

The North Sea Advisory Council



**A Long Term Management Plan for North
Sea *Nephrops***

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1. The Scope of the Long Term Management Plan

This Long Term Management Plan (LTMP), hereafter referred to as the 'Management Plan', is intended to set out clear objectives and options for managing the *Nephrops* fisheries of the North Sea. The overall goal is to ensure that further development and improvement in the *Nephrops* fisheries can take place in a sustainable way, without affecting natural resources adversely.

The plan has been prepared by a Focus Group of the NSAC, and has been discussed extensively by the Demersal Working Group and approved in its present form by the Executive Committee of the NSAC. The plan is mainly of interest to fishers from the United Kingdom, Denmark, Sweden and the Netherlands, and relates to the fisheries within ICES Statistical Areas IVa and IVb (North Sea). As French fishers do not fish for *Nephrops* in the North Sea, and the French fishing industry (CNP/MEM/UAPF) did not participate in this work, they are not committed to the content or the principles included in the plan.

The plan has been prepared at a time when reforms to the Common Fisheries Policy (CFP) have been agreed. Those reforms are expected to lead to a greater degree of self-management of fisheries within the North Sea. The Management Plan is designed to fit within a new regional approach, where appropriate Member States will lead fisheries management in particular regional seas in consultation with stakeholders. It is hoped that these reforms will lead to the adoption of a "stewardship" approach; where regional authorities delegate management responsibilities to stakeholders within set limits, while retaining the right to intervene if the fishery moves in an unsustainable direction.

Individuals and communities must be involved in any management decisions that will significantly affect them. In developing this plan for the *Nephrops* fisheries the NSAC has aimed at a plan that has industry "buy in". The plan has been developed from discussions with fishers and other interested parties, including those responsible for accrediting the *Nephrops* fisheries.

Because this is the first plan that has been prepared in this way, with the full involvement of stakeholders, the plan is rather longer and more detailed than a conventional Management Plan. The plan includes information on how the management conclusions were reached, and how the plan has progressively evolved. Later versions are expected to be more concise.

During the preparation of the Management Plan, several major changes were made to fisheries management within the EU. A central objective of the reform of the Common Fisheries Policy (CFP) is now the progressive elimination of discards in all EU fisheries through the introduction of an obligation to land all catches. The North Sea demersal fishing fleets will soon be operating within a CFP transformed by the discard ban and other reforms. The Landing Obligation will be applied to the industrial and pelagic fisheries in the North Sea on the 1st January 2015, and to the demersal fisheries in the North Sea on the 1st January 2016 for some species. Discard plans are progressively being developed and proposed by cooperating Member States to meet that target date. Such plans will require changes to current management and control regimes, and will affect other aspects of the CFP, including management plans.

The Commission has recently announced its intention of producing a Mixed Fishery Plan for the North Sea. The plan is intended to achieve the overall CFP objective of maintaining stocks at Maximum Sustainable Yield (MSY), whilst recognising that a number of species are caught within the mixed fishery and conflict must be avoided between management proposals for these different species. An important aspect of the Mixed Fishery Plan will be how it will deal with *Nephrops*.

The NSAC has tried to take account of these new developments in preparing this Management Plan for *Nephrops*.

2. Overall Objectives of the Long Term Management Plan

The new Basic Regulation (EU Regulation 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy requires that Management Plan objectives are consistent with objectives set out in Article 2 and with the relevant provisions of Articles 7 and 9 of the Regulation. This Management Plan follows that requirement:

Objective 1: Sustainability

The Management Plan aims to ensure that fishing activities are sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving environmental, economic, social, and employment benefits; and of contributing to the availability of food supplies. The plan aims to meet biological and ecological objectives whilst ensuring that fishing businesses are prepared for the economic stresses that are inevitable when exploiting a variable natural resource in an uncertain global economy. The plan recognises that these objectives cannot necessarily be reached simultaneously without some trade-offs between competing priorities in the short term.

Objective 2: Achieving Maximum Sustainable Yield

This Management Plan aims to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels that can produce Maximum Sustainable Yield (MSY). The Plan accepts that the MSY exploitation rate is to be achieved by 2015 wherever possible, and at the very latest MSY must be achieved by 2020. Specific measures have been introduced in the plan to promote recovery where stocks are not exploited at MSY levels. Where there are insufficient data to determine MSY targets the plan is committed to measures based on the precautionary approach, ensuring at least a comparable degree of conservation.

The Plan sets quantifiable targets for fishing mortality and aims to restore and maintain spawning stock biomass above levels that can produce MSY, with clear time frames to reach the quantifiable targets. Reference points are employed, consistent with the objectives set out in Article 2 of the new basic regulation.

Instruments are set out in the Plan, in terms of conservation and technical measures to be taken in order to achieve the targets.

Objective 3: Based on the Best Possible Advice

This Management Plan is intended to be firmly based on the best available scientific, technical and economic advice and is committed to the collection of additional scientific data where that is appropriate.

Objective 4: Avoidance of Unwanted Catches

This Management Plan is aimed at progressively eliminating discards, taking into account the best available scientific advice, by avoiding and reducing unwanted catches as far as possible and gradually ensuring that catches are landed. It also emphasises the importance of making the best use of unwanted catches. The Plan recognises that the newly formulated landings obligation will need to be implemented in the *Nephrops* fishery and that a discard plan will need to be developed and incorporated into this Plan through discussions at a regional seas level between Member States and the NSAC.

Objective 5: A Fleet-Orientated Approach

This Management Plan aims to provide conditions for an economically viable and competitive fishing capture and processing industry. It recognises that there are real challenges in developing plans for sustainable fisheries that are biologically and ecologically orientated, but also fleet orientated. For those fleets it will be important to optimise long-term and sustained economic returns.

Objective 6: Achieving a Fair Standard of Living

This Management Plan is intended to enhance the position of coastal communities by improving their resilience; promoting a fair standard of living for those engaged in fishing and other activities that support the fishing industry.

Objective 7: Efficient Markets

The Management Plan aims to contribute to an efficient and transparent internal market for fisheries products, ensuring a level playing field for the marketing of fisheries products.

Objective 8: Achieving Good Environmental Status

This Management Plan has adopted the objective of achieving Good Environmental Status by 2020, as set out in the Marine Strategy Framework Directive.

The Plan is intended to be multi-annual, with regular review every three years. It is designed to be adaptive and capable of being adjusted to match any major change in circumstances. It is also intended to be compatible with, and interdependent on, other Management Plans and especially the Mixed Fishery Plan being developed for the North Sea.

Once this Plan is agreed and put into operation then progress with implementing it will be monitored.

3. Summary of the Long Term Management Plan

In the table below we summarise the proposals contained within this Long Term Management Plan for the North Sea *Nephrops* fisheries. The targets and instruments are set out in more detail later.

<p>The overall goal:</p> <p>To ensure that further development and improvement in the <i>Nephrops</i> fisheries can take place in a sustainable way, without affecting natural resources adversely. Fishing must be at a level that will allow <i>Nephrops</i> and other stocks to be maintained at levels that can achieve MSY, whilst ensuring an economically viable fishing industry.</p> <p>It is envisaged that in the future overall management of the North Sea demersal fisheries will be undertaken within a Mixed Fishery Plan, setting a range of set a range of target fishing mortalities for each stock. However, within the North Sea <i>Nephrops</i> occurs in discrete populations limited by substrate type. Each of these Functional Units needs to be considered separately. Catches from each Functional Unit should be managed to ensure that the level of exploitation is consistent with MSY and that the local <i>Nephrops</i> population can sustain itself. This Management Plan therefore proposes the preparation of Fishing Plans, to be implemented in a timely manner for each Functional Unit.</p>	
Biological Targets	Instruments
<p>Restore and maintain the biomass of each <i>Nephrops</i> Functional Unit in the North Sea at levels that can produce MSY.</p> <p>Exploit <i>Nephrops</i> in the North Sea at a rate that is sustainable and consistent with Fmsy through the setting of Fmsy targets for each of the Functional Units (FUs).</p>	<p><i>Nephrops</i> will be exploited at a rate that is sustainable and consistent with the upper limit of Fmsy through the setting of targets for each of the FUs. A proxy for Fmsy limits will be set for each FU wherever possible. The overall TAC for the North Sea will be consistent with the target values set. The limit F will be reached gradually, through incremental annual reductions in fishing mortality with the overall aim of achieving Fmsy by 2015, and certainly by 2020.</p> <p>Fishing Plans for the FUs will provide the means for meeting this aspiration. For each Functional Unit an abundance buffer level (Bbuffer) will be set, with advice from ICES, which will prompt a revision of the target value for fishing mortality in the event of a major change in stock size revealed by underwater TV surveys. F will be reduced in line with the reduction in stock size indicated</p>

	<p>by those surveys, so as to recover to Bmsy (or proxy with similar intent) as soon as possible. If recruitment improves and stock size increases above Bmsy (or proxy), then F will be increased up to Fmsy through agreed procedures for setting TACs.</p> <p>A TAC will be set for the North Sea as a whole, consistent with the aggregated advice from the Functional Units.</p> <p>Specific measures for management of the Functional Units will be dealt with through the Fishing Plans, tailored to each FU. Each plan will propose measures for limiting fishing pressure in the event of a major change in abundance.</p> <p>The measures to be adopted for particular FUs will be prepared and proposed by the regional management body, through a Fishing Plan, with the support and participation of the fishers who fish that ground, and other stakeholders, and subject to evaluation by STECF.</p> <p>Where there is a lack of information on the fishery or stock the Fishing Plan will include proposals to remedy that deficiency.</p> <p>Restrictions upon one Functional Unit may have an effect upon other Functional Units through displacement of effort. Steps may need to be taken to deal with displacement effects.</p>
Ecological Targets	Instruments
<p>Reduce discards of both <i>Nephrops</i> and whitefish in the fishery to meet the Landing Obligation.</p> <p>Minimise damage to threatened, endangered and protected species</p> <p>Minimise impacts on benthic habitats and associated biological communities.</p> <p>Adopt such other measures as may be necessary to achieve Good Environmental</p>	<p>Measures will differ for different fleets. Use will be made of flexibilities under Article 15 of the basic regulation.</p> <p>In the first instance, a discard plan for the North Sea demersal fisheries will be adopted before January 2016 through discussions at a regional seas level between relevant Member States and the NSAC.</p> <p>It will be for fishers to adopt measures for reducing discards and by-catches to meet the</p>

