflict, please identify the "other person's gear type" with which you experienced THE MOST CONFLICTS. (i.e. you can only tick one box per row).

	Nephrop Trawls	Other Trawls	Dredges	Nephrop pots/creels	Other shellfish pots/creels	Lines	Hand diving
0-1 nautical mile from shore	○	○	○	○	○	○	○
1-3 nautical miles from shore	○	○	○	○	○	○	○
3-6 nautical miles from shore	○	○	○	○	○	○	○
6-12 nautical miles from shore	○	○	○	○	○	○	○
beyond 12 nautical miles from shore	○	○	○	○	○	○	○

15. With reference to 2012, please estimate the PERCENTAGE OF TOTAL GEAR CONFLICTS described by each of the following scenarios:

% where OTHERS fished their gear where they COULD NOT HAVE reasonably expected YOUR gear already to be there.	
% where OTHERS fished their gear where they MIGHT HAVE reasonably expected YOUR gear already to be there.	
% where OTHERS fished their gear where they ALMOST CERTAINLY could have expected YOUR gear already to be there.	
% where YOU deployed your gear in locations where you COULD NOT HAVE reasonably expected OTHER gear already to be there.	
% where YOU deployed your gear in locations where you MIGHT HAVE reasonably expected OTHER gear already to be there.	
% where YOU deployed your gear where you ALMOST CERTAINLY could have expected OTHER gear already to be there.	
% of conflicts where there was a different or unknown scenario.	

16. If you feel this questionnaire does not address aspects of gear conflict which should be brought to the attention of Marine Scotland then please provide written comment in the box below. For example, you might wish to elaborate on how conflict affects you, or how you have avoided, prevented or resolved conflict. You might wish to highlight local or Scottish wide policy initiatives that should be considered.

All these additional comments will be presented verbatim to Marine Scotland. If you do not wish your comments to appear in publicly available documents please tick the appropriate box in Question 17 below.

17. Do you object to the above comments appearing in publicly available documents?

- ◯ Yes, I object and wish the above comments to remain private within Marine Scotland.
- ◯ I have no objections.

26.8 Appendix 6: Gear Conflict Questionnaire: Fishery Officers

FISHERY OFFICE QUESTIONNAIRE

For the purposes of our analysis, gear conflict is where there has been **physical contact** between fishing gear. We are collecting data for 2012 (1st Jan to 31 December). If you cannot provide a definitive answer please provide the best estimate that you can.

1. **Name the IFG area you are providing information for.** [ ]

2. **Name of your Fishery Office.** [ ]

3. **With respect to your Office's territory within the IFG, what was the total number of <u>all known gear conflicts</u> during 2012 (including those not formally reported, but known to have occurred)?** [ ]

4. **What percentage of the total in Q3 was formally reported to Marine Scotland Compliance or others agencies within Marine Scotland?** (Marine Scotland gear conflict intelligence data is appended to assist you answering this questionnaire) [%]

5. **Please try and estimate the percentage of the total known gear conflicts in Q3 occurring in each of the following distance zones.**

0-1 nautical mile from shore	%
1-3 nautical miles from shore	%
3-6 nautical miles from shore	%

6. **Please try and estimate the total known gear conflicts in 2012 occurring <u>immediately outside your territory</u> but within 6-12 nautical miles from the shore.** [ ]

7. **To your knowledge, how does the number of gear conflicts in your territory in 2012 compare with previous years? Please tick the appropriate box.**

Substantially more	
Slightly more	
About the same	
Slightly less	
Substantially less	
Don't know	

8. **How do you think the number of gear conflicts in your territory this year (2013) will compare with the total for 2012? Please tick the appropriate box.**

Substantially more than 2012	
Slightly more than 2012	
About the same as 2012	
Slightly less than 2012	

Substantially less than 2012	
Don’t know	

9. **We need to know the types of gears that are in conflict <u>within your Office's territory</u>. Each of the cells in the table below implies a conflict between two gears types. Only a few will be relevant to your territory. Please tick any cells that describe a gear conflict that occurred in your territory during 2012. Even if there was only one incidence of that gear conflict, please tick the relevant cell.**

	Nephrop Trawls	Other Trawls	Dredges	Nephrop Pots/Creels	Other Shellfish Pots / Creels	Lines	Hand Diving	Other (Please Specify)
Nephrop Trawls								
Other Trawls								
Dredges								
Nephrop Pots/Creels								
Other Shellfish Pots / Creels								
Lines								
Hand Diving								
Other (Please Specify)								

10. **We need to know the relative importance of the gear conflicts you identified above. Using the table below, as best you can, please estimate the percentage of total known conflicts (see Q3 above) accounted for by each of the conflicts you identified above.**

	Nephrop Trawls	Other Trawls	Dredges	Nephrop Pots/Creels	Other Shellfish Pots / Creels	Lines	Hand Diving	Other (Please Specify)
Nephrop Trawls	%	%	%	%	%	%	%	%
Other Trawls	%	%	%	%	%	%	%	%
Dredges	%	%	%	%	%	%	%	%
Nephrop Pots/Creels	%	%	%	%	%	%	%	%
Other Shellfish Pots / Creels	%	%	%	%	%	%	%	%
Lines	%	%	%	%	%	%	%	%
Hand Diving	%	%	%	%	%	%	%	%
Other (Please Specify)	%	%	%	%	%	%	%	%

Thank you very much for your time and effort.

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