<p>Status, consistent with the requirements of the Marine Strategy Framework Directive and Habitats Directive, paying due regard to site designations.</p>	<p>Landing Obligation. It will be their responsibility to:</p> <ul style="list-style-type: none"> • Ensure that all relevant catches are landed, or fully recorded • Reduce the level of unwanted catches to the lowest level possible • Ensure that the requirements of the Landing Obligation are met <p>Other management measures will be adopted through discussions at a regional seas level and will include:</p> <ul style="list-style-type: none"> • Identifying and implementing Marine Protected Areas, including 'real-time', seasonal and permanent closed areas • Restricting the range of gears that can be used in vulnerable areas (including creel only areas) • Promoting the development of environmentally friendly fishing practices, for example gears with less bottom contact, larger meshes and better selectivity profiles • Improving data recording systems to identify capture and damage to endangered, threatened and protected species • Safe and speedy return to the sea of endangered and threatened species
Economic Targets	Instruments
<p>Provide incentives for fishers to move the fishery in the direction of lower fishing mortality while enabling them to meet their own business aims and objectives</p> <p>Avoid regulation that makes fleets less efficient or provides perverse incentives which act to the detriment of the fishery and the <i>Nephrops</i> stock</p>	<p>Member States, Producer Organisations and fishing businesses will ensure that fishing for <i>Nephrops</i> remains sustainable through the measures outlines above. But they must also decide how to deal with changing economic pressures, operating through a transparent internal market which functions smoothly and aims to achieve good product quality.</p>

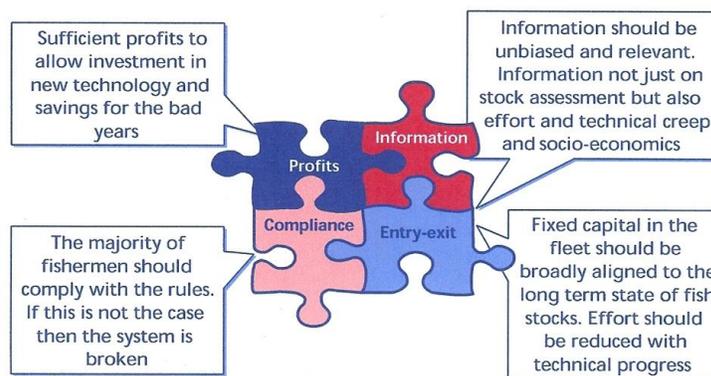
<p>Any change imposed on the fishery to meet biological and ecological objectives should take place at a rate that can be absorbed by individual businesses and communities.</p>	<p>There are no specific economic instruments imposed by this Management Plan. However, in meeting the biological and ecological objectives it will be important to:</p> <ul style="list-style-type: none"> • Provide incentives and opportunities for individual fishers to change their fishing practices to meet new business aims and objectives. • Avoid regulation that makes fleets less efficient or provides perverse incentives which are detrimental to the fishery and the <i>Nephrops</i> stocks • Ensure that any changes imposed on the fishery to meet biological and ecological objectives take place at a rate that can be absorbed by individual businesses and communities
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4. The Approach adopted by the Management Plan

Achieving sustainability

The Report on Long-term Management of North Sea Fisheries, produced from a workshop held in Edinburgh in March 2006 by the NSAC, pointed out that it is only by taking account of ecological, economic, and social factors within an appropriate institutional structure that development can continue without exhausting natural resources. The report went on to point out that the overall goal of achieving sustainable fisheries could not be achieved by prioritising any one of the components of sustainability to the exclusion of others – for example targeting a high biomass or making profit maximisation the only goal. All aspects of sustainability have to be considered together.

This point was also the theme of the Net Benefits Report from the UK Cabinet Office. It presented a management jigsaw, where all the separate issues must mesh together to create the overall picture:



The main biological objective of this plan is to avoid over-exploiting the resource. *Nephrops* Functional Units in the North Sea must remain at or close to their full reproductive capacity and must never approach a state where stocks would be unable to replace themselves as a result of fishing mortality.

Within the North Sea there is a risk that a recovery of whitefish stocks, and especially cod, may result in increased predation upon *Nephrops*, leading to a decline in the available resource. The management objectives must deal with such multi-species interactions.

Many vessels catch *Nephrops* along with other species like plaice, cod, whiting or haddock. Even where *Nephrops* is the main target, a significant income may be obtained from the capture of whitefish species. Days at sea restrictions, together with other measures, have now greatly restricted the range of fishing opportunities for fishers and have disrupted their traditional fishing patterns. Fishers have repeatedly pointed out to the NSAC that it is now more difficult to pursue a seasonal pattern of fishing, moving from one species to another in the way they once did. A mixed fishery management regime that respects these traditional patterns and recognises that vessels catch a range of species has much to commend it. Preparation of a Mixed Fishery Plan for the North Sea is now under way. It will involve the development of a new paradigm for fisheries management. Development of a mixed fisheries approach will depend on strong cooperation between the NSAC, scientists and fishery managers.

It is envisaged that under the reformed CFP there will be an over-arching, North Sea Mixed Fishery Plan, based on the main species captured, including *Nephrops*. However, unlike many other species, *Nephrops* within the North Sea occurs in discrete populations limited by substrate type. Management of the *Nephrops* fishery must ensure that catches from each of these Functional Units are regulated in order to ensure that the level of exploitation is consistent with MSY and that the local *Nephrops* population can sustain itself. Management by Functional Unit is a key issue in the management of the *Nephrops* fisheries. This Management Plan allows for the development and implementation of the Fishery Plans for these Functional Units, to be implemented through a regional approach.

Whilst this Plan was being prepared the Landing Obligation was introduced, with its far-reaching consequences. Under evolving proposals for meeting the Landing Obligation a discard plan has to be prepared for the lead species in the fishery to meet the target date for introduction of the Landing Obligation for demersal species by January 2016. Many fishers are interested in initiatives that will allow them to land all their catch. The Landing Obligation has the potential to change both gear design and fishing behaviour. There is scope for improving management if the expertise and views of fishers are fully taken into account. The preparation of a discard plan for the North Sea must proceed initially as a parallel development to this Management Plan, as the various issues must be discussed with Member States. The agreed discard proposals will, however, be incorporated into this Management Plan at a later stage of development.

For the time being this Plan will concentrate on dealing with the issue of management of North Sea *Nephrops* at the Functional Unit level. At a later stage it will be developed further to include measures to meet the Landing Obligation and to include mixed fishery considerations.

Functional Units

Currently, in the North Sea, ICES has divided *Nephrops* stocks into separate Functional Units (FUs) for assessment purposes. A major management consideration for *Nephrops* stocks is whether management should be at the FU level rather than a North Sea level. Advice from ICES and STECF has been that current management of *Nephrops* in the North Sea (both in terms of TACs and effort) does not provide adequate safeguards to ensure that local effort is sufficiently limited to avoid depletion of resources in the FUs. Catches can be taken anywhere in the North Sea and vessels have the flexibility to move between grounds. Scientists have warned that this freedom, although it permits flexibility for fishing vessels, may lead to unacceptably high harvest rates from some of the FUs.

A key element of this Long Term Management Plan is therefore to achieve management by FU through the preparation of Fishing Plans for *Nephrops* FUs in the North Sea, within the wider context of a Mixed Fishery Plan for the North Sea. A Fishing Plan describes in detail the way in which FUs are to be managed and exploited. Each Fishing Plan is intended to ensure the biological objectives are met for each FU, while also taking account of any displacement effects upon other FUs as a result of the measures taken.

To be effective, any management plan needs to specify what actions will be taken when the stock falls outside defined reference points. Fishing Plans would be agreed before such an event occurred, to avoid delays in implementation.

This Management Plan concludes that management at the FU level through Fishing Plans will provide the necessary controls to ensure that catch opportunities and effort are compatible and in line with the scale of the resources in each of the stocks defined by the FUs. At the same time this approach also retains flexibility for the fleets to move between grounds and to engage in mixed fisheries.

Economic and business considerations

Fishing fleets should be economically resilient, with an ability to withstand changes in their circumstances. Economically, fishing businesses must be able to rely on a sustainable level of profit.

There is currently a need to rationalise and harmonise various fisheries management measures and regulations, many of which currently make fleets less efficient and threaten profits. Socially, it is preferable for changes in management to take place at a rate that can be absorbed by businesses, ports and communities, especially if change is imposed through regulation. It is also important for stakeholders to be involved in any decisions that will have significant impact upon them.

One important aim of this Plan is to achieve a modern, safe, fishing fleet that is earning profits. However, this document is a fisheries management plan, not a business plan. The fleets themselves are very diverse and conditions in Member States differ. Although this plan will set out some general economic guiding principles, it will not be prescriptive in defining economic measures to be taken by Member States, producer organisations or fishing businesses.

5. Targets for the Management Plan

Setting biological targets

An important role of any plan for North Sea *Nephrops* must be to match overall fishing capacity to the long-term sustainable yield. Fishing must be at a level that will allow *Nephrops* stocks to renew themselves and be maintained at levels that can produce MSY so as to fulfil their natural role in the marine ecosystem and also support a profitable and secure fishing industry. The overall aim must be to match fishing capacity to a longer-term sustainable yield, whilst accommodating fluctuations in the state of the stocks. However, we cannot control abundance, we can only influence it through managing F. There is natural year-to-year variability in the wider environment affecting factors like recruitment and predation; and these factors must also be taken into account when setting F at suitably precautionary levels.

The most recent assessments for all units are described in Table 1, below. The advice for FUs with UWTV surveys (i.e. with abundance estimates) follows ICES MSY Harvest Control Rules, based on the most recent abundance estimates; taking into account discard rates and mean weights. For the rest of the FUs, that are classed as Data Limited Stocks, advice is based on average landings of last 10 years, unless this is not considered precautionary.

Table 1: Current Status of the North Sea stocks

ICES Division	FU	Name	F in relation to MSY (F _{msy} proxy*)	SSB in relation to MSY (B _{trigger} proxy**)
IVb,c	5	Botney Gut – Silver Pit	Data Limited Stock	
IVb	6	Farne Deeps	Above	Below
IVa	7	Fladen Ground	Below	Above
IVb	8	Firth of Forth	Below	Above
Iva	9	Moray Firth	Below	Above
IVa	10	Noup	Data Limited Stock	
IVa	32	Norwegian Deep	Data Limited Stock	
IVb	33	Off Horn's Reef	Data Limited Stock	
IVb	34	Devil's Hole	Data Limited Stock	

*Owing to the way *Nephrops* are assessed, it is not possible to estimate F_{MSY} directly and hence proxies for F_{MSY} are determined.

**The proposed preliminary MSY B_{trigger} values were set at the lowest observed Underwater Television (UWTV) survey abundance, unless the stock has shown signs of stress at higher abundance (in which case a higher value is used).

Accompanying the assessment are the following comments from ICES:

- Management should be implemented at Functional Unit level (particular problems are FU6, Farne Deeps, & potential displacements from FU7, Fladen Ground).

- Cod is a major predator; *Nephrops* abundance may decrease with cod recovery.
- *Nephrops* trawl fisheries have a by-catch of cod, haddock, whiting, and can have high discards; but more selective gears have been used in recent years, further measures may be necessary (subject to evaluation of current measures).
- The survival of any *Nephrops* that are discarded is highly variable, and is FU-specific ($\leq 25\%$ in all FUs). (NB This issue is discussed later).

The *Nephrops* fisheries within the European Union are governed by the key policy goal of achieving MSY by 2015 and ICES presents this advice in terms of attaining a fishing mortality at or below F_{msy} . Proxies for F_{msy} are available for the key FUs with precautionary data deficient protocols in use for those with less reliable information. Proxies are currently set at F_{max} or below.

The ICES advice makes use of a biomass trigger level (MSY Btrigger), which is intended to safeguard against an undesirable or unexpected low Spawning Stock Biomass (SSB) when fishing at F_{msy} . This level is considered to be the lower bound of SSB fluctuations around B_{msy} . For *Nephrops* stocks MSY Btrigger has been defined as the lowest stock size from which the abundance has increased.

The values currently used for MSY Btrigger for *Nephrops* are actually equivalent to B_{lim} for whitefish stocks. In future, ICES may need to revise the reference points to be more consistent with the definitions used for whitefish stocks. This would mean the values currently associated with Btrigger would be redefined, as B_{lim} , and new values would need to be agreed for Btrigger.

Recent stock assessments have indicated declines in abundance in two FUs (the Farne Deeps and the Fladen Ground). The Farne Deeps has displayed signs of a reduction in abundance since about 2007. Both underwater TV surveys and anecdotal evidence from the Fladen Ground illustrate a decline since 2012 despite being fished at a level below F_{msy} .

Cod in the North Sea, a species that preys upon *Nephrops*, is moving from a level of low abundance to one of higher abundance. It is necessary to take account of species interactions and other changes to the ecosystem that may have a significant effect in the future upon *Nephrops* stocks. Ecological systems are dynamic and unpredictable with major effects, for example from climate changes, which cannot be influenced by fisheries management measures. Management systems and Management Plans must be robust in the face of uncertainty. They must be adaptive and capable of changing with circumstances so as to allow stocks to be sustainably harvested despite changes to environmental conditions.

Fishers are sceptical over risks to *Nephrops* stocks from predation as a result of a recovering cod stock. However, they accept that there might be other circumstances under which particular stocks may become less abundant, for example as a result of environmental change, as well as through over-exploitation. It is acknowledged by fishers that it would be useful to set a trigger point to enable fishing mortality to be adjusted in the event of a sudden collapse or increase in the stocks. The trigger point might be based on results from the underwater TV surveys and the size distribution of *Nephrops* in the

catches. However, it would not be sufficiently precautionary to use MSY Btrigger as the trigger to invoke management measures; another level above MSY Btrigger is needed.

This Management Plan suggests the designation of an abundance buffer point (Bbuffer). Bbuffer is a precautionary level of abundance above Btrigger that will turn on a set of management measures designed to avoid further stock decline to below Btrigger, and then turn off those measures once recovery has been achieved. Advice has been taken from ICES in defining Bbuffer. A discussion paper prepared following the ICES WGNPS Meeting in October 2014 has been attached as Annexe 2. This preliminary analysis indicates that using the proportion of the mean inter annual change of the TV surveys would be a reasonable option for the FUs analysed.

Taking all the above considerations into account the NSAC is proposing the following biological targets for the North Sea Nephrops fishery:

- To maintain the abundance of each Functional Unit at a sustainable level, above Bbuffer
- To exploit *Nephrops* in the North Sea at a rate that is sustainable and consistent with Fmsy through the setting of Fmsy targets for each of the FUs

The first of these targets will be achieved by setting an abundance buffer point (Bbuffer) for each FU that will prompt a revision of the target value for fishing mortality in the event of a major change in stock size.

The proposed definition is $B_{buffer} = B_{trigger} + \text{mean inter annual abundance change}$, using the proportion value, (as described in Annexe 2). This method fits all the FUs analysed and could potentially be a good precautionary reference point to turn on management measures designed to avoid further stock decline to below Btrigger, and then lift those measures when the stock has recovered.

As the main management measure, a TAC will be set for the North Sea as a whole, consistent with the Fmsy catch advice based on aggregated assessments for the individual FUs. Under the proposed Mixed Fishery Plan for the North Sea it is likely that a range of Fmsy targets will be set for *Nephrops*, rather than a single point value.

Management at the FU level will be achieved not through the setting of individual TACs but through the adoption of specific management measures for vulnerable FUs. Those measures should reflect the particular circumstances on those grounds, including any effects as a result of displacement from other grounds.

Measures for the individual FUs would be developed through the preparation of Fishing Plans for vessels and fleets fishing the designated FUs.

Wider ecological targets

Ecological sustainability is an important aspect of this Management Plan. Management practices must be set so as to maintain ecological processes and minimise impact on other species and on habitats for the benefit of future generations. This aspect of the plan

should be complementary to the other aspects of the plan. Ecological objectives must be part of the overall strategy.

The Marine Strategy Framework Directive establishes a framework for Member States to take steps to achieve or maintain good environmental status in their marine waters by 2020 at the latest. Good Environmental Status (GES) is to be determined on a regional seas basis – in this case for the Greater North Sea including the Kattegat and the Channel. The Member States sharing a marine region or sub-region are obliged to cooperate to ensure that the Directive's objectives are achieved.

The overall goal of the Directive is to conserve marine ecosystems and, where practicable, restore marine areas that have been damaged by preventing and eliminating pollution and by protecting our waters from any adverse effects of human activities.

The Directive was transposed into Member States' legislation in 2010. It requires there to be:

- An assessment of the current state of the seas by July 2012
- A detailed description of what GES means, and the development of targets and indicators by July 2012
- Establishment of a monitoring programme to measure progress towards GES by July 2014
- Establishment of a programme of measures for achieving GES by 2016

In September 2010 the Commission adopted a series of criteria for maintaining GES. From a fisheries standpoint these criteria require:

- Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.
- Descriptor 3: Populations of all commercially exploited fish and shellfish are to be within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.
- Descriptor 4: All elements of the marine food chain are to occur at normal abundance and diversity and at levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity
- Descriptor 6: Sea-floor integrity is to be at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.
- Descriptor 9: Contaminants in fish and seafood for human consumption are at levels not giving rise to pollution effects

For all these descriptors, Member States are proposing their own monitoring programmes to measure progress towards achieving and maintaining GES in their seas. The final stage is the implementation of management measures to achieve GES by 2020. These have to be developed by 2015 and implemented by 2016. Each stage of the implementation process then has to be reviewed every 6 years, and if necessary updated.

A key requirement of the Directive is that European Member States must take a coordinated approach to implementation, cooperating with other Member States in the relevant Marine Region or sub region to ensure each element of their marine strategies is coherent and coordinated.

It is clear that to meet obligations under the Marine Strategy Framework Directive there is a need to reduce the impact of the *Nephrops* fishery on threatened endangered and protected species, as well as the effects of bottom disturbance from *Nephrops* trawls upon habitats and sensitive benthic communities. Parts of the seabed with a soft substrate, where *Nephrops* are found, are highly diverse, productive and of high ecological value.

An important aspect of this *Nephrops* fishery management plan must therefore be to minimise impacts on the ecosystem. Steps will need to be taken to protect vulnerable species and habitats. Protection of the seabed must receive particular attention, and animals that are not being fished for, but which might be adversely affected by the fisheries, will need to be protected. Achieving overall ecological sustainability is also important. Management practices must be set so as to maintain ecological processes and minimise impact on other species and on habitats for the benefit of future generations. Within the Management Plan it will be necessary to align ecological objectives with the descriptors for achieving GES, once these have been finalised by Member States and agreed on a regional basis.

In addition to objectives for *Nephrops* this Management Plan identifies four ecological goals that will contribute to attaining GES for species and habitats associated with the *Nephrops* fishery;

- Reduce discards in the *Nephrops* fishery and observe the Landing Obligation
- Minimise damage to endangered, threatened and protected species
- Minimise impacts on benthic habitats and associated communities
- Achieve Good Environmental Status (GES), consistent with the requirements of the Marine Strategy Framework Directive

Common to each of these targets is a long-term aim of reducing fishing pressure on non-target species by whatever means are available. The development and implementation of environmentally friendly fishing gear and fishing practices must become standard practice in order to minimise impacts on the ecosystem.

Another important requirement is to improve data recording systems to identify capture and damage to endangered, threatened and protected species and also to define the spatial footprint of the fishery as a whole.

The adoption of other measures might prove necessary to achieve GES, consistent with the requirements of the Marine Strategy Framework Directive.

Implementation of the Landing Obligation

The European Commission has established the Landing Obligation (the discard ban) to be implemented in several steps: pelagic species in 2015 (including in the Mediterranean), demersal species in 2016. The 1st January 2016 will be the date for implementing the ban for demersal fisheries. This ban will apply initially to the “species defining the fishery”, with all other species having to be accommodated by 2019.

It will be necessary for this NSAC Management Plan for *Nephrops* to be adjusted as these initiatives develop. Currently, the Scheveningen Group of North Sea member States is seeking the advice of the NSAC on the preparation of a discard plan for the North Sea demersal fisheries.

Economic targets

One of the starting points for the fishers consulted in the preparation of this plan was – “what has this plan got to do us, and what will it do to keep fishing communities alive? If it results in still more restrictions upon fishing then there will be no fishing communities”.

The main economic aim for any fishery must be to achieve economic resilience based on a sustainable level of profit; to provide increased revenue and profits for vessels operating in the *Nephrops* fishery. Profitability is also a necessary precondition for higher compliance with fishery regulations. In economic terms the *Nephrops* plan should aim in the long term (over the next 10 years) to provide for a modern, safe fishing fleet, able to renew itself, and capable of providing a stable supply of fish matched to the needs of the market at reasonable prices. Essentially the plan must provide conditions where all those involved in the industry can achieve the best possible outcome for their businesses – but without specifying in detail how those individual businesses should operate.

Failure to match fleet capacity to the future state of the resource will both reduce long-term profitability and undermine compliance with the regulations, as well as endangering the resource.

It is recognised that there is a problem with technology creep and that fishing capacity will tend to increase in a progressive way with time. Failure to match fleet capacity to the future state of the resource will both undermine compliance and mean that revenues are flowing into businesses with no chance of long-term profitability.

There are already heavy additional costs placed upon fishers as a result of current regulations, and the need to lease quota and days at sea. Effort restrictions imposed under the cod recovery plan have had a profoundly negative effect upon profitability. There is therefore a need to rationalise and harmonise various management measures and regulations that make fleets less efficient.

The economic targets of the plan are:

- To provide incentives for fishers to move the fishery in the direction of lower fishing mortality while enabling them to meet their own business aims and objectives
- To avoid regulation that makes fleets less efficient or provides perverse incentives which act to the detriment of the fishery and the *Nephrops* stock
- Any change imposed on the fishery to meet biological and ecological objectives should take place at a rate that allows individual businesses and communities to adapt.

6. Measures to meet the targets

Biological instruments

To ensure that the Management Plan is effective in ensuring stock sustainability, a point for revocation and renewal of the measures within the plan must be agreed. Currently, it appears that using terms related to abundance and/or exploitation would be most sensible, as the limit and target reference points are expressed in these terms. The use of an MSY Btrigger and Fmsy as the defined targets, however, should be avoided, as this approach would not be sufficiently precautionary. Alternative terms need to be agreed to provide a buffer zone above MSY Btrigger and/or below Fmsy to reduce the risk of breaching the reference points and placing the stock at risk. This buffer point will be referred to as Bbuffer.

It is proposed that a term relating to abundance would be preferable to a term relating to exploitation. There are several possible ways of expressing a precautionary buffer point (Bbuffer) in terms of abundance. The ICES Working Group on *Nephrops* Surveys (WGNEPS) is currently discussing alternative approaches to setting buffer points. Their initial thoughts are set out in Annexe 2. The outcome of their deliberations will have implications for this Long Term Management Plan and this plan may subsequently be modified to take account of future advice from ICES in setting the Bbuffer level.

The definition of precautionary abundance buffer points to be applied to the *Nephrops* Functional Units should be consistent across the different FUs in the North Sea.

For stocks without underwater TV surveys but with catch length frequency information, such as FU 5 (Botney Gut – Silver Pits), the data can be used to define both recruitment (% of catch in numbers below a particular cut off) and exploitation (slope of the declining right hand portion of the curve) proxies which, can, in turn, be used as an indicator of stock trends. Although the measurements would be to a certain extent relative, the comparative states of each indicator can be compared.

This methodology was used by the North West Waters Advisory Council to derive a simple rule to determine the length of time for the closure in FU 16 (Porcupine Bank). Essentially the duration of a seasonal closure is to be decided on the basis of the estimated level of

exploitation and the estimated level of recruitment. The rule has been applied through the use of a matrix – below is the matrix used in the management of *Nephrops* on the Porcupine Bank (an area outside the North Sea). An additional matrix used in the lifting of the management measures is also provided.

Suggested rules to apply to the invocation of management measures for the Porcupine Bank with green indicating no measures, as risk is low, and red indicating the use of measures outlined in the local plan. Amber indicates an area of increased risk and indicates no local plan measures in place but increased awareness of the activities within the fishery.

Exploitation		Recruitment		
		Low	Medium	High
	Low			
	Medium			
	High			

Rules applied to assess the duration of the closure on the Porcupine Bank for 2013.

Exploitation		Recruitment		
		Low	Medium	High
	Low	1 May – 30 June	1 May – 31 May	1 May – 31 May
	Medium	1 May – 31 July	1 May – 30 June	1 May – 31 May
	High	1 May – 31 July	1 May – 30 June	1 May – 30 June

This method assumes accurate catch data and there may be some areas where it is appropriate to apply some level of precaution due to uncertainties. Examples of this include the Noup, where the assumed density is ‘borrowed’ from other areas, and Off Horns Reef where the landings are very low. The method does, however, give the potential for added precaution in cases where the information is uncertain and there are concerns about the state of the stock. Fishing Plans should consider whether the level of surveying is appropriate for that FU and promote additional surveys where these are considered necessary.

In the case of the Porcupine Bank, management is through varying the duration of seasonal closures. Such closures would not be appropriate for all FUs in the North Sea. Closure would not be appropriate as a management measure for the Farne Deep, for example, as this is essentially a winter fishery with a relatively short season. The above option requires testing for a number of different FUs. It will also be necessary to seek ICES advice on other possible options. Seasonal closures may be appropriate in some instances. "Of which no more than...." provisions might be used to limit the catch from some FUs. In some cases effort limitations, or the exclusion of particular fishing gears might provide appropriate solutions, specific to that FU.

Thus, the main biological targets for the North Sea *Nephrops* fishery of maintaining the abundance of each functional unit at a sustainable level, above B_{trigger}, is to be achieved by setting an abundance buffer point (B_{buffer}) for each FU that will prompt a revision of the target value for fishing mortality in the event of a major change in stock size.

To ensure that *Nephrops* are exploited in the North Sea at a rate that is sustainable and consistent with F_{msy} a target fishing mortality consistent with F_{msy} will be set for each of the FUs. It is then proposed that a TAC will be set for the North Sea as a whole, consistent with the aggregated assessments for the individual FUs, and consistent with the provisions of the Mixed Fishery Plan for the North Sea, which may stipulate a range of F_{msy} values rather than a specific point target.

Management at the FU level will be achieved not through the setting of individual TACs but through the adoption of specific management measures for vulnerable FUs or for FUs for which there are few data. Those measures should reflect the particular circumstances on those grounds, including any effects as a result of displacement from other grounds. This Management Plan proposes that management at the FU level should be achieved through the preparation of Fishing Plans for vessels and fleets fishing the designated FU.

Managing fisheries within Functional Units

It is evident that some of the *Nephrops* FUs within the North Sea are vulnerable to over-exploitation. If the Long Term Management Plan is to be consistent with ICES and STECF advice, then management at an FU level must be introduced with the aim of safeguarding individual FUs against depletion.

Thus, this Management Plan for *Nephrops* must set out how potential damage to FUs might be limited and how stocks within FUs will be restored to sustainable levels. Setting an overall harvest rate will go a long way in guarding against depletion; nevertheless it is important that local plans are agreed which will promote recovery of an FU stock in the event that it requires rebuilding, or is subject to over-exploitation.

There was no support from the commercial fishing representatives of the NSAC for the allocation of quotas to each of the FUs through separate TACs. The application of quotas specific to each of the FUs reduces the flexibility of the fleet and also raises a number of rather difficult questions in relation to quota allocation. Management of the FUs by setting individual TACs or catch limits is therefore not favoured in this Management Plan. There is conservation merit in FU TAC's as ICES have advised that management at the FU level should provide the controls to ensure that catch opportunities and effort are compatible and in line with the scale of the resources in each of the stocks defined by the FUs.

However, ICES also state that FU TACs are only one way of managing fisheries and other approaches may also deliver the required safeguards. It is acknowledged by the eNGOs that if fishing plans can demonstrably achieve the same required outcomes, through for example the imposition of short-term “of which no more than” measures, then FU TACs may be avoided.

Instead this Management Plan suggests that Fishing Plans be developed for each FU. The first step in preparing such a Fishing Plan is to ensure that full information relating to the state of the fishery, and the state of the resource the fishery depends upon, is provided. Where a lack of information is the main impediment to sustainable management then the collection of appropriate data would be emphasised within the Fishing Plan.

Where that information is lacking, Fishing Plans will need to be sufficiently precautionary. The Fishing Plan will then consider how the *Nephrops* stock could be rebuilt; in a manner that is fair and equitable to all fishers. Each Fishing Plan will relate only to a particular FU and will not discriminate against any fishers. An important element of the plans is the detailed information on how the FU has been fished in the past and is being fished in the present (the track record). The main elements of each Fishing Plan are concerned with protecting and rebuilding the *Nephrops* resource within an FU.

Where insufficient data are available for particular vulnerable FUs, either in terms of poor landings data, a lack of underwater TV survey data or lack of information on discarding then this Management Plan proposes that an essential feature of the Fishing Plan for that FU would be proposals for improving data collection to facilitate evaluation of the state of the stock. Where it is not feasible to conduct full underwater TV surveys then alternative methods should be considered. For some FUs, more comprehensive surveys of *Nephrops* stocks may be necessary, and should be proposed within the Fishing Plan

All the FUs are intended to have Fishing Plans. Plans should be prepared in advance, and will be prepared first for those FUs thought most likely to become vulnerable, and those units for which data are available. Implementation of the Fishing Plan only takes place once the agreed abundance buffer point is reached. Measures will then be set to restore abundance to a level consistent with fishing at Fmsy. The Fishing Plan remains in place during the rebuilding phase. The restrictions specified within the Fishing Plan are lifted once the FU moves back above or below the respective buffer level.

It is important to recognise that the imposition of particular restrictions within an FU may have implications for other FUs. If there is likely to be displacement of effort into other FUs then this must be taken into account.

A provisional Fishing Plan for the Farne Deeps Functional Unit is appended as Annexe 1.

Wider ecological instruments

In addition to objectives for *Nephrops* this Management Plan sets three other ecological targets that will contribute to attaining GES for species and habitats associated with the *Nephrops* fishery. It proposes that there should be a reduction of discards in the fishery; minimisation of damage to threatened, endangered and protected species; and minimisation of impacts on benthic habitats and associated communities.

1. Discards: Meeting the Landings Obligation

ICES in its 2014 advice notes that in some FUs *Nephrops* discard rates can be high, especially where many small *Nephrops* are encountered - below the 25 mm carapace length that is currently the Minimum Landing Size. The increasing use of more selective fishing gears in the *Nephrops* fishery is now matching catches to the Minimum Landing Size, with the aim of reducing discards and landing all the *Nephrops* that are caught.

A particular issue with *Nephrops* is whether the survival of discarded Norway lobsters is high. Research has shown that not all discarded *Nephrops* die. Table 2 presents data on *Nephrops* survival compiled by STECF.

Table 2: Discard Survival Estimates, from STECF

Species	Fishing Gear	Survival Estimates (%)			Location	Reference
		Mean	Lower	Upper		
<i>Nephrops</i>	Crustacean trawl, simulated	-	58	75	Sweden	Harris and Ulmestrand (2004) ICES Journal of Marine Science, 61: 127-139.
<i>Nephrops</i>	Crustacean trawl	-	30	79.3	Irish Sea	Symonds and Simpson (1971) Journal du Conseil International pour l'Exploration de la Mer, 34: 89-98.
<i>Nephrops</i>	Crustacean trawl	-	12	60	Portugal	Castro et al. (2003) Fisheries Research, 65: 475-484.
<i>Nephrops</i>	<i>Nephrops</i> trawl	28.6	18.9	38.9	West of Scotland	Wileman et al., (1999) Final report to European Commission, Brussels, FAIR - CT95-0753. ICES
<i>Nephrops</i>	<i>Nephrops</i> trawl	-	16.5	38.9	France?	Gueguen and Charuau (1975) ICES CM 1975/K: 12.
<i>Nephrops</i>	<i>Nephrops</i> trawl	19-31	11	36	Bay of Biscay/Celtic Sea	Charuau et al (1982) ICES-CM-1982/B:13.
<i>Nephrops</i>	<i>Nephrops</i> trawl		45	65	Bay of Biscay	Mehault et al. (2010) Working document for ICES <i>Nephrops</i> working group. IFREMER Report of project PRESPO, pp. 15.

ICES, in its 2014 advice, notes that the immediate survival rate of discarded trawl-caught *Nephrops* is highly variable and depends on many factors, including tow duration, catch composition, air temperature, and post-capture handling. There are no recent estimates for the fisheries in Subarea IV, but estimates from studies conducted in other areas range from 20-40% in the West of Scotland (Wileman *et al.*, 1999) to 45-65% in the Bay of Biscay (Méhault *et al.*, 2011). The type of ground the *Nephrops* are returned to will affect their longer-term survival, as *Nephrops* have specific sediment requirements for the construction of burrows. The probability of being returned to suitable habitat will therefore depend upon the fishery practice and the spatial structure of the particular grounds. Large, more homogeneous grounds like Fladen (FU 7) are more likely to have a higher survival rate when compared to discarding on patchier grounds like Devil's Hole (FU 34) or Botney Gut (FU 5). The length of the trip undertaken will also affect discard survival. Understanding and experience of the individual fisheries are, therefore, used in combination with the estimates from the published studies to derive FU-specific discard

survival rates. A range of survival rates from 0 to 25% has been assumed for FUs in the North Sea in the absence of direct information for these areas (Table 3).

Table 3: Discard Survival Estimates for North Sea, assumed by ICES in its 2014 Advice

Functional Unit	Survival Rate %
Botney Gut – Silver Pit	0
Farne Deepes	15
Fladen Ground	No discards
Firth of Forth	25
Moray Firth	25
Noup	0
Norwegian Deepes	No assumptions made
Horn's Reef	No assumptions made
Devils Hole	0

Article 15 paragraph 2(b) of the regulation allows for the possibility of exemptions from the landing obligation for species for which "scientific evidence demonstrates high survival rates". STECF has said that it is not possible to provide any judgement on what constitutes 'high' as this is a subjective term. A primary consideration is whether exempting fisheries will remove the incentive to reduce discards, which is the primary objective of Article 15. Where it is not feasible to reduce discards, the NSAC proposes that where there is scientific evidence of high survival of discards in a fishery, priority should be given to avoiding any overall increase in fishing mortality. *Nephrops* might be a candidate for exemption on the grounds that in some *Nephrops* trawl fisheries a high percentage of the discarded animals have survived. However it would be important to ensure that such survival rates are transferable to the conditions and operations in the North Sea. Any exemptions based on high survivability should be accompanied by requirements to implement practices or modifications that maximise the survival rate and ensure robust monitoring. There should also be a proviso that *Nephrops* should only be discarded within the FU of capture (as substrates elsewhere may not support *Nephrops*).

There is also some discarding of whitefish by vessels fishing for *Nephrops*. Once the Landing Obligation is in place the capture of these fish may convert to a larger problem. Lack of quota for some species, coupled with the requirement to land all fish and to have quota for all fish landed, would mean that vessels would have to stop fishing when quota was exhausted. The species with the least plentiful quota allocation will "choke" the fishery, leading to an early cessation of fishing. The extent of the choke species problem will depend largely on whether the restriction is applied at the individual vessel level, Producer Organisation (PO) level, or fleet level. If applied too rigidly it could result in the early closure of some, if not all, *Nephrops* operations. Species of fish being discarded in the North Sea *Nephrops* trawl fleet are predominantly haddock, whiting, cod and plaice, with a significant proportion below the Minimum Landing Size (MLS).

Much is being done through technical measures to reduce unwanted fish catches, including small haddock and whiting. Fishers have been innovative in developing a range of selectivity measures that go way beyond what they originally thought possible and they are now looking at aspects of spatial and temporal management, which adds a new dimension to managing the mixed fishery aspect of the *Nephrops* fishery.

Reducing discards in the *Nephrops* fishery is an important objective especially in terms of meeting the Landing Obligation. In addition to the voluntary advancements in selectivity adopted by fishers, flexibilities incorporated into Article 15 of the new basic regulation go some way to marry technical development with regulatory requirement.

Article 15 of the Basic Regulation (Regulation (EU) No 1380/2013) presents the detail of the Landing Obligation, which applies to all catches of species subject to catch limits. The regulation applies to the *Nephrops* fishery from 1st January 2016 although from the 1st January 2016 until the 1st January 2019 it applies only to the target species, and not the associated by-catch species.

It should be noted that the Landing Obligation does not apply to:

- Species in respect of which fishing is prohibited and which are identified as such within the CFP regulations;
- Species for which scientific evidence demonstrates high survival rates, taking into account the characteristics of the gear, of the fishing practices and of the ecosystem;
- Catches falling under *de minimis* exemptions of up to 5% of total annual catches subject to the landing obligation although for a transitional period of four years, the percentage of the total annual catches shall increase by two percentage points in the first two years of application of the landing obligation and by one percentage point in the subsequent two years. *De minimis* exemptions apply in the following cases:
 - Where scientific evidence indicates that increases in selectivity are very difficult to achieve; or
 - To avoid disproportionate costs of handling unwanted catches, for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in a plan, of total annual catch of that gear. Catches under this provision need not be counted against the relevant quotas; however, all such catches are required to be fully recorded.

Article 15 (8) provides for flexibility to guard against such events of premature closure as a result of the effects of choke species. These provisions are:

- Catches may be deducted from the quota of the target species provided that they do not exceed 9 % of the quota of the target species, although this provision only applies where the stock of the non-target species is within safe biological limits.

In addition Member States may utilize a system of banking and borrowing, which is set out in Article 15(9)

- For stocks subject to the landing obligation, Member States may use a year-to-year flexibility of up to 10% of their permitted landings. For this purpose, a Member

State may allow landing of additional quantities of the stock that is subject to the landing obligation provided that such quantities do not exceed 10 % of the quota allocated to that Member State. Article 105 of Regulation (EC) No 1224/2009 shall apply.

These provisions, together with adjustments to the TACs to accommodate previously discarded fish, will be helpful in softening the impact on the *Nephrops* sector as it moves through its period of transition.

The introduction of the obligation to land all catches should see the removal of regulations, such as catch composition rules, which dictate that vessels must discard elements of the fish catch to enable the vessel to remain within the limit ratio between catches of *Nephrops* and fish (30/70).

It is also evident that quota uplift will be required for some whitefish species to allow the landing of the fish that are currently caught and discarded.

It became evident during the preparation of this Management Plan that the development within it of a full discard plan to meet the Landings Obligation was not feasible within the plan itself. A discard plan is now being developed for the North Sea through discussions at a regional seas level between relevant Member States and the NSAC. Such a plan would need to contain at least the following components:

- Provisions regarding fisheries or species covered by the Landing- Obligation (LO)
- Identification of the likely consequences of the LO and clear strategies to address these
- Specification of exemptions to the LO
- Provisions for *de minimis* exemptions of up to 5 % of total annual catches of all species
- Provisions on documentation of catches
- The fixing of minimum conservation reference sizes

Under this Management Plan it is for fishers to adopt measures for reducing discards and by-catches. It will be their responsibility to:

- Ensure that all relevant catches are landed
- Reduce the level of unwanted catches to the lowest level possible
- Ensure that the Landing Obligation is met

This Management Plan proposes that measures for reducing discards and managing the Landing Obligation should be considered in preparing the Fishing Plans for FUs, where

the measures could be tailored to local conditions and deal with the issues of quota adjustments and quota flexibilities, and the other specific actions that would need to be taken. There may be no need to specify particular mesh sizes or to propose alternative measures for making nets more selective within the framework of the Landing Obligation. The philosophy of this Management Plan is that wherever possible specific measures should be left for fishers to decide under a system of results-based management. The Fishing Plans should describe the required output rather than specify detailed measures by which that output would be achieved.

Information flow will be a critical issue in meeting the Landing Obligation. Full documentation of catches will be necessary in all parts of the fishery. Generally, *Nephrops* catches are well documented. If there are any deficiencies it is with respect to the smaller *Nephrops* vessels (<10m), where current requirements for documentation are less stringent. It will be important to ensure full documentation at local FU level on *Nephrops* catches and discards for all vessels.

Currently the wider issue of meeting the Landing Obligation within the context of plans for mixed fisheries are being discussed within the NSAC, and a Landing Obligation Vision Paper has been prepared. Further discussion of this issue, and preparation of a discard plan for *Nephrops*, is taking place at a regional seas level, involving the relevant Member States and the NSAC.

2. Reducing impacts on endangered, threatened and protected (ETP) species

In terms of the capture of ETP species, fishers opined that the main problems were likely to be through the catching of sharks, skates and rays. Few of these were currently being caught but it was recognised that this may be a consequence of their low abundance. There are major provisions in place to prevent such protected species from being landed however, an objective of this plan is to further reduce such landings and improve the post capture survival of these species. There are also gear options for permitting the escape of particular threatened or endangered species, although these are not applicable to all types of vessel. The use of such devices and development of other effective by-catch reduction devices needs to be considered for all boats in the fishery.

It is important to monitor the capture of any endangered or threatened species as part of this Management Plan. It is proposed that the capture of such animals should routinely be recorded in electronic logbooks. They should be recorded by species: as not all skates and rays, for example, are classed as endangered. In terms of improving the survival of live specimens returned to the sea, the Fishing Plan could set out procedures for best practice. Tagging of specimens might also be undertaken as a voluntary measure, although this would require training and licensing. Advice on handling these fishes with minimal damage is available from Seafish and the Shark Trust. If there are severe problems with the capture of endangered species then the Fishing Plan should specify additional measures. The inclusion of such measures would ensure that this Management Plan contributes to Good Environmental Status, as required by the Marine Strategy Framework Directive.

3. Reducing damage to the seabed and vulnerable organisms

Nephrops grounds are often on very fine mud that harbours fragile benthic invertebrates such as sea pens and other genera of soft coral that are susceptible to damage by mobile fishing gears. Although it is evident that there are effects from fishing gears upon the seabed there is a lack of evidence on any impact caused by this, in terms of any damage to populations of living organisms and the overall ecology of an area. This deficiency needs to be addressed. Provision for implementing more environmentally friendly fishing gears would then be possible within this Management Plan and the Fishing Plans for individual FUs.

Fishers accept the need to limit the overall environmental footprint of the fishery. They have emphasised that areas already set aside for oil and gas platforms, pipelines, renewable energy installations and conservation areas already serve the purpose of providing areas free from the effects of fishing. There are major plans for wind farms in areas like the Moray Firth where large areas will be closed to fishing because of these developments.

Marine Protected Areas can provide a solution to conserving vulnerable sea life and habitats, and – perhaps more importantly – provide the conditions for recovery of those habitats and species that have been adversely affected by fishing and other activities. There has been pressure upon Member States to move in this direction from the Commission through various Directives. In addition, some Member States are taking their own initiatives. Fishers are concerned at the current procedures for identifying these areas, where areas appear often to be selected before the consultation process has begun. There are some existing proposals for MPA's on *Nephrops* fishing grounds and it is important if these are to go ahead that there should be full consultation with fishers. There is particular concern on the part of fishers about the cumulative effects of European and National MPAs in addition to the development of large and intrusive offshore energy developments that will greatly restrict the areas available for fishing and result in heavier fishing in adjacent areas. The environmental NGOs note the potential impact of offshore energy developments upon fishers, but emphasise that MPAs need to be established around 'core' features in order for them to assist with the recovery of habitat, which is important to achieve sea-floor integrity and restore natural food webs. Energy developments are not necessarily positioned in areas that would be important or useful for habitat recovery.

The development of indicators for 'sea floor integrity' under the Marine Strategy Framework Directive is of importance to all fisheries. Disturbance of marine organisms must be minimised and therefore it is of great importance to develop a programme of measures aimed at reducing any impact upon marine life.

4. Summary of ecological instruments

The instruments proposed in this plan for reducing damage to vulnerable organisms and to the seabed will include:

- Identifying and implementing Marine Protected Areas in consultation with fishers. These include 'real-time', seasonal and permanent closed areas. There are already programmes for identifying and implementing these areas.

- Restricting the range of gears that can be used in vulnerable areas (including creel only areas).
- Promoting the development of environmentally friendly fishing practices, for example gears with less intrusive bottom contact, larger meshes and better selectivity profiles.
- Improving data recording systems to identify capture and damage to endangered, threatened and protected species or habitats.
- Safe and speedy return to the sea of endangered and threatened species.

To ensure that problems of damage are identified and that the measures adopted effectively address these problems there is a need to set out a research & monitoring programme to address data gaps within the fishery and on its wider environmental impact. Monitoring should include fishery dependent and independent data collection, including the material that is currently provided by the various research institutes. It will be especially important to assess impacts on habitat and associated species communities, including benthic communities, by different fishing gears. It is also important to identify the distribution of especially vulnerable habitats and species, and to monitor recovery rates in those areas that have been designated as MPAs.

It is accepted within this plan that the adoption of other measures might prove necessary to achieve Good Environmental Status, consistent with the requirements of the Marine Strategy Framework Directive. Agreement on such measures would be reached through discussions at a regional seas level between relevant Member States and the NSAC, once clear indicators of GES have been agreed.

Economic instruments

The purpose of this plan is to build and maintain sustainable *Nephrops* stocks in the North Sea to support sustainable fishing businesses. It is for Member States, producer organisations and fishing businesses to decide how to deal with changing economic pressures whilst ensuring ensure that fishing is sustainable. They must decide how to operate through a transparent internal market which functions smoothly and aims to achieve good product quality. There are no specific economic instruments that require to be imposed by this Management Plan. However, it is sensible to add the proviso that in meeting the biological and ecological objectives it is important to avoid regulation that makes fleets less efficient or provides perverse incentives which act to the detriment of the fishery, the *Nephrops* stocks, or by-catch species. As an earlier example we have the large and unforeseen increase of effort in the *Nephrops* fishery as a result of the effort management regime introduced as part of the Cod Recovery Plan. It is also important to provide incentives for individual fishers to change their fishing behaviour to meet conservation needs, whilst continuing to meet their business aims and objectives. Moreover, any change imposed on the fishery to meet biological and ecological objectives should take place at a rate that can be absorbed by individual businesses and communities.

The Common Organisation of the Markets, the EU policy for managing the market in fishery and aquaculture products, has been a mainstay of the Common Fisheries Policy since 1970. The newly adopted (July 2013) Common Fisheries Policy includes a new regulation for the Common Organisation of the markets (CMO), as well as a new European Maritime and Fisheries Fund. These new regulations offer opportunities to regulate fisheries in line with the market, as well as promoting market development. Producer Organisations are compelled to make Production and Marketing Plans (PMP's) to stimulate markets and adapt operations of its PO members towards market requirements and optimise the economic proceeds from catches. The positive effects of these measures rely, however, on their application within fleets. Their effects can be limited where fishers who are not member of PO's take part in the fishery, although this can be mitigated, under certain conditions, when Member States declare such measures binding on all fishers.

Responsible fishing schemes have already been put in place to ensure quality of product and safety of operation. Marketing and consumer education initiatives are for businesses to undertake.

7. Monitoring of the Management Plan

An important feature of any Management Plan should be to track its successes and failures against the objectives set. The extent to which this Management Plan is achieving the range of stated goals and objectives would be assessed using a combination of indicators designed to measure performance of the fishery. These performance indicators may be biological or non-biological. Possible performance indicators are:

- Level of fishing mortality (with respect to the target/limit F). Percentage of FUs for which F is below F_{msy}
- Abundance trends obtained through underwater TV surveys. Maintenance of abundance above B_{buffer} for all functional units
- Levels of discarding in accord with discard plan and success in meeting the provisions of the Landing Obligation
- Increased data on ETP species as a result of improved monitoring
- Reduced mortality of ETP species
- Delivery and uptake of environmentally friendly fishing practices
- Economic indicators, including revenue, profitability, average prices etc.
- Social Indicators – number of businesses (vessels), numbers employed, average earnings, quota prices (linked to ability to access the fishery), number of new entrants etc.

This Management Plan is intended to be adaptive. The plan will be reviewed every three years. If things go wrong the plan will be adapted to meet the new circumstances.

8. Mixed fishery considerations & linkages with other Management Plans

Much of the North Sea *Nephrops* trawl catch was originally taken in mixed fisheries, and that is still the case in many areas like the Fladen Ground, the Skagerrak and Kattegat and in the Scottish, Dutch and Danish fisheries. Most of the FUs were fished seasonally in the past. They formed part of a network of grounds that were explored at different times of the year and under different weather conditions.

Many vessels catch *Nephrops* whilst targeting other species like plaice, cod, whiting or haddock at other times of the year. Even where *Nephrops* is the main target a significant income may be obtained from the whitefish species caught.

The Commission has now recognised that one of the core realities of the demersal fisheries is that they are mixed fisheries, exploiting multi-species complexes. It is now accepted that the management regime needs to take this fully into account. Mixed fisheries and multi-species interactions are central considerations within the reformed Common Fisheries Policy.

ICES scientists have traditionally given fishery management advice on an individual stock basis. For each assessed stock, catch options corresponding to the formal ICES advice are provided for the following year and form the basis of the Total Allowable Catch (TAC) for that stock. Now, both ICES and the European Commission are investigating ways to advise on and manage mixed fisheries. ICES scientists are providing tentative mixed fisheries advice, although the process for refining that advice is still developing. Currently, the advice is presented to fisheries managers as a set of potential outcomes.

It is evident that a mixed fisheries approach will have implications for this Management Plan for *Nephrops*. At this stage, however, it is not clear how the plan should take account of mixed fisheries management, or multi-species interactions.

It has recently been proposed by the Commission that there should be an over-arching, North Sea Mixed Fishery Plan. The species likely to be considered as part of the demersal mixed fisheries of the North Sea are cod, haddock, whiting, saithe, plaice, sole, and *Nephrops*. The plan is intended to achieve the overall CFP objective of maintaining stocks at Maximum Sustainable Yield (MSY), whilst recognising that a number of species are caught within the mixed fishery in this area and conflict must be avoided between management proposals for these different species. The Commission also recognises that within a mixed fishery plan there is a need to make full use of the yield that is available. Any deviation from a single stock management plan to a multiple stock approach implies a suboptimal outcome for some of those stocks. The plan has therefore to search for optimal exploitation on a group basis, while ensuring that other stocks are safeguarded. The Commission proposes to set a range of target fishing mortalities for each stock, as originally suggested by the NSAC. That is, set F_{msy} ranges rather than point estimates. The Commission also accepts the need to reduce the impact of any unavoidable associations between species (where targeting one species in a given area may result in

the capture of another), by reaching agreement at regional level on technical measures, closed areas and other means for reducing the capture of the unwanted species.

It is important that this Management Plan for the *Nephrops* fisheries, which deals essentially with management at the Functional Unit level, should take account of the emerging Mixed Fishery Management Plan, and also any other plans for particular stocks or for other fisheries. There must be interdependence between plans.

In the past, and even today, the fishery for *Nephrops* in the North Sea has been greatly affected by the Cod Recovery Plan. Days at sea restrictions, together with real-time closures have restricted the range of fishing opportunities and disrupted traditional fishing patterns. Additional effort has in the past been transferred into the *Nephrops* fleet as a result of the heavy restrictions placed on vessels fishing for whitefish. This is a most unsatisfactory situation, which has acted against the adoption of some conservation measures. It will be important in approving future Management Plans to avoid perverse effects of this kind.

In preparing this draft Management Plan we have recognised that the fleets catching *Nephrops* are very diverse. A few vessels catch only *Nephrops* but many more are dependent on a wide range of species. Dealing with mixed fisheries aspects presents a major challenge for the future.

9. Future institutional structures

The philosophy behind the preparation of this Long Term Management Plan is that Management Planning is likely to be more successful if it involves those people whose activities are to be managed. This plan has been prepared with strong stakeholder involvement, whilst also drawing upon the advice of fisheries scientists and fishery managers. The overall aim has been to develop a sense of stewardship on the part of the industry and to move towards full 'co-management' with others.

We have to be aware, however, that preparation of the plan has taken place against a background of changes to the regulatory structure. In particular, as a result of the coming into force of the Lisbon Treaty, the European Parliament is now involved in the preparation of Management Plans through the process of co-decision taking. Revision of a number of Management Plans has been delayed – to the great detriment of fish stocks and the fishing industry.

New arrangements for implementation of this and other Management Plans are currently still being discussed in the context of reforms to the Common Fisheries Policy. It is expected that Management Plans will be prepared and agreed for a particular region by the relevant Member States, with advice from the Advisory Councils, but subsequently require the approval of the Council and Parliament.

There is currently strong criticism from fishers of the over-detailed central regulation that characterises the CFP. A move to allow Member States to work together regionally to implement appropriate management measures has much to commend it. It will be critical for this Management Plan to be discussed, endorsed, adopted and monitored by such a

regional management body for the North Sea, on which it is hoped that fishers and other interests will be fully represented.

10. Research and Monitoring

There is insufficient information available on some of the *Nephrops* fisheries, and this deficiency must be addressed as part of this Long Term Management Plan. Although some of the FUs are regularly surveyed by means of underwater television, others are not, and information on the distribution and numbers of *Nephrops* in these un-surveyed areas is limited. For some of the FUs with lower levels of landings (e.g. Botney Gut), there are no underwater TV abundance estimates. These data limited FUs are also often lacking in information on catch/landings composition. There is potential for fishers/processors to contribute here by providing additional information and by ensuring that all the *Nephrops* fisheries are fully documented. Further development and extension of fishery independent surveys, including underwater TV surveys, are important, not only to aid the assessment of *Nephrops* stocks, and aid the overall fishery management process, but also to play a crucial role in monitoring the fishery's broader ecological performance. It is also important that there should be no incentive to withhold information on the fishery in particular FUs.

Nephrops are also caught in areas outside the FUs. The advice from ICES is that the definition of additional FUs should be considered. The Devil's Hole has recently been included in a new FU. Further work is needed to ascertain whether the current division into FUs adequately reflects the distribution of *Nephrops*.

The *Nephrops* assessments are not currently presented in a form that can readily be understood by non-specialists, including fishermen. In future it will be important to express the results of the scientific assessments and the management objectives in clear everyday language, so that they may be understood by those responsible for stewardship of the fishery. It is recognised that ICES scientists have already taken some steps in that direction.

There is a general lack of effort data, especially for the under-10m fleet. National authorities should provide information on the numbers and types of vessels and their capacity, from all nations, operating within the different FUs. Better electronic logbooks, self-monitoring of where fishing occurs, and full documentation of catches including by-catches and catches of endangered species would all be beneficial.

A case can be made for mapping of fishing effort for *Nephrops* in the North Sea, using VMS and other sources, for protective purposes, to monitor the distribution of effort between FUs and to ensure that any displacement of effort as a result of management measures, MPA proposals, and wind-farm developments can be evaluated.

There is a need to improve data recording systems to examine fishing interactions with endangered, threatened and protected species. It is important to monitor the capture of any endangered or threatened species, including skates and rays. It will also be important to determine whether there are particular areas in the North Sea where threatened endangered and protected species and habitats are likely to be adversely affected by trawling for *Nephrops*. This is a task for national authorities under the Marine Strategy Framework Directive.

There is some evidence on the effects upon the seabed of different gears used to catch *Nephrops* and there needs to be further work to examine the impact of these effects upon animal populations. It is not always clear whether these effects are damaging to populations and to the overall ecology. Where adverse impact can be clearly shown then there may be scope for developing or identifying less destructive gears.

There can be advantages from the closure of areas to fishing in terms of enabling comparisons to be made between fished and un-fished areas and assessing impacts on the seabed and the fragile animals that live there. However, the choice of areas intended to protect vulnerable organisms and habitats must be based on the best available scientific advice. The choice of area should be suitably precautionary, and subsequent management should employ a risk-based approach, taking account of animal populations as well as seabed integrity, structure and function. It should be noted that there is currently deep distrust by fishers of the procedures adopted by those bodies responsible for defining such areas.

Fish are not caught in neat ratios and management through a series of quotas for individual species does not recognise the reality of conditions on the fishing grounds. The mixed species aspects of managing fisheries have received insufficient attention. Major efforts are required to develop innovative management measures that recognise the diverse nature of the fisheries. Many fishers are interested in initiatives which would allow them to land all their catch and have said that this would influence both gear design and fishing behaviour. The development of a Mixed Fishery Plan for the North Sea is a step in the right direction but there is still some way to go in examining interactions between species, and in the development of valid mixed fishery advice for the North Sea.

To summarise, there are a number of research and monitoring requirements for the *Nephrops* fishery to achieve the objectives of this Management Plan.

- The development and extension of fishery independent surveys, including underwater TV surveys, is an important feature of the plan, not only to aid the assessment of *Nephrops* stocks, and aid the overall fishery management process, but also to play a crucial role in monitoring the fishery's broader ecological performance.
- If full analytical assessments are to be made additional data need to be collected on most of the FUs in the North Sea. Further research will also be required by scientists to enable analytical assessments to be conducted, either by developing techniques for the age of *Nephrops* to be determined, or by employing suitable length-based techniques.
- It will be important to express the results of the scientific assessments and the management objectives in clear every-day language, so that they may be understood by those responsible for stewardship of the fishery.
- Further work is needed to ascertain whether the current division into FUs adequately reflects the distribution of *Nephrops*. Should other areas containing *Nephrops* be incorporated into the assessments? Are there small pockets of *Nephrops* at different locations that should also be taken into account?

- There is a need for an analysis of the numbers and types of vessels and their capacity, from all nations, operating within the different FUs. There is a general lack of effort data, especially for the under-10m fleet.
- Data gaps within the fishery and on its wider environmental impact must be addressed. It will be especially important to evaluate any impacts of the fishery, including different gear types, on habitat and associated species communities, including benthic communities.
- Wider information is required on the distribution of vulnerable and protected species and habitats in the North Sea in relation to the *Nephrops* fishing grounds.
- There is also a need to improve data recording systems to capture fishing interactions with endangered, threatened and protected species.

11. Uncertainties

Differences in the importance of *Nephrops* to different Member States means that there are differences in the level of commitment to scientific research into *Nephrops* and in the collection of data to support scientific assessments. In the main, scientific studies of *Nephrops* in the North Sea are confined to the UK and Denmark. There are few data available for some of the FUs. For example, for some of the FUs with lower levels of landings (e.g. Botney Gut), there is no underwater TV abundance estimate and in addition, commercial sampling data (length frequency information) have often only been gathered in recent years. A full and complete Management Plan will need to consider whether additional information is required for management to be effective, and how that additional information might be obtained. Where there is uncertainty about the status of a FU there should be no incentives for continuing to maintain that uncertainty.

An important feature of any Management Plan is that it should be adaptive; the plan should be based on a learning process. If management goes wrong in some way, or deviates from the objectives laid down, then there should be recourse to means of putting the plan back on track. It will be important to monitor the outcomes of this Management Plan, to take account of uncertainties, and to steer the plan back on course when it has deviated from the desired course.

Multi-annual plans for North Sea Fisheries, including the Cod Management Plan, have not been adaptive. STECF reported in 2011 that the current Cod Management Plan was failing to meet its objectives, and was flawed in some quite fundamental ways. However, the arrival of co-decision-taking, under the provisions of the Lisbon Treaty, meant that full review and revision of the plan and its replacement by a better plan was delayed. Member States and the Regional Advisory Councils called for an interim regime to address the most immediate problems associated with the dysfunctional plan. These problems have still not been resolved. This position may be rectified if a suitable and adaptive Mixed Fishery Plan can be developed for the North Sea.

12. Timeframe

The NSAC sees the LTMP for *Nephrops* fisheries as a gradual and sequential development. The plan needs to be responsive and adaptive, changing as circumstances change. It is suggested that the plan should be reconsidered at 3-year intervals.

Annexe 1

A Provisional Fishing Plan for the Farne Deeps

Overall the *Nephrops* stocks in the North Sea do not appear to be over exploited. However, even with the adoption of a more sustainable approach towards the total *Nephrops* stock in the North Sea, through the development of a Long Term Management Plan, there may still be a risk of over-exploitation of *Nephrops* in some of the FUs. The Farne Deeps has already shown evidence of over-exploitation.

The latest ICES assessment for the Farne Deeps is that fishing pressure is far above MSY (Fmsy) and that stock size is below MSY Btrigger. Abundance has declined since 2005 and the Harvest Rate has recently increased. It is likely that there has been an increase in effective fishing power per kW hour (more vessels are using twin-rig and multi-rig gears). There have been signs of overexploitation in recent years and an unbalanced sex ratio has been observed that is likely to lead to poor recruitment. Without suitable controls on effort movement between FUs, both effort and the Harvest Rate could increase in this FU in 2015.

The Farne Deeps provides a winter fishery. The ground is close to shore and it enables local vessels to land daily and return to port often. However, there are currently many vessels from distant ports also fishing the Farne Deeps. It is appreciated that some of the local fishermen do not have the same options of fishing elsewhere as the vessels from distant ports. Although some flexibility in the ability to roam between different areas is considered advantageous and is provided for under the CFP, in the case of the Farne Deeps heavy effort is being concentrated into a small area and this is affecting *Nephrops* adversely within that FU.

The preparation of a draft Fishing Plan for the Farne Deeps *Nephrops* fishery has been undertaken by the NSAC to provide a test bed for the principles identified in the draft Long Term Management Plan, tailored to suit the unique characteristics of the Farne Deeps *Nephrops* fishery.

The area of the *Nephrops* fishing grounds within the Farne Deeps FU boundary is very small and highly localised. A marked increase of landings from this area was noted in 2005. Subsequently, a significant increase in fishing effort was observed on these grounds from 2006 to 2008. The increase in effort was attributed to the number of vessels with twin rig gear visiting the grounds from distant ports. Many of the visiting vessels were larger or more powerful than vessels within the local fleet.

One of the reasons for the influx of effort may have been the days-at-sea limitation, first introduced under the Cod Recovery Plan. Division of the fleet into whitefish vessels, with large mesh nets and fewer days at sea (TR1), and *Nephrops* vessels, with smaller mesh nets and more days at sea (TR2), resulted in a major transfer of effort into the *Nephrops* fleet in the North Sea.

As part of the preparations for this Management Plan a report on a Sustainable Fishing Plan for the Farne Deeps *Nephrops* fishery was prepared by Newcastle University and submitted to the English Marine Management Organisation (MMO). It listed the different management options and summarised the views of different fleet sectors on these. As part

of that project, in order to identify the concerns of those operating within the Farne Deep fishery a consultation of fishers was undertaken during the 2011 – 2012 *Nephrops* season.

Although *Nephrops* fishing only takes place within a very small part of the area known as the Farne Deep it was decided that the area to which the Fishing Plan would apply would be that defined for the Farne Deep Functional Unit by ICES.

Measures to be selected had to be:

- Relevant for the Farne Deep fishery
- Practical
- Understandable
- Enforceable
- Meet the needs of all those vessels engaged in the Farne Deep fishery.
- Take account of proposals for MPAs in this and adjacent areas

The Fishing Plan should have as its primary aim the reduction of fishing pressure on *Nephrops*. In initial discussions, the measures included:

1. Limitations of gear and/ or vessel types;
2. Imposition of area restrictions; and
3. Application of quota management measures.

Consideration was also given to how potential damage to the FU benthic habitat and ecosystem might best be managed and avoided, together with measures for reducing by-catch. However, it was decided that these latter issues concerned all the FUs for the North Sea and were best dealt with as part of the main Long Term Management Plan. There was general support from all fishers for the adoption of selective measures tailored to particular fishing gears and capture species. Measures had already been adopted by the industry to improve gear selectivity; allowing escape of undersize whitefish through netting panels with larger meshes and also through metal and plastic grids.

A focus group established to consider the different options identified three steps to be taken as part of a Fishing Plan for the *Nephrops* fishery within the Farne Deep Functional Unit:

- To exploit *Nephrops* at a rate which is sustainable by setting a target fishing mortality (F) consistent with that of maximum sustainable yield (F_{msy}),
- Set a buffer level for abundance (B_{buffer}) at which F_{msy} and the harvest rate must be reviewed, and
- Set an overall TAC at North Sea level but allocate that part of the quota pertaining to the Farne Deep through an "...of which no more than ..." provision.

The latter measure effectively imposes a restriction on landings from the Farne Deep. Such a provision would protect the Farne Deep *Nephrops* stock, while allowing the fleet to continue to move between other FUs within the confines of the overall TAC for the North Sea. This provision has the advantage of allowing the fleet to retain flexibility, whilst protecting a vulnerable stock.

It is emphasised, however, that the “of which no more than” solution is specifically being advocated for rebuilding stocks in the Farne Deeps Functional Unit. It does not necessarily offer the right solution for all FUs. The measures proposed would:

- Come into effect for the Farne Deeps when the defined buffer point was met for the *Nephrops* stock
- Be an alternative to Functional Unit TACs
- Provide additional, targeted protection when the *Nephrops* stock within the Farne Deeps FU was assessed as vulnerable
- Be maintained in position until such time as the fishery indicators showed that the stock was restored to an acceptable level (above Bbuffer).
- Ensure equity in the distribution of quota.

Management at the FU level through the preparation of a Fishing Plan for the Farne Deeps would provide the necessary controls to ensure that catch opportunities and effort are compatible and in line with the scale of the resources on this ground. However, the NSAC recognises that with this approach a problem arises over the allocation of shares in the catch for that fishery. The issue has been thoroughly discussed and all parties accept that in the event of a significant reduction in *Nephrops* fishing opportunities for operators in the Farne Deeps fishery, quota availability would become a serious issue for locally based vessels dependent on this single fishery. The administrations involved would need to work with the POs to find the best outcome for those who have a record of fishing in the area and to safeguard the interests of the locally based fleet for the duration of any required quota reductions.

The introduction of additional accompanying measures, including the adoption of more selective fishing gears or area restrictions, would also contribute to the overall aim of reducing fishing pressure on *Nephrops*. However, by-catch and discarding issues in this and other FUs are best dealt with in the context of the overall Long Term Management Plan for North Sea *Nephrops*, and in terms of measures to meet the Landing Obligation. There are already pressures in terms of both cod recovery and the move towards more fully documented fisheries that will place pressure on fishing fleets to adopt more selective fishing methods, and considerable progress has already been made in the development of more selective fishing gears.

Annexe 2

Definition of a new reference point – Bbuffer

The current proposed definitions for Btrigger and Bbuffer are as follows:

MSY Btrigger (as used by ICES) is intended to safeguard against an undesirable or unexpected low SSB when fishing at Fmsy and is considered the lower bound of SSB fluctuations around Bmsy. For Nephrops stocks MSY Btrigger has been defined as the lowest stock size from which the abundance has increased.

Bbuffer (for NSAC LTMP) is a precautionary level of abundance above Btrigger that will turn on a set of management measures designed to avoid further stock decline to below Btrigger.

The values currently used for MSY Btrigger for *Nephrops* are actually equivalent to Blim for whitefish stocks. In future, ICES may need to revise the reference points to be more consistent with the definitions used for whitefish stocks. This would mean the values currently associated with Btrigger would be redefined as Blim and new values would need to be agreed for Btrigger, potentially based on the definition of Bbuffer as described in this document.

The following were taken into account in the proposed definition of Bbuffer:

- The way of calculating Bbuffer should be consistent across all functional units, at least on a regional basis.
- If Bbuffer were to be agreed as a new reference point, then the value should be fixed and only revised at a benchmark meeting when a full revision of the stock is made.
- There are different possible ways to calculate Bbuffer (Table 1) and each option will have pros and cons.
- This preliminary analysis indicates that using the proportion of the mean inter annual change of the TV surveys would be a reasonable option for the FUs analysed (highlighted in blue in Table 1).
- Once the stock abundance levels go above the Bbuffer levels the management measures will be switched off.

Table 1 - Bbuffer calculations tested for FUs with UWTV surveys.

FUs	Btrigger	Btrigger+95%CI	25th.abundance.percentile	Btrigger+Mean.abs.change (abs value)	Btrigger+Mean.abs.change (prop)
FU6*	858	881	744*	1013*	999*
FU7	2767	3277	3661	2900	3583
FU8	292	373	448	620	362
FU9	262	317	345	262	262
FU11	541	NA	898	824	663
FU12	1016	1171	1152	1449	1322
FU13	579	755	1233	1525	697

*For FU6, 2007 – 2014 average (geospatial model annual series)

Bbuffer = Btrigger + 95% CI Btrigger (Btrigger+95%CI)

This method has some consistency with whitefish assessments and the use of lowest observed biomass for Blim and the upper confidence limit of this for Bpa. However, the confidence intervals for the estimated abundance associated with some FUs (FU6 for example) are very narrow, and based on this approach Bbuff would be relatively close to Btrigger. In such cases, in order to stay away from the Btrigger, it would be desirable to set Bbuff at a higher level.

Bbuffer = 25th.abundance.percentile (25th.abundance.percentile)

This method can fit the Scottish grounds but not the Farne Deeps ground as this limit would be below Btrigger.

Bbuffer = Btrigger + mean inter annual abundance change, using the absolute value (Mean.abs.change (abs value))

This method also fits all grounds. However in cases where there is been a large change in abundance over the time series it would be preferable to estimate that change in relative terms rather than absolute terms.

Bbuffer = Btrigger + mean inter annual abundance change, using the proportion value Mean.abs.change (prop)

This method fits to all FUs analysed and could potentially be a good precautionary reference point to turn ON management measures designed to avoid further stock decline to below Btrigger.

Plots for all FUs analysed:

