ECOREGION    North Sea
STOCK        Nephrops in Subarea IV (North Sea)

Introduction

*Nephrops* are limited to a muddy habitat. This means that the distribution of suitable sediment defines the species distribution and the stocks are therefore assessed as nine separate functional units (FUs) (Figure 6.4.15b.1). The advice summary for *Nephrops* stocks is given by functional units in Sections 6.4.15.1–9, with updated advice given for Farns Deep in Section 6.4.15b.2.

<table>
<thead>
<tr>
<th>Section</th>
<th>FU no.</th>
<th>Name</th>
<th>ICES division</th>
<th>Statistical rectangles</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4.15.1*</td>
<td>5</td>
<td>Botney Gut – Silver Pit</td>
<td>IVb,c</td>
<td>36–37 F1–F4; 35 F2–F3</td>
</tr>
<tr>
<td>6.4.15.2</td>
<td>6</td>
<td>Farn Deeps</td>
<td>IVb</td>
<td>38–40 E8–E9; 37 E9</td>
</tr>
<tr>
<td>6.4.15.3</td>
<td>7</td>
<td>Fladen Ground</td>
<td>IVa</td>
<td>44–49 E9–F1; 45–46 E8</td>
</tr>
<tr>
<td>6.4.15.4</td>
<td>8</td>
<td>Firth of Forth</td>
<td>IVb</td>
<td>40–41 E7; 41 E6</td>
</tr>
<tr>
<td>6.4.15.5</td>
<td>9</td>
<td>Moray Firth</td>
<td>IVa</td>
<td>44–45 E6–E7; 44 E8</td>
</tr>
<tr>
<td>6.4.15.6*</td>
<td>10</td>
<td>Noup</td>
<td>IVa</td>
<td>47 E6</td>
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<tr>
<td>6.4.15.7*</td>
<td>32</td>
<td>Norwegian Deep</td>
<td>IVa</td>
<td>44–52 F2–F6; 43 F5–F7</td>
</tr>
<tr>
<td>6.4.15.8*</td>
<td>33</td>
<td>Off Horn’s Reef</td>
<td>IVb</td>
<td>39–41 F5–F6</td>
</tr>
<tr>
<td>6.4.15.9*</td>
<td>34</td>
<td>Devil’s Hole</td>
<td>IVb</td>
<td>41–43 F0–F1</td>
</tr>
</tbody>
</table>

* The advice for these stocks is biennial advice for 2013 and 2014.
** The advice for the Farn Deeps functional unit was reopened in November 2013 on the basis of the information provided by the UWTV survey conducted in 2013.

Figure 6.4.15b.1  *Nephrops* functional units in the North Sea and Skagerrak/Kattegat region (see Section 6.4.13).
Summary of the advice for 2014

A summary of the advice can be found in Table 6.4.15b.1. The advice is based on landings; note that this year, for those FUs where this can be calculated, ICES advice states explicitly the total catches (landings + dead and surviving discards) that occur with the landing options.

In order to ensure the stocks are exploited sustainably in the different FUs, management should be implemented at the functional unit level.

There is no information available on the trends in the stock or exploitation status for the rectangles outside the FUs for which ICES provides advice (‘other rectangles’). Advice for the FUs in the North Sea show increases as well as decreases. ICES advises that the catches in ‘other rectangles’ should not change from the 2012 landings of 608 tonnes.

<table>
<thead>
<tr>
<th>Year</th>
<th>Moray Firth</th>
<th>Noup Fladen Ground</th>
<th>Norwegian Deep</th>
<th>Farn Deep</th>
<th>Firth of Forth</th>
<th>Botney Gut – Silver Pit</th>
<th>Off Horn’s Reef</th>
<th>Devils Hole</th>
<th>Other rectangles 2)</th>
<th>Total advice 3)</th>
<th>Agreed TAC 1)</th>
<th>ICES landings</th>
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<tr>
<td>FU</td>
<td>9</td>
<td>10</td>
<td>7</td>
<td>32</td>
<td>6</td>
<td>8</td>
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<td>MA F</td>
<td>MA G</td>
<td>MA S</td>
<td>MA I</td>
<td>MA H</td>
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<td>26.144</td>
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<td>9.5</td>
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<td>&lt; 11.3</td>
<td>3)</td>
<td>&lt; 3.0</td>
<td>&lt; 2.5</td>
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<td>&lt; 16.4</td>
<td>4)</td>
<td>&lt; 1.2</td>
<td>&lt; 1.6</td>
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<td>7)</td>
<td>&lt; 1.9</td>
<td>&lt; 2.0</td>
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<td>23.454</td>
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<td>8)</td>
<td>&lt; 14.1</td>
<td>8)</td>
<td>&lt; 1.4</td>
<td>&lt; 1.7</td>
<td>&lt; 1.9</td>
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<td></td>
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<td>2013</td>
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<td>&lt; 0.05</td>
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<td>0.8</td>
<td>&lt; 1.4</td>
<td>&lt; 1.4</td>
<td>&lt; 1.1</td>
<td>&lt; 0.82</td>
<td>&lt; 0.608</td>
<td>17.350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>&lt; 0.739</td>
<td>&lt; 8.959</td>
<td>&lt; 1.026</td>
<td>4)</td>
<td>&lt; 1.417</td>
<td>4)</td>
<td>4)</td>
<td>4)</td>
<td>&lt; 0.608</td>
<td>17.350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Weights in thousand tonnes.

1) EU zone of Division IIa and Subarea IV.
2) Prior to advice for 2009, landings for other rectangles were included in “Management Areas (MA)”. This includes FU 34.
3) No increase in effort.
4) Biennial advice.
5) ICES advises that stocks should be managed by functional unit.
6) Refers to advice for FUs 5, 32, and 33.
7) See scenarios.
8) Reduced catches.
9) No increase in catches.
Mixed-fisheries advice

In contrast to single-species advice there is no single recommendation for mixed fisheries (ICES, 2013b), but rather a range of example scenarios, assuming fishing patterns and catchability in 2013 and 2014 are unchanged from those in 2012. Major differences between the outcomes of the various scenarios indicate potential undershoot or overshoot of the advised landings corresponding to the single-species advice. As a result, fleet dynamics may change, but cannot be determined.

Cod is the main limiting species for the North Sea demersal fisheries in 2014. The ‘minimum’ and ‘cod’ scenarios of the mixed-fisheries analyses are both consistent with the single-species advice for cod. The current single-stock Nephrops advice for each of the functional units (with the exception of FU 6) leads to catches of cod which are potentially higher than allowed by the cod management plan, i.e. if the cod management plan is strictly enforced catches of Nephrops would be lower than allowed in the single-stock advice.

The revised advice for Nephrops in FU 6 and North Sea whiting in November 2013, based on new survey information, has not changed the mixed-fisheries perception, and the mixed-fisheries projections from June remain valid.

Table 6.4.15b.2 Nephrops in Subarea IV. Landings of Nephrops according to single-stock advice and under different mixed-fisheries scenarios (ICES, 2013b).

<table>
<thead>
<tr>
<th>FU</th>
<th>Moray Firth</th>
<th>Noup</th>
<th>Fladen Ground</th>
<th>Norwegian Deeps</th>
<th>Fam Deeps</th>
<th>Firth of Forth</th>
<th>Botney Gut – Silver Pit</th>
<th>Off Horn’s Reef</th>
<th>Devils Hole</th>
<th>Other rectangles</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>0.739</td>
<td>0.050</td>
<td>8.959</td>
<td>0.800</td>
<td>1.026</td>
<td>1.417</td>
<td>1.000</td>
<td>1.100</td>
<td>0.600</td>
<td>0.608</td>
</tr>
</tbody>
</table>

Weights in thousand tonnes.

*B advised landings no more than the indicated value.

Biology

Nephrops is limited to a muddy habitat, and requires sediment with a silt and clay content of between 10–100% to excavate its burrows. This means that the distribution of suitable sediment defines the species distribution. Adult Nephrops only undertake very small-scale movements (a few 100 m), but larval transfer may occur between separate mud patches in some areas. Catches typically consist of a lower proportion of females than males due to the lower burrow emergence (resulting in lower catchability) of females during the egg bearing.

Environmental influence on the stock

Cod has been identified as a major predator of Nephrops in some areas. The generally low level of the cod in the North Sea is likely to have resulted in reduced predation. Multispecies models applied in the past to the exploitation of Irish Sea stocks indicated that management strategies which lead to an increase in the cod stock are associated with a reduction in Nephrops abundance. Therefore it may be expected that Nephrops stocks in the North Sea will decrease when cod recovers.

Effects of the fisheries on the ecosystem

Trawling for Nephrops results in bycatch and discards of other species, including cod, haddock, and whiting. 80 mm is the predominant mesh size used in Nephrops fisheries and the resulting proportion of discarded fish can be high. Initiatives are in place to reduce discarding (see below Factors affecting the fisheries and the stock). Discarding of Nephrops is also high for several FUs and the mortality of Nephrops after discarding is considered to be high (75%; Wileman et al., 1999).

The high mud content and soft nature of Nephrops grounds means that trawling readily marks the seabed, with trawl marks remaining visible for some time. Burrowing fauna can be seen re-emerging from freshly trawled grounds, implying that there is some resilience to trawling.
Additional considerations

The overriding management consideration for these stocks is that management should be at the functional unit (FU) rather than the ICES subarea level. Management at the functional unit 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 functional units. Functional unit TAC management is therefore only one way of managing the fisheries and other approaches may also deliver the required safeguards. Current management of Nephrops in Subarea IV (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 functional units. In the current situation vessels are free to move between grounds, allowing effort to develop on some grounds in a largely uncontrolled way and this has historically resulted in inappropriate harvest rates from some parts. This is a particular problem in the Farn Deeps where increased vessel activity from other parts of the UK occurred, resulting in low stock levels.

MSY approach

No precautionary reference points have been defined for Nephrops. Under the ICES MSY approach, exploitation rates that are likely to generate high long-term yield (and low probability of stock overfishing) have been explored and proposed for each functional unit. Owing to the way Nephrops are assessed, it is not possible to estimate F_{MSY} directly and hence proxies for F_{MSY} are determined. Three candidates for F_{MSY} are F_{0.1}, F_{35%SPR}, and F_{max}. There may be strong differences in relative exploitation rates between the sexes in many stocks. To account for this values for each of the candidates have been determined for males, females, and the two sexes combined. The appropriate F_{MSY} candidate has been selected for each functional unit independently according to the perception of stock resilience, factors affecting recruitment, population density, knowledge of biological parameters, and the nature of the fishery (relative exploitation of the sexes and historical harvest rate vs. stock status).

A decision-making framework based on the table below was used in the selection of preliminary stock-specific F_{MSY} proxies (ICES, 2010). These proxies may be modified following further data exploration and analysis. The combined-sex F_{MSY} proxy should be considered appropriate if the resulting percentage of virgin spawner-per-recruit for males or females does not fall below 20%. When this does happen a more conservative sex-specific F_{MSY} proxy should be picked instead of the combined proxy.

<table>
<thead>
<tr>
<th>Burrow density (average burrows m^{-2})</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&gt; F_{max}</td>
<td>F_{35%SPR}</td>
<td>F_{max}</td>
</tr>
<tr>
<td>Medium</td>
<td>F_{max}</td>
<td>F_{max}</td>
<td>F_{max}</td>
</tr>
<tr>
<td>High</td>
<td>F_{0.1}</td>
<td>F_{35%SPR}</td>
<td>F_{max}</td>
</tr>
<tr>
<td>Stock size estimates</td>
<td>Variable</td>
<td>F_{0.1}</td>
<td>F_{35%SPR}</td>
</tr>
<tr>
<td></td>
<td>Stable</td>
<td>F_{0.1}</td>
<td>F_{15%SPR}</td>
</tr>
<tr>
<td>Knowledge of biological parameters</td>
<td>Poor</td>
<td>F_{0.1}</td>
<td>F_{15%SPR}</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>F_{15%SPR}</td>
<td>F_{max}</td>
</tr>
<tr>
<td>Fishery history</td>
<td>Stable spatially and temporally</td>
<td>F_{35%SPR}</td>
<td>F_{max}</td>
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<tr>
<td></td>
<td>Sporadic</td>
<td>F_{0.1}</td>
<td>F_{35%SPR}</td>
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<tr>
<td></td>
<td>Developing</td>
<td>F_{0.1}</td>
<td>F_{35%SPR}</td>
</tr>
</tbody>
</table>

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

Impacts of fisheries on the ecosystem

In general, catches of cod in the Nephrops fisheries have been relatively low, particularly in recent years in inshore grounds of Subarea IV, but can vary amongst functional units. However, it is important that emerging year classes of cod should not be subjected to high discard mortality. The capture of juvenile fish or other species such as whiting and haddock is also a problem in some of the functional units and discarding of these is a problem in some years. This problem is being addressed with the use of more selective gear, and efforts are already being made in Scotland through the Conservation Credits scheme, requiring vessels targeting Nephrops to use gear with larger square-meshed panels (110 mm). Subject to evaluation of the effectiveness of these measures, further action may be required to reduce discards.
Trawling for Nephrops results in bycatch and discards of other species, including cod, haddock, and whiting. 80 mm is the predominant mesh size used in Nephrops fisheries and the resulting proportion of fish discarded can be high. Initiatives are in place to reduce discarding (see below Factors affecting the fisheries and the stock).

The high mud content and soft nature of Nephrops grounds means that trawling readily marks the seabed, with trawl marks remaining visible for some time. Burrowing fauna can be seen re-emerging from freshly trawled grounds, implying that there is some resilience to trawling.

Cod has been identified as a major predator of Nephrops in some areas. The generally low level of the cod in the North Sea has resulted in reduced predation by cod. Multispecies models applied in the past to the exploitation of Irish Sea stocks indicated that management strategies which lead to an increase in the cod stock are associated with a reduction in Nephrops abundance. Therefore it may be expected that Nephrops stocks in the North Sea will decrease when cod recovers.

Factors affecting the fisheries and the stock

The implementation of the “buyers and sellers” regulations in the UK in 2006 considerably tightened up the levels of reporting for Nephrops, and the landings figures since then are considered to be more reliable. Recent increases in landings and lpue may result from the increase in reporting levels and do not necessarily reflect changes to the stock.

A ban on the use of multitrawl gears (three or more trawls) for all Scottish boats was introduced from April 2008, limiting the expansion of effective effort.

Effort restrictions in the EU were introduced in 2003 (annexes to the annual TAC regulations) for the protection of the North Sea cod stock. In addition, a long-term plan for the recovery of cod stocks was adopted in 2008 (EC regulation 1342/2008). In 2009, the effort management programme switched from a days-at-sea to a kW-day system (EC regulation 43/2009), in which different amounts of kW-days are allocated within each area by member state to different groups of vessels depending on gear and mesh size. Effort ceilings are updated annually. However, for 2013, the European Council decided upon a roll-over of effort level of 2012 into 2013 for both the cod and the sole/plaice management plan.

Overall nominal effort (kW-days) by EU demersal trawls, seines, beam trawls, gill/trammelnets, and longlines (all mesh sizes included) in the North Sea, Skagerrak, and Eastern Channel had been substantially reduced since the implementation of the two successive effort management plans in 2003 and 2008 (~40% between 2003 and 2012, ~16% between 2008 and 2012). Following the introduction of days-at-sea regulations in 2003, there was a substantial switch from the larger mesh (>100 mm, TR1) gear to the smaller mesh (70–99 mm, TR2) gear. Subsequently, effort by TR1 has been relatively stable, whereas effort in TR2 and in small-mesh beam trawl (80–120 mm, BT2), has shown a pronounced decline (~14%, ~45%, and ~48%, respectively, between 2004 and 2012). Gill- and trammelnet fisheries have remained stable (ICES, 2013b). Effort in large mesh size beam trawl (≥120 mm, BT1) has increased significantly in 2012 after a decade of continuous decline. Nominal effort reported by Norway has increased since 2011 due to the generalization of electronic logbooks.

The Scottish industry operates under the Conservation Credits scheme and has implemented improved selectivity measures in gears which target Nephrops as well as real-time closures with a view to reducing unwanted bycatch of cod and other species. Since 2010 a number of vessels are reported to be using large square-meshed panels (of up to 160 mm).

Data and methods

Assessments of the Nephrops functional units of Subarea IV utilized a number of approaches, including underwater TV (UWTV) surveys, length composition information, and basic fishery data such as landings and effort. Owing to uncertainties in the accuracy of historical landings and to inaccurate effort figures in some fisheries, increasing attention is paid to survey information and size composition data as an indicator of stock status.

For those stocks without UWTV surveys, assessment is made on the basis of the ICES approach to data-limited Nephrops stocks. Biennial advice for these stocks was given for 2013 and 2014.

In 2009 there were important developments in the methodology to assess the status of Nephrops stocks. The use of UWTV surveys has enabled the development of fishery-independent indicators of abundance. STECF (2005) suggested that a combination of an absolute abundance estimate from an UWTV survey and a harvest rate based on \( F_{0.1} \) from a combined-sex length cohort analysis (LCA) and the mean weight and selection pattern from the commercial fishery, could be used to calculate appropriate landings. The approach has been further developed and evaluated by ICES workshops in 2007 and 2009 (ICES, 2007, 2009). The 2009 workshop addressed concerns raised
regarding factors which could potentially bias the UWTV survey results. Major sources of bias were quantified for each survey and an overall bias correction factor derived which, when applied to the estimates of abundance from the UWTV survey, allows them to be treated as absolute abundance levels.

In particular the workshop concluded that the burrows of *Nephrops* detected in the UWTV surveys are considerably smaller than the sizes of the *Nephrops* taken by the fishery. Therefore, the abundance estimates used to calculate the harvest ratios presented in the 2009 advice include a component of the stock that is too small to be exploited by the fishery. This has resulted in calculated harvest ratios appearing to have decreased in the current advice compared to previous estimates of harvest ratios. In essence, this is a scaling issue, not a change in exploitation rate. The previous proportion corresponding to fishing at $F_{0.1}$ was in the range of 15–20%, whereas the revised values from the benchmark in 2009 are in the range of 8–10%.

At the *Nephrops* benchmark meeting in February 2013 (ICES, 2013c), stocks in functional units 6, 32, and 34 were examined. For FU 6 new maturity estimates were presented along with a more detailed analysis concerning the possibility of sperm limitation in depleted stocks. For FU 32 available data sources were investigated, but the assessment was not changed. For FU 34, a detailed analysis of spatial distribution of the fishing grounds was presented, leading to an improved methodology for UWTV determination of the abundance in this FU.

**Information from the fishing industry**

Trends according to the Fishers’ North Sea stock survey (Figure 6.4.15b.2) are discussed in the specific FU stock summary sheets.

**Uncertainties in assessment and forecast**

For moderate exploitation rates the UWTV assessment provides an adequate basis for predicting catches. ICES has worked to reduce uncertainty and increase precision in the interpretation of survey data.

There is a gap of at least 12 months (more commonly 18 months) between the survey and the start of the TAC year. It is assumed that the stock is stable during this period (i.e. recruitment and growth balance mortality). The effect of this assumption on realised harvest rates has not been investigated.

New 2013 UWTV survey abundance estimates were available to ICES in October 2013 for FUs 6 and 7. Compared with the 2012 surveys, the 2013 survey results indicate a significant change in abundance for FU 6, but not for FU 7. Therefore, the advice for 2014 corresponding to FU 6 has been updated (with respect to the advice issued in June 2013). UWTV survey results for FU 8 and FU 9 were not available at the time of the reopening process.

The UWTV survey does not cover the complete spatial distribution of the stock, covering six of nine functional units and not the area outside the functional units. The area covered by the UWTV survey accounts for over 75% of the North Sea *Nephrops* landings in 2012. Landings from outside the FUs accounted for 4.4% of total landings in 2012. Vessel monitoring system (VMS) data for vessels >15 meters are being successfully used to match survey and fishery areas.

The harvest ratios equivalent to $F_{MSY}$ proxies are based on yield-per-recruit analyses from length cohort analyses. These analyses utilize average length–frequency data, discarding rates, and mean weight taken over a three-year period. The benchmark in 2009 used data from 2005–2007 and changes in selection, discarding rates, and mean weights appear to have occurred since then. Consequently the harvest rates used as $F_{MSY}$ proxies are reconsidered every year for FUs assessed annually and updated where significant change in fishing practice is observed to have occurred.

**Comparison with previous assessment and advice**

For those stocks without UWTV surveys, advice given in 2012 is biennial and applicable for 2013 and 2014. The basis for this *Nephrops* advice has changed from qualitative analysis of landings trends to advice based on habitat extent and population characteristics.

The advice basis for stocks with UWTV surveys has not changed from last year. The MSY approach and transition are used based on the situation of the stock.
Sources


Figure 6.4.15b.2 Nephrops in Subarea IV. Results of the North Sea Commission fishers’ survey perceptions of the abundance 2012 (Napier, 2012).
Table 6.4.15b.3  
*Nephrops* in Subarea IV. Officially reported landings (tonnes) by functional unit plus other rectangles.

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<thead>
<tr>
<th>Year</th>
<th>FU 5</th>
<th>FU 6</th>
<th>FU 7</th>
<th>FU 8</th>
<th>FU 9</th>
<th>FU 10</th>
<th>FU 32</th>
<th>FU 33</th>
<th>FU 34</th>
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<th>Total</th>
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* Provisional.

** Devil's Hole landings only separated from 2011.
6.4.15.1  Advice June 2013

ECOREGION: North Sea
STOCK: Nephrops in Botney Gut–Silver Pit (FU 5)

Advice for 2014

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 1000 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Scientific basis

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Input data</th>
<th>Discards and bycatch</th>
<th>Indicators</th>
<th>Other information</th>
<th>Working group report</th>
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<td>Data-limited method for Nephrops (category 4.1.4).</td>
<td>Commercial catches (international landings and length frequencies from Dutch catch sampling), two survey indices (two UWTV estimates of density per m² in 2010 and 2012), Habitat extent from VMS analysis and sediment maps.</td>
<td>Discards are assumed to be similar to those observed in FU6.</td>
<td>None.</td>
<td>None.</td>
<td>WGNSSK (ICES, 2013a)</td>
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Sources


Table 6.4.15.1.1  Nephrops in Botney Gut–Silver Pit (FU 5). ICES advice and landings.

<table>
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<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice</th>
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Weights in thousand tonnes.

1) Does not include discards.

2) Includes Off Horns Reef FU 33.
ECOREGION  North Sea  
STOCK  *Nephrops* in Farn Deeps (FU 6)  

**Advice for 2014**  
ICTES advises on the basis of the MSY transition that landings in 2014 should be no more than 1026 tonnes. If total discard rates do not change from the average of the last three years (2010–2012), this implies total catches of no more than 1169 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 15% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

### Stock status

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**Figure 6.4.15b.2.1**  *Nephrops* in Farn Deeps (FU 6). Long-term trends in landings, harvest rate, and UWTV abundance (used as F and SSB proxies. Weights in thousand tonnes, abundance in millions). Dashed green lines show proxies for F_{MSY} and MSY B_{trigger}. For the UWTV abundance calculation a geostatistical method has been determined from 2007 onwards (red line).

The UWTV survey indicates that the stock status has declined since 2005 and has been fluctuating near MSY B_{trigger} since 2007. Changes in survey methodology in 2007 make exact comparisons with the preceding series difficult, but the general trend is considered reliable.
Management plans

No specific management objectives are known to ICES.

The fisheries

*Nephrops* in FU 6 are predominantly caught in trawl fisheries using meshes in the 80–99 mm category. A small amount of creeling takes place. Increases in the numbers of vessels using twin-rig and multi-rig gears observed in this area are likely to have increased the effective fishing power per kW hour.

<table>
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<tr>
<th>Catch distribution</th>
<th>Total catch (2012) = 2805 t, of which 87.7% were landings (almost entirely taken in demersal trawl fisheries, either a directed <em>Nephrops</em> or a mixed <em>Nephrops</em>/demersal fishery) and 12.3% discards in weight.</th>
</tr>
</thead>
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Quality considerations

Market sampling misses portions of the tailed category of landings. For assessment purposes, only sampling of the full unsorted catch is used to estimate the size composition of removals. The method used to raise the abundances in years prior to 2007 has been found to be statistically flawed and a raising procedure has been developed to avoid these errors. Improvements in the recording of position (GPS) for the underwater TV survey from 2007 permit a more accurate estimate of absolute abundance than previously possible. Prior to this date there is a potential upward bias in the absolute estimate due to underestimation of the distance covered.

Revisions in 2013 of UWTV abundances (going back to 2007) have made small (< 5%) changes in the series, including the 2007 point used as the MSY B\(_{\text{trigger}}\) point; however, the general conclusions about stock status remain unchanged.

Scientific basis

**Assessment type**

Underwater TV survey linked to yield-per-recruit analysis from length data.

**Input data**

One survey index (UWTV); Length–frequency data from the fishery. Commercial catches (international landings and length frequencies from English catch sampling), one survey index (FU6 UWTV). Maturity data from commercial catch sampling. Natural mortalities from Morizur (1982).

**Discards and bycatch**

Discards are included in the assessment since 2000, from English trawls (TR1 & TR2).

**Indicators**

None.

**Other information**

Latest benchmark was performed in 2013 (ICES, 2013c). The advice was reopened in November 2013 based on information provided by the UWTV survey conducted in 2013.

**Working group report**

[WNSSK](https://ices.dk) (ICES, 2013a).
ECOREGION North Sea
STOCK Nephrops in Farn Deeps (FU 6)

Reference points

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
<th>Technical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY</td>
<td>MSY (B_{\text{trigger}})</td>
<td>858 million (\text{UWTV survey index at start of current decline (2007) as measured by a geostatistical method.})</td>
</tr>
<tr>
<td>Approach</td>
<td>(F_{\text{MSY}})</td>
<td>Harvest rate 8.1% (\text{Equivalent to } F_{35% \text{SPR}} \text{ males in 2011.})</td>
</tr>
<tr>
<td>Precautionary Approach</td>
<td>(F_{0.1})</td>
<td>Not agreed.</td>
</tr>
<tr>
<td></td>
<td>(F_{\text{max}})</td>
<td>Not agreed.</td>
</tr>
</tbody>
</table>

(Changed in 2013)

Harvest rate reference points (2013):

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F_{\text{max}})</td>
<td>11.6 %</td>
<td>21.6 %</td>
<td>15.3 %</td>
</tr>
<tr>
<td>(F_{0.1})</td>
<td>7.1%</td>
<td>14.0 %</td>
<td>8.7 %</td>
</tr>
<tr>
<td>(F_{35% \text{SPR}})</td>
<td>8.1%</td>
<td>15.2 %</td>
<td>11.1 %</td>
</tr>
</tbody>
</table>

For this functional unit (FU), the exploitation rate on males is usually considerably higher than on females and there is evidence of sperm-limitation following harvest rates in the region of 20%. There is evidence to suggest that in both 2006 and 2010 mature females have not been able to successfully mate and therefore a larger male spawning potential is desirable. To this effect the harvest rate equivalent to fishing at \(F_{35\% \text{SPR}}\) for males is suggested as a proxy for \(F_{\text{MSY}}\) \(\text{(} F_{35\% \text{SPR}}, \text{ males = 8.1%}\)\). New size-at-maturity data were analyzed at the 2013 benchmark meeting, leading to revisions in the harvest rate reference points.

Outlook for 2014


<table>
<thead>
<tr>
<th>Basis</th>
<th>Total catches*</th>
<th>Landings</th>
<th>Dead discards**</th>
<th>Surviving discards**</th>
<th>Harvest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L+DD+SD</td>
<td>L</td>
<td>DD</td>
<td>SD</td>
<td>for L+DD</td>
</tr>
<tr>
<td>MSY approach</td>
<td>323</td>
<td>283</td>
<td>34</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>646</td>
<td>567</td>
<td>67</td>
<td>11</td>
<td>4%</td>
</tr>
<tr>
<td>MSY transition</td>
<td>1078</td>
<td>947</td>
<td>112</td>
<td>19</td>
<td>6.7%</td>
</tr>
<tr>
<td>(F_{\text{MSY}})</td>
<td>1169</td>
<td>1026</td>
<td>122</td>
<td>21</td>
<td>7.2%</td>
</tr>
<tr>
<td>(F_{2010-2012})</td>
<td>1310</td>
<td>1151</td>
<td>137</td>
<td>23</td>
<td>8.1%</td>
</tr>
<tr>
<td></td>
<td>1453</td>
<td>1275</td>
<td>151</td>
<td>26</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>1775</td>
<td>1559</td>
<td>185</td>
<td>31</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>1937</td>
<td>1700</td>
<td>202</td>
<td>34</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>1985</td>
<td>1743</td>
<td>207</td>
<td>35</td>
<td>12.3%</td>
</tr>
<tr>
<td></td>
<td>2421</td>
<td>2126</td>
<td>252</td>
<td>43</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>3228</td>
<td>2834</td>
<td>336</td>
<td>57</td>
<td>20%</td>
</tr>
</tbody>
</table>

Weights in tonnes.
* Total catches are the landings including dead and surviving discards.
** The total discard rate is assumed to be 24.34% of the catches (in number, average of the last three years (2010–2012)); discard survival is assumed to be 15% (ICES, 2013c).

**MSY approach**

Following the ICES MSY approach implies a harvest rate of 6.7% (below \(F_{\text{MSY}}\) because biomass is below MSY \(B_{\text{trigger}}\)), resulting in landings of 947 t in 2014.

Following the transition scheme towards the ICES MSY approach implies fishing mortality to be reduced to \((0.2 \times F_{2010} + 0.8 \times (F_{\text{MSY}} \times (SSB_{2014}/MSY \ B_{\text{trigger}}))) = 7.2\%\), corresponding to landings of no more than 1026 t in 2014. If
discard rates do not change from the average of the last three years (2010–2012, assuming 15% discard survival), this implies total catches of no more than 1169 t.

**Additional considerations**

In mixed fisheries projections the ‘min’ scenario (where fishing is assumed to stop when the catch for any one of the stocks considered meets the single-stock advice) estimates that the Nephrops stock in FU 6 is one of the main limiting species for 2014, together with cod.

Declines in abundance in other FUs (i.e. Firth of Forth and the Fladen grounds) may increase the risk of higher effort being deployed in this FU which would be inadvisable, given the current low level of the stock.

The stock has shown signs of overexploitation in recent years, with an unbalanced sex ratio leading to poor recruitment. Without suitable controls on the movement of effort between functional units there is nothing to prevent the effort in 2014 from increasing and moving the observed harvest ratios even further beyond the level of F_{MSY}.

**The effects of regulations**

The minimum landing size for Nephrops in the North Sea is 25 mm carapace length. Discarding rates of Nephrops are fairly stable between 2007 to 2012 at around 25% by number.

**Changes in fishing technology and fishing patterns**

The number of vessels using multi-rig gear had been increasing but now appears to have stabilized. These gears have a higher fishing power than single rigs for Nephrops and may have a higher environmental impact due to the additional weight required for deployment.

**Information from the fishing industry**

There is a fair level of consistency between the overall abundance track and the scientific survey. The Fishers’ Stock Survey trajectory (Napier, 2012) for area 4 shows less increase than in other areas, consistent with the scientific perception that the Farn Deeps stock had not experienced the stock increases of other functional units. There is also agreement that the stock in this area has declined in recent years.

**Uncertainties in assessment and forecast**

General comments are found at the beginning of Section 6.4.15b.

Revisions to the UWTV survey calculations for 2007–2010 (in 2012) have resulted in changes to the bias-corrected abundance indices, particularly in 2010 which is reduced by 15% from 892 million to 753 million. The value used for the MSY B_{trigger} biomass proxy (the 2007 value) has decreased from 879 million to 858 million (−2%).

**Comparison with previous assessment and advice**

The historical abundance is not revised from one year to the next because abundances are based on direct observation.

The basis for the advice has not changed, but the advice for 2014 has been updated from the advice issued in June 2013, based on the information provided by the UWTV survey conducted in 2013.
Figure 6.4.15b.2.2  *Nephrops* Farn Deeps (FU 6). Length composition of catch (dotted) and landed (solid) of males (right) and females (left) from 1996 (bottom) to 2012 (top). Mean sizes of catch and landings (using same line types) is shown in relation to minimum landing size (MLS).

Table 6.4.15b.2.1  *Nephrops* Farn Deeps (FU 6). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice Farn Deeps (FU 6)</th>
<th>Recommended landings FU's 6 and 8</th>
<th>ICES landings FU 6(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td>4.17</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>4.17</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>No increase in effort</td>
<td>-</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>No increase in effort, harvest rate &lt; 15%</td>
<td>3.5</td>
<td>5.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2008</td>
<td>No new advice, same as for 2007</td>
<td>3.5</td>
<td>5.0</td>
<td>1.2</td>
</tr>
<tr>
<td>2009</td>
<td>No increase in effort and landings (2007)</td>
<td>&lt; 3.0</td>
<td>(2))</td>
<td>2.7</td>
</tr>
<tr>
<td>2010</td>
<td>Harvest rate no greater than that equivalent to fishing at F(_{2008})</td>
<td>&lt; 1.2</td>
<td>(2))</td>
<td>1.4</td>
</tr>
<tr>
<td>2011</td>
<td>MSY transition</td>
<td>&lt; 1.9</td>
<td>(2))</td>
<td>2.1</td>
</tr>
<tr>
<td>2012</td>
<td>MSY transition</td>
<td>&lt; 1.4</td>
<td>(2))</td>
<td>2.5</td>
</tr>
<tr>
<td>2013</td>
<td>MSY transition</td>
<td>&lt; 1.4</td>
<td>(2))</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>MSY transition</td>
<td>&lt; 1.026</td>
<td>(2))</td>
<td></td>
</tr>
</tbody>
</table>

Weights in thousand tonnes.

\(^1\) Does not include discards.

\(^2\) Advice given at FU level only.
**Table 6.4.15b.2.2**  
*Nephrops* Farn Deeps (FU 6). Official landings (tonnes).

<table>
<thead>
<tr>
<th>Year</th>
<th>UK England &amp; N. Ireland</th>
<th>UK Scotland</th>
<th>Sub total</th>
<th>Other countries**</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>1981</td>
<td>1006</td>
<td>67</td>
<td>1073</td>
<td>0</td>
<td>1073</td>
</tr>
<tr>
<td>1982</td>
<td>2443</td>
<td>81</td>
<td>2524</td>
<td>0</td>
<td>2524</td>
</tr>
<tr>
<td>1983</td>
<td>2073</td>
<td>5</td>
<td>2078</td>
<td>0</td>
<td>2078</td>
</tr>
<tr>
<td>1984</td>
<td>1471</td>
<td>8</td>
<td>1479</td>
<td>0</td>
<td>1479</td>
</tr>
<tr>
<td>1985</td>
<td>2009</td>
<td>18</td>
<td>2027</td>
<td>0</td>
<td>2027</td>
</tr>
<tr>
<td>1986</td>
<td>1987</td>
<td>28</td>
<td>2015</td>
<td>0</td>
<td>2015</td>
</tr>
<tr>
<td>1987</td>
<td>2158</td>
<td>33</td>
<td>2191</td>
<td>0</td>
<td>2191</td>
</tr>
<tr>
<td>1988</td>
<td>2390</td>
<td>105</td>
<td>2495</td>
<td>0</td>
<td>2495</td>
</tr>
<tr>
<td>1989</td>
<td>2930</td>
<td>168</td>
<td>3098</td>
<td>0</td>
<td>3098</td>
</tr>
<tr>
<td>1990</td>
<td>2306</td>
<td>192</td>
<td>2498</td>
<td>0</td>
<td>2498</td>
</tr>
<tr>
<td>1991</td>
<td>1884</td>
<td>179</td>
<td>2063</td>
<td>0</td>
<td>2063</td>
</tr>
<tr>
<td>1992</td>
<td>1403</td>
<td>60</td>
<td>1463</td>
<td>10</td>
<td>1473</td>
</tr>
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<td>2941</td>
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<td>3030</td>
</tr>
<tr>
<td>1994</td>
<td>3530</td>
<td>153</td>
<td>3683</td>
<td>0</td>
<td>3683</td>
</tr>
<tr>
<td>1995</td>
<td>2478</td>
<td>90</td>
<td>2568</td>
<td>1</td>
<td>2569</td>
</tr>
<tr>
<td>1996</td>
<td>2386</td>
<td>96</td>
<td>2482</td>
<td>1</td>
<td>2483</td>
</tr>
<tr>
<td>1997</td>
<td>2109</td>
<td>80</td>
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<td>0</td>
<td>2189</td>
</tr>
<tr>
<td>1998</td>
<td>2029</td>
<td>147</td>
<td>2176</td>
<td>1</td>
<td>2177</td>
</tr>
<tr>
<td>1999</td>
<td>2197</td>
<td>194</td>
<td>2391</td>
<td>0</td>
<td>2391</td>
</tr>
<tr>
<td>2000</td>
<td>1947</td>
<td>231</td>
<td>2178</td>
<td>0</td>
<td>2178</td>
</tr>
<tr>
<td>2001</td>
<td>2319</td>
<td>255</td>
<td>2574</td>
<td>0</td>
<td>2574</td>
</tr>
<tr>
<td>2002</td>
<td>1739</td>
<td>215</td>
<td>1954</td>
<td>0</td>
<td>1954</td>
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<td>2003</td>
<td>2031</td>
<td>214</td>
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<td>0</td>
<td>2245</td>
</tr>
<tr>
<td>2004</td>
<td>1952</td>
<td>201</td>
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<td>2153</td>
</tr>
<tr>
<td>2005</td>
<td>2936</td>
<td>158</td>
<td>3094</td>
<td>0</td>
<td>3094</td>
</tr>
<tr>
<td>2006</td>
<td>4430</td>
<td>434</td>
<td>4864</td>
<td>39</td>
<td>4903</td>
</tr>
<tr>
<td>2007</td>
<td>2525</td>
<td>437</td>
<td>2962</td>
<td>4</td>
<td>2966</td>
</tr>
<tr>
<td>2008</td>
<td>976</td>
<td>244</td>
<td>1220</td>
<td>0</td>
<td>1220</td>
</tr>
<tr>
<td>2009</td>
<td>2299</td>
<td>414</td>
<td>2713</td>
<td>0</td>
<td>2713</td>
</tr>
<tr>
<td>2010</td>
<td>1258</td>
<td>185</td>
<td>1443</td>
<td>0</td>
<td>1443</td>
</tr>
<tr>
<td>2011</td>
<td>1806</td>
<td>250</td>
<td>2056</td>
<td>14</td>
<td>2070</td>
</tr>
<tr>
<td>2012*</td>
<td>2177</td>
<td>256</td>
<td>2433</td>
<td>27</td>
<td>2460</td>
</tr>
</tbody>
</table>

na = not available.  
* Provisional.  
** Other countries includes Netherlands, Belgium, and Denmark.
Table 6.4.15b.2.3  *Nephrops* Farn Deeps (FU 6). Summary of the assessment.

<table>
<thead>
<tr>
<th>Year</th>
<th>TV abundance index</th>
<th>Landings (t)</th>
<th>Discard rate (number)</th>
<th>Mean weight – Landings (g)</th>
<th>Mean weight – Discards (g)</th>
<th>Number removed</th>
<th>Observed harvest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1685</td>
<td>2574</td>
<td>66.60%</td>
<td>20.67</td>
<td>9.62</td>
<td>374</td>
<td>22.2%</td>
</tr>
<tr>
<td>2002</td>
<td>1048</td>
<td>1953</td>
<td>46.10%</td>
<td>20.00</td>
<td>9.50</td>
<td>182</td>
<td>17.3%</td>
</tr>
<tr>
<td>2003</td>
<td>1085</td>
<td>2245</td>
<td>42.10%</td>
<td>21.89</td>
<td>9.56</td>
<td>177</td>
<td>16.3%</td>
</tr>
<tr>
<td>2004</td>
<td>1377</td>
<td>2152</td>
<td>41.70%</td>
<td>23.14</td>
<td>9.22</td>
<td>160</td>
<td>11.6%</td>
</tr>
<tr>
<td>2005</td>
<td>1657</td>
<td>3094</td>
<td>34.50%</td>
<td>23.58</td>
<td>10.32</td>
<td>200</td>
<td>12.1%</td>
</tr>
<tr>
<td>2006</td>
<td>1244</td>
<td>4858</td>
<td>31.30%</td>
<td>22.53</td>
<td>10.58</td>
<td>317</td>
<td>25.5%</td>
</tr>
<tr>
<td>2007</td>
<td>858</td>
<td>2966</td>
<td>25.00%</td>
<td>24.95</td>
<td>10.89</td>
<td>158</td>
<td>18.5%</td>
</tr>
<tr>
<td>2008</td>
<td>987</td>
<td>1213</td>
<td>24.90%</td>
<td>26.63</td>
<td>10.97</td>
<td>61</td>
<td>6.2%</td>
</tr>
<tr>
<td>2009</td>
<td>682</td>
<td>2711</td>
<td>29.30%</td>
<td>24.45</td>
<td>10.54</td>
<td>155</td>
<td>22.7%</td>
</tr>
<tr>
<td>2010</td>
<td>785</td>
<td>1443</td>
<td>23.00%</td>
<td>25.18</td>
<td>11.74</td>
<td>74</td>
<td>9.5%</td>
</tr>
<tr>
<td>2011</td>
<td>878</td>
<td>2072</td>
<td>22.60%</td>
<td>27.05</td>
<td>11.02</td>
<td>99</td>
<td>11.3%</td>
</tr>
<tr>
<td>2012</td>
<td>758</td>
<td>2457</td>
<td>27.42%</td>
<td>27.30</td>
<td>10.16</td>
<td>123</td>
<td>16.2%</td>
</tr>
<tr>
<td>2013</td>
<td>706</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ECOREGION  North Sea  
STOCK  Nephrops in Fladen Ground (FU 7)

Advice summary for 2014

ICES advises on the basis of the MSY approach that landings in 2014 should be no more than 8959 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 9059 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level. Should the catch in this FU be lower that advised, the difference should not be transferred to other FUs.

Stock status

<table>
<thead>
<tr>
<th>F (Fishing Mortality)</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY (F_MSY)</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Precautionary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>approach (F_lim)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSB (Spawning-Stock Biomass)</td>
<td>2010</td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>MSY (B_trigger)</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Precautionary</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>approach (B_lim)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The stock has declined from the highest observed value in 2008 and is now just below the MSY B_trigger. The harvest rate has fluctuated in recent years, and fell to approximately 4% in 2012 which is below F_MSY.
Management plans

No specific management objectives are known to ICES.

Biology

See Section 6.4.15 for general comments. The Nephrops population at the Fladen is characterized by a low density of individuals compared to other FUs. There also appears to be fewer competing burrowing species in this area.

The fisheries

Over 95% of the landings are taken by Scottish vessels. Most of the landings are made by single-rig vessels. 80 mm mesh is the most common mesh size although there is anecdotal evidence of increasing use of meshes larger than 80 mm. Whitefish represents an important bycatch for a significant component of the Scottish Nephrops trawlers operating at the Fladen.

| Catch distribution | Total catch (2012) = 4.4 kt. Almost all landings are taken in demersal trawl fisheries, either in a directed Nephrops or a mixed Nephrops/demersal fishery. Observer trips recorded no Nephrops discards in 2012. |

Quality considerations

See Section 6.4.15 for general comments. The UWTV survey in this area is conducted over the main part of the ground, representing an area of around 28 200 km$^2$ of suitable mud substrate. The Fladen Ground functional unit contains several patches of mud to the north of the ground which are fished, bringing the overall area of substrate to 30 633 km$^2$. This area is not surveyed but would add to the abundance estimate. The bias-corrected absolute abundance estimate for this ground is therefore likely to be underestimated by the current methodology.

Scientific basis

| Assessment type | Underwater TV survey linked to yield-per-recruit analysis from length data. Commercial catches (international landings, length frequencies from Scottish catch sampling), one survey index (FU 7 UWTV-Scotia-June). Maturity data from commercial catch sampling and natural mortalities from Morizur (1982) |
| Discards and bycatch Indicators | Discards included in the assessment since 2000, from Scottish trawls (TR1 and TR2) Size structure of catches, mean size, lput. |
| Other information | Latest benchmark (based on the UWTV survey) was performed in 2009. |
| Working group report | WGNSSK (ICES, 2013a) |
6.4.15.3 Supporting information June 2013

ECOREGION North Sea
STOCK Nephrops in Fladen Ground (FU 7)

Reference points

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<thead>
<tr>
<th>Type</th>
<th>Value</th>
<th>Technical basis</th>
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<td>Lowest observed UWTV survey estimate of abundance</td>
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<td>Approach</td>
<td>F&lt;sub&gt;MSY&lt;/sub&gt; Harvest rate 10.3%.</td>
<td>Equivalent to F&lt;sub&gt;0.1&lt;/sub&gt; combined sex in 2011.</td>
</tr>
<tr>
<td>Precautionary Approach</td>
<td>Not defined.</td>
<td>(unchanged since: 2011)</td>
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Harvest rate reference points (2011):

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<th>Female</th>
<th>Combined</th>
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<td>16.2%</td>
<td>24.1%</td>
<td>18.5%</td>
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<tr>
<td>F&lt;sub&gt;0.1&lt;/sub&gt;</td>
<td>9.5%</td>
<td>12.1%</td>
<td>10.3%</td>
</tr>
<tr>
<td>F&lt;sub&gt;35%&lt;/sub&gt;</td>
<td>11.4%</td>
<td>14.4%</td>
<td>12.4%</td>
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</table>

For this FU, the absolute density observed on the UWTV survey is low with a long term average (1992–2012) of just below 0.2 burrows m<sup>-2</sup>, suggesting the stock may have low productivity. Historical harvest ratios in this FU have been below that equivalent to fishing at F<sub>0.1</sub>, and therefore an appropriate proxy for F<sub>MSY</sub> would be F<sub>0.1</sub> for combined sexes.

The F<sub>MSY</sub> proxy harvest rate values were updated in 2011 from the per-recruit analysis based on input parameters from a combined-sex length cohort analysis of 2008–2010 catch-at-length data. Previous analysis used 2005, 2006, and preliminary 2007 data which showed substantially greater discard rates than have recently been observed.

Outlook for 2014

Basis: F<sub>2010–2012</sub> =average harvest rate of 2010-2012=6.9%; Survey abundance (2012) = 2748 million; Mean weight in landings (2010–2012) = 33.15 g; Discard rate (dead, by number) = 1.7% (average 2010–2012), Mean weight in discards (2010 only as no discards in 2011 and 2012) = 16.4g.

<table>
<thead>
<tr>
<th>Basis</th>
<th>Total Catches*</th>
<th>Landings</th>
<th>Dead Discards**</th>
<th>Surviving Discards**</th>
<th>Harvest Rate</th>
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</thead>
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<tr>
<td></td>
<td>L+DD+SD</td>
<td>L</td>
<td>DD</td>
<td>SD</td>
<td>for L+DD</td>
</tr>
<tr>
<td>F&lt;sub&gt;2010-2012&lt;/sub&gt;</td>
<td>4530</td>
<td>4479</td>
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<td>13</td>
<td>5.0%</td>
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<tr>
<td>MSY approach</td>
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<td>52</td>
<td>17</td>
<td>6.9%</td>
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<td>F&lt;sub&gt;MSY&lt;/sub&gt;</td>
<td>6794</td>
<td>6719</td>
<td>56</td>
<td>19</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>9059</td>
<td>8959</td>
<td>75</td>
<td>25</td>
<td>10.0%</td>
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<tr>
<td></td>
<td>9330</td>
<td>9227</td>
<td>77</td>
<td>26</td>
<td>10.3%</td>
</tr>
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</table>

Weights in tonnes
* Total catches are the landings including dead and surviving discards
** Total discard rate is assumed to be 2% of the catches (in number, last 3 years average, 2010-2012), discard survival is assumed 25% (ICES, 2009).

MSY approach

Following the ICES MSY approach implies a harvest rate of 10.0%, (lower than the F<sub>MSY</sub> because SSB is below MSY B<sub>trigger</sub>), resulting in landings of less than 8959 t in 2013. If discards rates do not change from the average of the last 3 years (2010–2012, assuming 25 % discard survival), this implies total catches of no more than 9059 t.
ICES notes that this implies an increase in harvest rate when the stock has shown a steady decline since 2008, and is now below MSY Btrigger. Considering the harvest options for this FU have not been utilised, utilisation of the harvest options from FU 7 elsewhere, may result in overexploitation of other FUs.

Additional considerations

In mixed fisheries projections the maximum scenario (‘max’, where fishing stops when all stocks considered have been caught up to the ICES single-stock advice) the Nephrops stock in FU7 is one of the least limiting stocks. The advice for FU 7 has not been restrictive to landings from the area since 2010. Should the catch in this FU be lower that advised, the difference should not be transferred to other FUs where this would cause local overfishing.

In the Fladen area the Nephrops stock is restricted to a generally continuous area of muddy sediments extending from 57°30’N to 60°N, and from 1°W to 1°30’E, with other smaller patches to the north. The Fladen is one of the largest known Nephrops grounds; fishing activity can shift spatially so that effort can vary on parts of the ground.

The effects of regulations

The minimum landing size for Nephrops in the North Sea is 25 mm carapace length. Discarding of both undersize and poor quality Nephrops sometimes takes place at a low rate in this FU. Values have fallen in recent years, from about 10% in the early 2000s to around 5% by number in the period covered by the Y/R analysis (2008–2010); in 2011 and 2012 there were zero discards of Nephrops. Discard rates in this FU have historically been low compared to other North Sea functional units because of the generally larger size of Nephrops found at the Fladen.

Changes in fishing technology and fishing patterns

In the early years of the fishery, effort was primarily directed to a region that could be reached within 12 hours’ steaming from ports along the northeast coast of Scotland. In recent years, logbook information and VMS show that vessels are fishing more widely over the ground, including to the farther easterly and northerly edges of the extensive mud area.

The reduction in the discard rate since 2000 appears to be caused partly by increased retention of small individuals (lower mean sizes of the < 35 mm component of the landings for part of the time-series) and possibly, in the most recent years, by a period of reduced recruitment which has led to some changes in the size composition of the catch.

Information from the fishing industry

The Fishers’ North Sea stock survey in 2012 shows that perceived abundance increased to 2007 and have subsequently declined to below the level at the start of the series. This is broadly in line with the results of the UWTV survey.

Uncertainties in assessment and forecast

General comments are found at the beginning of Section 6.4.15.

The population has not been well-studied and biological parameters such as growth are considered particularly uncertain.

The UWTV survey is conducted over the main part of the ground, representing an area of around 28 200 km² of suitable mud substrate (the largest ground in Europe). The Fladen functional unit contains several patches of mud to the north of the ground which are fished, bringing the overall area of substrate to 30 633 km². This area is not surveyed but would add to the abundance estimate. The absolute abundance estimate for this ground is therefore likely to be underestimated by the current methodology.

Comparison with previous assessment and advice

The perception of the state of the stock in previous years has not changed (i.e. based on an absolute abundance estimate from a survey).

The advice given in 2013 is based on the MSY approach (as last year).
Figure 6.4.15.3.2  
*Nephrops*, Fladen (FU 7). Catch length–frequency distribution and mean sizes in the catch and landings. Vertical lines are minimum landing size (25 mm) and 35 mm.

Table 6.4.15.3.1  
*Nephrops* in Fladen Ground (FU 7). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings Correspond. to advice Fladen Grounds (FU 7)</th>
<th>ICES landings FU 7&lt;sup&gt;1)&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>1992</td>
<td>~2.7</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>2.7</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>5.0</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>1995</td>
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<tr>
<td>2006</td>
<td>No increase of effort</td>
<td>-</td>
<td>10.8</td>
</tr>
<tr>
<td>2007</td>
<td>No increase in effort and harvest rate below 7.5%</td>
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<td>2008</td>
<td>No new advice, same as for 2007</td>
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<td>12.24</td>
</tr>
<tr>
<td>2009</td>
<td>No increase in effort and recent average landings</td>
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<tr>
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<td>Harvest Rate no greater than that equivalent to fishing at F&lt;sub&gt;0.1&lt;/sub&gt;</td>
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Weights in thousand tonnes.

<sup>1)</sup> Does not include discards.
Table 6.4.15.3.2  
*Nephrops* in Fladen Ground (FU 7). Official landings (tonnes) of *Nephrops*, as reported to ICES.

<table>
<thead>
<tr>
<th>Year</th>
<th>Denmark</th>
<th>UK Scotland</th>
<th>Other</th>
<th>Sub-total</th>
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<td>67</td>
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<td>4369</td>
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*na = not available*

**Other countries includes Belgium, Norway and UK England**
Table 6.4.13.3  *Nephrops* in Fladen (FU 7). Results of the 1992–2012 UWTV surveys (abundances and confidence interval).

<table>
<thead>
<tr>
<th>Year</th>
<th>Stations</th>
<th>Abundance (millions)</th>
<th>Mean density (burrows/m²)</th>
<th>95% confidence interval (millions)</th>
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<td>1995</td>
<td>61</td>
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<td>896</td>
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<td>1996</td>
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<td>510</td>
</tr>
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<td>491</td>
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<td>2012</td>
<td>70</td>
<td>2748</td>
<td>0.10</td>
<td>392</td>
</tr>
</tbody>
</table>

Table 6.4.13.3.4  *Nephrops* in Fladen (FU 7). Adjusted TV survey abundance, landings, total discard rate (proportion by number), dead discard rate (by number), and estimated harvest rate.

<table>
<thead>
<tr>
<th>Year</th>
<th>Adjusted abundance (millions)</th>
<th>Landings (tonnes)</th>
<th>Discard rate</th>
<th>Dead discard rate</th>
<th>Harvest ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>5547</td>
<td>6294</td>
<td>0.1</td>
<td>0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>2004</td>
<td>5725</td>
<td>8729</td>
<td>0.11</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>2005</td>
<td>4325</td>
<td>10685</td>
<td>0.11</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>2006</td>
<td>4862</td>
<td>10791</td>
<td>0.13</td>
<td>0.1</td>
<td>0.08</td>
</tr>
<tr>
<td>2007</td>
<td>7017</td>
<td>11910</td>
<td>0.11</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>2008</td>
<td>7360</td>
<td>12240</td>
<td>0.04</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>2009</td>
<td>5457</td>
<td>13327</td>
<td>0.1</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>2010</td>
<td>5224</td>
<td>12825</td>
<td>0.06</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>2011</td>
<td>3382</td>
<td>7558</td>
<td>0</td>
<td>0</td>
<td>0.062</td>
</tr>
<tr>
<td>2012</td>
<td>2748</td>
<td>4369</td>
<td>0</td>
<td>0</td>
<td>0.047</td>
</tr>
</tbody>
</table>
ECOREGION  North Sea  
STOCK  *Nephrops in Firth of Forth (FU 8)*  

Advice for 2014

ICES advises on the basis of the transition to the MSY approach that landings in 2013 should be no more than 1417 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 1646 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

<table>
<thead>
<tr>
<th>Stock status</th>
<th>F (Fishing Mortality)</th>
<th>MSY (F&lt;sub&gt;MSY&lt;/sub&gt;)</th>
<th>Precautionary approach (F&lt;sub&gt;pa&lt;/sub&gt;,F&lt;sub&gt;lim&lt;/sub&gt;)</th>
<th>SSB (Spawning-Stock Biomass)</th>
<th>MSY (B&lt;sub&gt;trigger&lt;/sub&gt;)</th>
<th>Precautionary approach (B&lt;sub&gt;pa&lt;/sub&gt;,B&lt;sub&gt;lim&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010 2011</td>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSY (F&lt;sub&gt;MSY&lt;/sub&gt;)</td>
<td></td>
<td></td>
<td>Above target</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precautionary approach (F&lt;sub&gt;pa&lt;/sub&gt;,F&lt;sub&gt;lim&lt;/sub&gt;)</td>
<td></td>
<td></td>
<td>Undefined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSB (Spawning-Stock Biomass)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010 2011</td>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSY (B&lt;sub&gt;trigger&lt;/sub&gt;)</td>
<td></td>
<td></td>
<td>Above trigger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precautionary approach (B&lt;sub&gt;pa&lt;/sub&gt;,B&lt;sub&gt;lim&lt;/sub&gt;)</td>
<td></td>
<td></td>
<td>Undefined</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The stock remains above MSY B<sub>trigger</sub> but has declined since 2008. The harvest rate remains above F<sub>MSY</sub>.

Figure 6.4.15.4.1 *Nephrops in Firth of Forth (FU 8).* Long-term trends in landings, harvest rate, and UWTV biomass (used as F and SSB proxies; weights in thousand tonnes and UWTV in millions). Dashed green lines show proxies for F<sub>MSY</sub> and MSY B<sub>trigger</sub>. Harvest rates before 2007 may be unreliable due to underreporting of landings.
Management plans

No specific management objectives are known to ICES.

Biology

The population of Nephrops in the Firth of Forth appears to consist of a high density of small individuals in comparison to other FU's.

The fisheries

The Nephrops fishery in the Firth of Forth is dominated by UK (Scotland) vessels, with low landings reported by other UK nations. Nephrops discard rates are higher than in a number of other areas but the rates have declined to 25% by number and 13% by weight (average 2011–2012).

**Catch distribution**

Total catch (2012) = 2091, where 87% are landings taken in demersal trawl fisheries, either a directed Nephrops or a mixed Nephrops/demersal fishery, and 13% are discards (in weight).

Quality considerations

See Section 6.4.15 for general comments.

Scientific basis

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Underwater TV survey linked to yield-per-recruit analysis from length data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Commercial catches (international landings, length frequencies from Scottish catch sampling), 1 survey index (FU 8 UWTV). Maturity data from commercial catch sampling, natural mortalities from Morizur (1982)</td>
</tr>
<tr>
<td>Discards and bycatch indicators</td>
<td>Discards included in the assessment since 1990, from Scottish trawls (TR1 and TR2)</td>
</tr>
<tr>
<td>Other information</td>
<td>Information on size structure; mean size; lpue.</td>
</tr>
<tr>
<td>Working group report</td>
<td>WGNSSK (ICES, 2013a)</td>
</tr>
</tbody>
</table>
ECOREGION  North Sea  
STOCK    Nephrops in Firth of Forth (FU 8)

Reference points

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
<th>Technical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY Approach</td>
<td>MSY Btrigger 292 million individuals.</td>
<td>Lowest observed UWTV survey estimate of abundance (1993-2010).</td>
</tr>
<tr>
<td>F&lt;sub&gt;MSY&lt;/sub&gt;</td>
<td>Harvest rate 16.3%.</td>
<td>Equivalent to F&lt;sub&gt;max&lt;/sub&gt; combined-sex in 2011. F&lt;sub&gt;MSY&lt;/sub&gt; proxy based on length-based Y/R -</td>
</tr>
<tr>
<td>Precautionary Approach</td>
<td>Not defined.</td>
<td>(unchanged since: 2011)</td>
</tr>
</tbody>
</table>

Harvest rate reference points (2011):

<table>
<thead>
<tr>
<th>F&lt;sub&gt;max&lt;/sub&gt;</th>
<th>Male</th>
<th>Female</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.7%</td>
<td>26.7%</td>
<td>16.3%</td>
</tr>
<tr>
<td>F&lt;sub&gt;0.1&lt;/sub&gt;</td>
<td>7.7%</td>
<td>15.2%</td>
<td>9.4%</td>
</tr>
<tr>
<td>F&lt;sub&gt;35%&lt;/sub&gt;</td>
<td>9.4%</td>
<td>18.3%</td>
<td>12.7%</td>
</tr>
</tbody>
</table>

For this FU, the absolute density observed on the UWTV survey is relatively high (average of ~ 0.8 burrows m<sup>-2</sup>). A long time-series of relatively stable landings (average reported landings ~ 2000 tonnes), well above those predicted by currently fishing at F<sub>max</sub> while the stock abundance has been stable, suggest a productive stock. It is suggested that F<sub>max</sub> for combined sexes is chosen as the F<sub>MSY</sub> proxy.

The F<sub>MSY</sub> proxy harvest rate values were updated in 2011 on the basis of per-recruit analysis, based on input parameters from a combined-sex length cohort analysis of 2008–2010 catch-at-length data. Previous analysis used 2005, 2006, and preliminary 2007 data, which showed greater discard rates than those observed recently.

Outlook for 2014


<table>
<thead>
<tr>
<th>Basis</th>
<th>Total Catches*</th>
<th>Landings</th>
<th>Dead Discards**</th>
<th>Surviving Discards**</th>
<th>Harvest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L+DD+SD</td>
<td>L</td>
<td>DD</td>
<td>SD</td>
<td>for L+DD</td>
</tr>
<tr>
<td>F&lt;sub&gt;MSY&lt;/sub&gt;</td>
<td>1605</td>
<td>1381</td>
<td>168</td>
<td>56</td>
<td>16.3%</td>
</tr>
<tr>
<td>MSY transition</td>
<td>1646</td>
<td>1417</td>
<td>172</td>
<td>57</td>
<td>16.7%</td>
</tr>
<tr>
<td>F&lt;sub&gt;2010-2012&lt;/sub&gt;</td>
<td>2137</td>
<td>1840</td>
<td>223</td>
<td>74</td>
<td>21.7%</td>
</tr>
<tr>
<td></td>
<td>2463</td>
<td>2120</td>
<td>257</td>
<td>86</td>
<td>25.0%</td>
</tr>
</tbody>
</table>

* Total catches are the landings including dead and surviving discards
** Total discard rate is assumed to be 25.3% of the catches (in number, last 3 years average, 2010-2012), discard survival is assumed 25% (ICES, 2009).

**MSY approach**

To follow the ICES MSY approach the harvest rate should be reduced to 16.3%, corresponding to maximum landings of 1381 t in 2014.

To follow the transition scheme towards the ICES MSY – approach, the harvest rate should be reduced to 16.7% (0.2* F<sub>2010</sub>+ 0.8* F<sub>MSY</sub>), corresponding to landings of no more than 1417 t in 2013 (where F<sub>2010</sub> is the observed harvest rate.
in 2010 (18.4%). If discards rates do not change from the ratio in 2012, assuming 25% discard survival), this implies total catches of no more than 1646 t.

**Additional considerations**

*Factors affecting the fisheries and the stock*

Landings from the Firth of Forth fishery are predominantly reported from Scotland, with very small contributions from England. The area is periodically visited by vessels from other parts of the UK. The Firth of Forth is close inshore and is of small geographic size so that any significant increase of effort could rapidly lead to overexploitation.

Catches of marketable bycatch fish are small from this area and there are few other species in the area for vessels to target.

Estimated discarding rates of *Nephrops* are 27% by number in the Firth of Forth in 2012. This arises from the use of mainly small-meshed (80 mm) nets and the population size structure, which appears to arise from slower growth. Local markets for small whole *Nephrops* are seasonally important.

*The effects of regulations*

The minimum landing size for *Nephrops* in the North Sea is 25 mm carapace length. The apparent small size of *Nephrops* in this area results in higher discard rates than in some other areas around Scotland.

*Changes in fishing technology and fishing patterns*

The Firth of Forth resident fleet contains numerous small boats which are generally restricted to more sheltered inshore waters. There are, however, observations of shifts of *Nephrops* fishing by larger vessels from the fleet to grounds such as the Devil’s Hole (FU 34).

*Information from the fishing industry*

The Fishers’ North Sea stock survey (Figure 6.4.15.2) does not include specific information for the Firth of Forth. Area 3 covers the Moray Firth, Firth of Forth and areas of the Devil’s Hole. The 2012 report shows a decrease in abundance since 2008 which matches the UWTV survey results.

*Uncertainties in assessment and forecast*

General comments are found at the beginning of Section 6.4.15.

*Comparison with previous assessment and advice*

The perception of the state of the stock in earlier years has not changed – assessments are based on direct observations.

The advice given for 2014 is based on the MSY transition scheme (as the advice given for 2013).
Figure 6.4.15.4.2 *Nephrops* in Firth of Forth (FU 8). Catch length–frequency distribution and mean sizes in the catch and landings. Vertical lines are minimum landing size (25 mm) and 35 mm.
Table 6.4.15.4.1  
*Nephrops* in Firth of Forth (FU 8). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice Firth of Forth (FU 8)</th>
<th>Recommended landings FUs 6 and 8</th>
<th>ICES landings FU 8&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td></td>
<td>~4.6</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td>4.17</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td>4.17</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td>4.17</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td>4.17</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>4.17</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td>4.17</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td>4.17</td>
<td>2.2</td>
<td></td>
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<tr>
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<td>4.17</td>
<td>1.8</td>
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</tr>
<tr>
<td>2001</td>
<td></td>
<td>4.17</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td>4.17</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>2003</td>
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<td>1.1</td>
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</tr>
<tr>
<td>2004</td>
<td></td>
<td>4.17</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>4.17</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>No increase in effort</td>
<td>-</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>No increase in effort, harvest rate &lt;15%</td>
<td>1.5</td>
<td>5.0</td>
<td>2.6</td>
</tr>
<tr>
<td>2008</td>
<td>No new advice, same as for 2007</td>
<td>1.5</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2009</td>
<td>No increase in effort and recent average landings</td>
<td>&lt; 2.5</td>
<td>2.4</td>
<td>2.7</td>
</tr>
<tr>
<td>2010</td>
<td>Harvest rate no greater than that equivalent to fishing at $F_{\text{max}}$</td>
<td>&lt; 1.6</td>
<td>&lt; 1.6&lt;sup&gt;2)&lt;/sup&gt;</td>
<td>1.9</td>
</tr>
<tr>
<td>2011</td>
<td>MSY transition</td>
<td>&lt; 2.0</td>
<td>&lt; 2.0&lt;sup&gt;2)&lt;/sup&gt;</td>
<td>1.9</td>
</tr>
<tr>
<td>2012</td>
<td>MSY transition</td>
<td>&lt; 1.7</td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>2013</td>
<td>MSY transition</td>
<td>&lt; 1.4</td>
<td></td>
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<tr>
<td>2014</td>
<td>MSY transition</td>
<td>&lt; 1.417</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Weights in thousand tonnes.

<sup>1)</sup> Does not include discards.

<sup>2)</sup> It is not advised to manage these stocks as a single unit.
Table 6.4.15.4.2  
*Nephrops* in Firth of Forth (FU 8). Nominal landings (tonnes) of *Nephrops*, as reported to ICES.

<table>
<thead>
<tr>
<th>Year</th>
<th>UK Scotland</th>
<th></th>
<th></th>
<th>UK (E, W &amp; NI)</th>
<th>Total **</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nephrops trawl</td>
<td>Other trawl</td>
<td>Creel</td>
<td>Sub-total</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>945</td>
<td>61</td>
<td>0</td>
<td>1006</td>
<td>1006</td>
</tr>
<tr>
<td>1982</td>
<td>1138</td>
<td>57</td>
<td>0</td>
<td>1195</td>
<td>1195</td>
</tr>
<tr>
<td>1983</td>
<td>1681</td>
<td>43</td>
<td>0</td>
<td>1724</td>
<td>1724</td>
</tr>
<tr>
<td>1984</td>
<td>2078</td>
<td>56</td>
<td>0</td>
<td>2134</td>
<td>2134</td>
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<td>1985</td>
<td>1908</td>
<td>61</td>
<td>0</td>
<td>1969</td>
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<td>1930</td>
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<td>2349</td>
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<td>0</td>
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<td>2369</td>
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<td>1994</td>
<td>1827</td>
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<td>0</td>
<td>1844</td>
<td>1850</td>
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<tr>
<td>1995</td>
<td>1708</td>
<td>53</td>
<td>0</td>
<td>1761</td>
<td>1763</td>
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<td>1621</td>
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<td>2194</td>
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<td>1998</td>
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<td>2143</td>
<td>2145</td>
</tr>
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<td>1999</td>
<td>2192</td>
<td>9</td>
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</tr>
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<td>2006</td>
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<td>4</td>
<td>12</td>
<td>2453</td>
<td>2458</td>
</tr>
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<td>2628</td>
<td>9</td>
<td>8</td>
<td>2645</td>
<td>2652</td>
</tr>
<tr>
<td>2008</td>
<td>2435</td>
<td>3</td>
<td>7</td>
<td>2445</td>
<td>2450</td>
</tr>
<tr>
<td>2009</td>
<td>2626</td>
<td>1</td>
<td>26</td>
<td>2653</td>
<td>2662</td>
</tr>
<tr>
<td>2010</td>
<td>1848</td>
<td>3</td>
<td>12</td>
<td>1862</td>
<td>1871</td>
</tr>
<tr>
<td>2011</td>
<td>1793</td>
<td>1</td>
<td>89</td>
<td>1883</td>
<td>1888</td>
</tr>
<tr>
<td>2012*</td>
<td>1918</td>
<td>7</td>
<td>124</td>
<td>2049</td>
<td>2091</td>
</tr>
</tbody>
</table>

* provisional  na = not available  
** There are no landings by other countries from this FU  
*** 4 trawl gears in 2011; also includes 5 t other gears
**Table 6.4.15.4.3**  
*Nephrops* in Firth of Forth (FU 8): Results of the TV surveys (abundance and confidence interval).

<table>
<thead>
<tr>
<th>Year</th>
<th>Stations</th>
<th>Mean Density</th>
<th>Abundance</th>
<th>95% conf interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>burrows/m²</td>
<td>millions</td>
<td>millions</td>
</tr>
<tr>
<td>1993</td>
<td>37</td>
<td>0.61</td>
<td>555</td>
<td>142</td>
</tr>
<tr>
<td>1994</td>
<td>30</td>
<td>0.49</td>
<td>448</td>
<td>78</td>
</tr>
<tr>
<td>1995</td>
<td>no survey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>27</td>
<td>0.41</td>
<td>375</td>
<td>88</td>
</tr>
<tr>
<td>1997</td>
<td>no survey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>32</td>
<td>0.32</td>
<td>292</td>
<td>81</td>
</tr>
<tr>
<td>1999</td>
<td>49</td>
<td>0.51</td>
<td>463</td>
<td>78</td>
</tr>
<tr>
<td>2000</td>
<td>53</td>
<td>0.48</td>
<td>443</td>
<td>70</td>
</tr>
<tr>
<td>2001</td>
<td>46</td>
<td>0.46</td>
<td>419</td>
<td>79</td>
</tr>
<tr>
<td>2002</td>
<td>41</td>
<td>0.56</td>
<td>508</td>
<td>119</td>
</tr>
<tr>
<td>2003</td>
<td>36</td>
<td>0.84</td>
<td>767</td>
<td>138</td>
</tr>
<tr>
<td>2004</td>
<td>37</td>
<td>0.69</td>
<td>630</td>
<td>141</td>
</tr>
<tr>
<td>2005</td>
<td>54</td>
<td>0.78</td>
<td>710</td>
<td>143</td>
</tr>
<tr>
<td>2006</td>
<td>43</td>
<td>0.91</td>
<td>827</td>
<td>125</td>
</tr>
<tr>
<td>2007</td>
<td>49</td>
<td>0.76</td>
<td>692</td>
<td>132</td>
</tr>
<tr>
<td>2008</td>
<td>38</td>
<td>0.97</td>
<td>881</td>
<td>297</td>
</tr>
<tr>
<td>2009</td>
<td>45</td>
<td>0.80</td>
<td>732</td>
<td>142</td>
</tr>
<tr>
<td>2010</td>
<td>39</td>
<td>0.75</td>
<td>681</td>
<td>147</td>
</tr>
<tr>
<td>2011</td>
<td>45</td>
<td>0.58</td>
<td>533</td>
<td>87</td>
</tr>
<tr>
<td>2012</td>
<td>66</td>
<td>0.57</td>
<td>522</td>
<td>64</td>
</tr>
</tbody>
</table>

**Table 6.4.15.4.4**  
*Nephrops* in Firth of Forth (FU 8): Adjusted TV survey abundance, landings, total discard rate (proportion by number), dead discard rate (by number), and estimated harvest rate.

<table>
<thead>
<tr>
<th>Year</th>
<th>Adjusted abundance (millions)</th>
<th>Landings (tonnes)</th>
<th>Discard rate</th>
<th>Dead discard rate</th>
<th>Harvest ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>767</td>
<td>1126</td>
<td>0.54</td>
<td>0.47</td>
<td>0.123</td>
</tr>
<tr>
<td>2004</td>
<td>630</td>
<td>1658</td>
<td>0.35</td>
<td>0.29</td>
<td>0.164</td>
</tr>
<tr>
<td>2005</td>
<td>710</td>
<td>1990</td>
<td>0.42</td>
<td>0.35</td>
<td>0.194</td>
</tr>
<tr>
<td>2006</td>
<td>827</td>
<td>2458</td>
<td>0.55</td>
<td>0.48</td>
<td>0.267</td>
</tr>
<tr>
<td>2007</td>
<td>692</td>
<td>2652</td>
<td>0.25</td>
<td>0.2</td>
<td>0.229</td>
</tr>
<tr>
<td>2008</td>
<td>881</td>
<td>2450</td>
<td>0.29</td>
<td>0.24</td>
<td>0.211</td>
</tr>
<tr>
<td>2009</td>
<td>732</td>
<td>2662</td>
<td>0.34</td>
<td>0.28</td>
<td>0.26</td>
</tr>
<tr>
<td>2010</td>
<td>682</td>
<td>1871</td>
<td>0.3</td>
<td>0.24</td>
<td>0.184</td>
</tr>
<tr>
<td>2011</td>
<td>533</td>
<td>1888</td>
<td>0.19</td>
<td>0.15</td>
<td>0.221</td>
</tr>
<tr>
<td>2012</td>
<td>522</td>
<td>2091</td>
<td>0.27</td>
<td>0.22</td>
<td>0.246</td>
</tr>
</tbody>
</table>
ECOREGION     North Sea
STOCK         *Nephrops* in Moray Firth (FU 9)

Advice for 2014

ICES advises on the basis of the MSY approach that landings in 2014 should be no more than 739 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 796 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

**Stock status**

<table>
<thead>
<tr>
<th></th>
<th>F (Fishing Mortality)</th>
<th>SSB (Spawning-Stock Biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY (F_{MSY})</td>
<td>✔ ✔ X ✔ ✔</td>
<td>X X X X ✔</td>
</tr>
<tr>
<td>MSY (B_{trigger})</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
</tr>
</tbody>
</table>

**Figure 6.4.15.5.1** *Nephrops* in Moray Firth (FU 9). Long-term trends in landings, harvest rate, and UWTV abundance (used as F and SSB proxies; weights in thousand tonnes and UWTV in millions). Dashed green lines show proxies for F_{MSY} and MSY B_{trigger}. Harvest rates before 2007 may be unreliable due to underreporting of landings.

The stock is declining but remains just above MSY B_{trigger}. The harvest rate was above F_{MSY} in 2011 and decreased in 2012, although it is still above F_{msy}.

**Management plans**

No specific management objectives are known to ICES.
Biology

See Section 6.4.15 for general comments.

The fisheries

The Moray Firth *Nephrops* fishery is essentially a Scottish fishery, with only occasional landings made by vessels from elsewhere in the UK. Vessels typically conduct day trips from the nearby ports along the Moray Firth coast. Occasionally larger vessels fish the outer Moray Firth grounds on their way to/from the Fladen or in times of poor weather.

**Catch distribution**

Total catch (2012) = 860 t, where 93% are landings taken in demersal trawl fisheries, either in a directed *Nephrops* or a mixed *Nephrops*/demersal fishery, and 7% are discards in weight.

Quality considerations

See Section 6.4.15 for general comments.

Scientific basis

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwater TV survey linked to yield-per-recruit analysis from length data.</td>
<td></td>
</tr>
<tr>
<td>Commercial catches (international landings, length frequencies from Scottish catch sampling), One survey index (UWT-TV-Alba na mara-August); Maturity data from (commercial catch surveys), Natural mortalities from Morizur (1982).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discards and bycatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discards included in the assessment since 1990, from Scottish trawls (TR1 and TR2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size structure information; mean size; lpue.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latest benchmark was performed in 2009.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working group report</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGNSSK (ICES, 2013a)</td>
</tr>
</tbody>
</table>
6.4.15.5 Supporting information June 2013

ECOREGION North Sea
STOCK Nephrops in Moray Firth (FU 9)

Reference points

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
<th>Technical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY Approach</td>
<td>MSY B_{trigger}</td>
<td>Bias-adjusted lowest observed UWTV survey estimate of abundance (1997).</td>
</tr>
<tr>
<td>F_{MSY}</td>
<td>Harvest rate 11.8%</td>
<td>Proxy, equivalent to F_{35%SPR} combined sex in 2011. F_{MSY} proxy based on length-based Y/R.</td>
</tr>
<tr>
<td>Precautionary</td>
<td>Not defined.</td>
<td></td>
</tr>
</tbody>
</table>

(unchanged since: 2011)

Harvest rate reference points (2011):

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_{max}</td>
<td>12.3%</td>
<td>23.8%</td>
<td>14.9%</td>
</tr>
<tr>
<td>F_{35%}</td>
<td>7.2%</td>
<td>11.6%</td>
<td>7.8%</td>
</tr>
<tr>
<td>F_{MSY}</td>
<td>9.1%</td>
<td>17.1%</td>
<td>11.8%</td>
</tr>
</tbody>
</table>

Moderate absolute densities are generally observed on the UWTV survey of this FU. Although variable, harvest ratios (which are likely to have been underestimated prior to 2006) appear to have been around or above F_{35\%SPR}, and in addition there is a long time-series of relatively stable landings (average reported landings ~ 1500 tonnes, above those predicted by currently fishing at F_{35\%SPR}). It is suggested that F_{35\%SPR(combined)} is chosen as the F_{MSY} proxy.

The F_{MSY} proxy harvest rate values were updated in 2011 on the basis of per-recruit analysis, based on input parameters from a combined-sex length cohort analysis of 2008–2010 catch-at-length data. Previous analysis used 2005, 2006, and preliminary 2007 data.

Outlook for 2014

Basis: F_{2010-2012}=average harvest rate of 2010–2012 = 14.6% (based on average (F_{2010} to F_{2012}); Survey abundance (2012) = 299 million; Mean weight in landings (2010–2012) = 23.91 g; Discard rate (dead, by number) = 12.3% (average 2010–2012); Mean weight in discards (2010–2012) = 9.95 g..

<table>
<thead>
<tr>
<th>Basis</th>
<th>Total Catches*</th>
<th>Landings</th>
<th>Dead Discards**</th>
<th>Surviving Discards**</th>
<th>Harvest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L+DD+SD</td>
<td>L</td>
<td>DD</td>
<td>SD</td>
<td>for L+DD</td>
</tr>
<tr>
<td></td>
<td>337</td>
<td>313</td>
<td>18</td>
<td>6</td>
<td>5.0%</td>
</tr>
<tr>
<td></td>
<td>507</td>
<td>470</td>
<td>28</td>
<td>9</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>676</td>
<td>627</td>
<td>37</td>
<td>12</td>
<td>10.0%</td>
</tr>
<tr>
<td>F_{MSY}</td>
<td>796</td>
<td>739</td>
<td>43</td>
<td>14</td>
<td>11.8%</td>
</tr>
<tr>
<td></td>
<td>844</td>
<td>783</td>
<td>46</td>
<td>15</td>
<td>12.5%</td>
</tr>
<tr>
<td>F_{2010-2012}</td>
<td>987</td>
<td>915</td>
<td>54</td>
<td>18</td>
<td>14.6%</td>
</tr>
<tr>
<td></td>
<td>1013</td>
<td>940</td>
<td>55</td>
<td>18</td>
<td>15.0%</td>
</tr>
<tr>
<td></td>
<td>1350</td>
<td>1253</td>
<td>73</td>
<td>24</td>
<td>20.0%</td>
</tr>
</tbody>
</table>

Weights in tonnes
* Total catches are the landings including dead and surviving discards
** Total discard rate is assumed to be 15.7% of the catches (in number, last 3 years average, 2010-2012), discard survival is assumed 25% (ICES, 2009).

MSY approach

Following the ICES MSY approach implies the harvest rate should be less than 11.8%, resulting in landings of less than 739 t in 2014. If discards rates do not change from the average of the last 3 years (2010–2012, assuming 25% discard survival), this implies total catches of no more than 796 t.
Additional considerations

See Section 6.4.15 for general comments.

Changes in fishing technology and fishing patterns

Discarding rates averaged over the period 2006–2012 for this stock were about 10% by number. This represents a reduction in discarding rate compared to the average for the period 2000–2005. This may arise from the increasing use of larger mesh sizes in the northern North Sea, although reduction in recruitment may also account for this change.

Information from the fishing industry

The Fishers’ North Sea stock survey (Figure 6.4.15.2) does not include specific information for the Moray Firth. Area 3 covers covers the Moray Firth, Firth of Forth and areas of the Devil’s Hole. The 2012 report shows a decrease in abundance since 2008 which matches the UWTV survey results.

Comparison with previous assessment and advice

The historical abundance is not revised from one year to the next because abundances are based on direct observation.

The basis for the advice is the same as last year: the MSY approach.

![Length frequencies for catch (dotted) and landed (solid): Nephrops in FU 9](image)

**Figure 6.4.15.5.2** Nephrops in Moray Firth (FU 9). Catch length–frequency distribution and mean size in catches and landings. Vertical lines are minimum landing size (25 mm) and 35 mm.
Table 6.4.15.5.1  *Nephrops* in Moray Firth (FU 9). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice Moray Firth (FU 9)</th>
<th>Recommended landings FUs 9 and 10</th>
<th>ICES landings FU 9&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>~2.4</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>2.4</td>
<td>2.4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>2.4</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>2.4</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Status quo TAC</td>
<td>2.4</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Status quo TAC</td>
<td>2.4</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>2.4</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>2.4</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>2.4</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>1.85</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>No increase in effort</td>
<td>-</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>No increase in effort, and harvest rate below 15%</td>
<td>2.4</td>
<td>2.64</td>
<td>1.8</td>
</tr>
<tr>
<td>2008</td>
<td>No new advice, same as for 2007</td>
<td>2.4</td>
<td>2.64</td>
<td>1.5</td>
</tr>
<tr>
<td>2009</td>
<td>No increase in effort and recent average landings</td>
<td>&lt;1.8</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Harvest Rate no greater than that equivalent to fishing at F&lt;sub&gt;2008&lt;/sub&gt;</td>
<td>&lt;1.4</td>
<td>--&lt;sup&gt;2)&lt;/sup&gt;</td>
<td>1.0</td>
</tr>
<tr>
<td>2011</td>
<td>MSY transition</td>
<td>&lt;1.3</td>
<td>--&lt;sup&gt;2)&lt;/sup&gt;</td>
<td>1.4</td>
</tr>
<tr>
<td>2012</td>
<td>MSY approach</td>
<td>&lt;1.1</td>
<td>&lt;1.0</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>MSY approach</td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>MSY approach</td>
<td>&lt;0.739</td>
<td>&lt;1.0</td>
<td></td>
</tr>
</tbody>
</table>

Weights in thousand tonnes.

<sup>1)</sup> Does not include discards.

<sup>2)</sup> It is not advised to manage these stocks as a single unit.
Table 6.4.15.5.2  *Nephrops* in Moray Firth (FU 9). Nominal landings (tonnes) of *Nephrops*, as reported to ICES.

<table>
<thead>
<tr>
<th>Year</th>
<th>UK Scotland</th>
<th></th>
<th>UK England</th>
<th>Total *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nephrops trawl</td>
<td>Other trawl</td>
<td>Creel</td>
<td>Sub-total</td>
</tr>
<tr>
<td>1981</td>
<td>1298</td>
<td>118</td>
<td>0</td>
<td>1416</td>
</tr>
<tr>
<td>1982</td>
<td>1034</td>
<td>86</td>
<td>0</td>
<td>1120</td>
</tr>
<tr>
<td>1983</td>
<td>850</td>
<td>90</td>
<td>0</td>
<td>940</td>
</tr>
<tr>
<td>1984</td>
<td>960</td>
<td>210</td>
<td>0</td>
<td>1170</td>
</tr>
<tr>
<td>1985</td>
<td>1908</td>
<td>173</td>
<td>0</td>
<td>2081</td>
</tr>
<tr>
<td>1986</td>
<td>1933</td>
<td>210</td>
<td>0</td>
<td>2143</td>
</tr>
<tr>
<td>1987</td>
<td>1723</td>
<td>268</td>
<td>0</td>
<td>1991</td>
</tr>
<tr>
<td>1988</td>
<td>1638</td>
<td>321</td>
<td>0</td>
<td>1959</td>
</tr>
<tr>
<td>1989</td>
<td>2101</td>
<td>475</td>
<td>0</td>
<td>2576</td>
</tr>
<tr>
<td>1990</td>
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<td>1118</td>
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<td>103</td>
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<td>1042</td>
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<td>18</td>
<td>9</td>
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<tr>
<td>2012</td>
<td>832</td>
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<td>8</td>
<td>860</td>
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* No landings by non UK countries from this FU
Table 6.4.15.3  
*Nephrops* in Moray Firth (FU 9): Results of the 1993–2012 UWTV surveys.

<table>
<thead>
<tr>
<th>Year</th>
<th>Stations</th>
<th>Mean density burrows/m²</th>
<th>Abundance millions</th>
<th>95% confidence interval millions</th>
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<tbody>
<tr>
<td>1993</td>
<td>31</td>
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<td>0.16</td>
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<td>1994</td>
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<td>0.32</td>
<td>702</td>
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<tr>
<td>1995</td>
<td>no survey</td>
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<tr>
<td>1996</td>
<td>27</td>
<td>0.21</td>
<td>0.21</td>
<td>465</td>
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<tr>
<td>1997</td>
<td>34</td>
<td>0.12</td>
<td>0.12</td>
<td>262</td>
</tr>
<tr>
<td>1998</td>
<td>31</td>
<td>0.15</td>
<td>0.15</td>
<td>323</td>
</tr>
<tr>
<td>1999</td>
<td>52</td>
<td>0.18</td>
<td>0.18</td>
<td>400</td>
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<td>2000</td>
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<td>0.17</td>
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<tr>
<td>2001</td>
<td>45</td>
<td>0.16</td>
<td>0.16</td>
<td>345</td>
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<tr>
<td>2002</td>
<td>31</td>
<td>0.24</td>
<td>0.24</td>
<td>521</td>
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<tr>
<td>2003</td>
<td>32</td>
<td>0.33</td>
<td>0.33</td>
<td>730</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
<td>0.29</td>
<td>0.29</td>
<td>626</td>
</tr>
<tr>
<td>2005</td>
<td>42</td>
<td>0.40</td>
<td>0.40</td>
<td>869</td>
</tr>
<tr>
<td>2006</td>
<td>50</td>
<td>0.21</td>
<td>0.21</td>
<td>445</td>
</tr>
<tr>
<td>2007</td>
<td>40</td>
<td>0.24</td>
<td>0.24</td>
<td>531</td>
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<tr>
<td>2008</td>
<td>45</td>
<td>0.21</td>
<td>0.21</td>
<td>479</td>
</tr>
<tr>
<td>2009</td>
<td>50</td>
<td>0.19</td>
<td>0.19</td>
<td>415</td>
</tr>
<tr>
<td>2010</td>
<td>43</td>
<td>0.18</td>
<td>0.18</td>
<td>406</td>
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<td>2011</td>
<td>37</td>
<td>0.17</td>
<td>0.17</td>
<td>373</td>
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<tr>
<td>2012</td>
<td>44</td>
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<td>298</td>
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</table>

Table 6.4.15.4  
*Nephrops* in Moray Firth (FU 9): UWTV survey abundance, landings, total discard rate (proportion by number), dead discard rate (by number), and estimated harvest rate.

<table>
<thead>
<tr>
<th></th>
<th>Adjusted abundance (millions)</th>
<th>Landings (tonnes)</th>
<th>Discard rate</th>
<th>Dead discard rate</th>
<th>Harvest ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>730</td>
<td>1079</td>
<td>0.14</td>
<td>0.11</td>
<td>0.07</td>
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<tr>
<td>2004</td>
<td>626</td>
<td>1335</td>
<td>0.33</td>
<td>0.27</td>
<td>0.11</td>
</tr>
<tr>
<td>2005</td>
<td>869</td>
<td>1605</td>
<td>0.15</td>
<td>0.12</td>
<td>0.09</td>
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<tr>
<td>2006</td>
<td>445</td>
<td>1803</td>
<td>0.13</td>
<td>0.1</td>
<td>0.2</td>
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<td>2007</td>
<td>531</td>
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<td>0.06</td>
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<tr>
<td>2008</td>
<td>481</td>
<td>1514</td>
<td>0.11</td>
<td>0.09</td>
<td>0.14</td>
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<td>415</td>
<td>1067</td>
<td>0.08</td>
<td>0.06</td>
<td>0.12</td>
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<td>2010</td>
<td>406</td>
<td>1032</td>
<td>0.2</td>
<td>0.16</td>
<td>0.11</td>
</tr>
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<td>2011</td>
<td>372</td>
<td>1391</td>
<td>0.14</td>
<td>0.11</td>
<td>0.19</td>
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<tr>
<td>2012</td>
<td>299</td>
<td>860</td>
<td>0.13</td>
<td>0.1</td>
<td>0.137</td>
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</table>
6.4.15.6 Advice June 2013

ECOREGION North Sea
STOCK Nephrops in Noup (FU 10)

Advice for 2014

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 50 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Scientific basis

| Assessment type | Data-limited approach for Nephrops (category 4.1.4). |
| Input data | Habitat extent, mean size, occasional UWTV surveys (incomplete time-series 1994, 1999, 2006, 2007). Commercial catches not included in the assessment but available for monitoring (international landings, length frequencies from Scottish catch sampling) |
| Discards and bycatch | No discard information available. |
| Indicators | Size structure information; lpue. |
| Other information | Latest benchmark was performed in 2013 (ICES, 2013c). |
| Working group report | WGNSSK (ICES, 2013a) |

Sources


Table 6.4.15.6.1 Nephrops in Noup (FU 10). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice FU 10</th>
<th>Recommended landings FUs 9 and 10</th>
<th>ICES landings (^1)</th>
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<td></td>
<td>0.19</td>
<td></td>
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<td></td>
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<tr>
<td>1994</td>
<td>2.4</td>
<td></td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>2.4</td>
<td></td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Status quo TAC</td>
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<td></td>
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<td>0.25</td>
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<td>2001</td>
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<td></td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>0.40</td>
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<tr>
<td>2003</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>0.34</td>
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<tr>
<td>2004</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>0.23</td>
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<tr>
<td>2005</td>
<td>Catches to be maintained at the 2000 level</td>
<td>2.0</td>
<td>0.17</td>
<td></td>
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<tr>
<td>2006</td>
<td>No increase in effort</td>
<td>-</td>
<td>0.13</td>
<td></td>
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<tr>
<td>2007</td>
<td>No increase in effort, and recent average landings</td>
<td>0.24</td>
<td>2.64  (^2)</td>
<td>0.16</td>
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<tr>
<td>2008</td>
<td>No new advice, same as for 2007</td>
<td>0.24</td>
<td>2.64 (^2)</td>
<td>0.17</td>
</tr>
<tr>
<td>2009</td>
<td>No increase in effort, and average landings 2003–2005</td>
<td>&lt;0.24</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>No new advice, same as for 2009</td>
<td>&lt;0.24</td>
<td>0.04</td>
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<tr>
<td>2011</td>
<td>No advice</td>
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<td>2012</td>
<td>Reduce catch</td>
<td>-</td>
<td>0.01</td>
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<tr>
<td>2013</td>
<td>20% Reduction in landings (last 3 years’ average)</td>
<td>&lt;0.05</td>
<td>0.05</td>
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<tr>
<td>2014</td>
<td>No new advice, same as 2013</td>
<td>&lt;0.05</td>
<td>0.05</td>
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</table>

Weights in thousand tonnes.

\(^1\) Does not include discards.

\(^2\) Based on a 15% harvest rate applied to TV survey abundance data. Includes Moray Firth (FU 9).
ECOREGION    North Sea
STOCK        Nephrops in the Norwegian Deep (FU 32)

Advice for 2014

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 800 tonnes.

For the stock in this functional unit (FU), management is implemented at the functional unit level.

Scientific basis

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<th>Assessment type</th>
<th>Data-limited approach for Nephrops (category 4.1.4).</th>
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<td>Input data</td>
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<td>One commercial index (Danish lpue)</td>
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<td>Discards and bycatch</td>
<td>Discards not included in the assessment but available for monitoring (Danish)</td>
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<td>Indicators</td>
<td>Danish commercial lpue.</td>
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<td>Other information</td>
<td>Benchmark in 2013 (ICES, 2013c).</td>
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<td>Working group report</td>
<td>WGNSSK (ICES, 2013a)</td>
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Sources


Table 6.4.15.7.1  Nephrops in the Norwegian Deep (FU 32). ICES advice, management, and landings.

<table>
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<th>ICES advice</th>
<th>Predicted landings corresp. to advice</th>
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<td>No increase in effort</td>
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<td>2009</td>
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<td>0.3</td>
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<td>2013</td>
<td>Average landings (last 10 years)</td>
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<td>No new advice, same as 2013</td>
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<td>0.8</td>
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</table>

Weights in thousand tonnes.

1) EU TAC for Norwegian zone of Subarea IV.
ECOREGION North Sea
STOCK *Nephrops* off Horn’s Reef (FU 33)

Advice for 2014

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): *Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 1100 tonnes*.

*In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.*

Scientific basis

<table>
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<th>Assessment type</th>
<th>Input data</th>
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<tr>
<td>Data-limited approach for <em>Nephrops</em> (category 4.1.4).</td>
<td>Commercial catches (international landings, and length frequencies from catch sampling)</td>
</tr>
<tr>
<td>Discards and bycatch</td>
<td>Discards not included in the assessment</td>
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<tr>
<td>Indicators</td>
<td>Commercial lpue.</td>
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<tr>
<td>Other information</td>
<td>None.</td>
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<td>Working group report</td>
<td>WGNSSK (ICES, 2013a)</td>
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Sources


### 6.4.15.8.1

*Nephrops* off Horn’s Reef (FU 33). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice</th>
<th>ICES landings 1)</th>
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<td>1992</td>
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<td>2.38 2)</td>
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<td>See scenarios</td>
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<td>Reduce catches</td>
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<td>Average landings (last 10 years)</td>
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<tr>
<td>2014</td>
<td>No new advice, same as 2013</td>
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</tr>
</tbody>
</table>

Weights in thousand tonnes.

1) Does not include discards.

2) Includes Farn Deeps (FU 6).
ECOREGION  | North Sea
STOCK       | *Nephrops* in Devil’s Hole (FU 34)

**Advice for 2014**

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 600 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

**Scientific basis**

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Input data</th>
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<tr>
<td>Data-limited method for <em>Nephrops</em> (category 4.1.4).</td>
<td></td>
</tr>
<tr>
<td>Commercial catches (international landings, length frequencies from Scottish catch sampling 2006–2011), habitat extent, mean size, occasional UWTV surveys (incomplete time-series 2003, 2005, 2009–2012), one survey index (FU 34 UWTV)</td>
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<table>
<thead>
<tr>
<th>Discards and bycatch</th>
<th>Indicators</th>
<th>Other information</th>
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<td>Discards not included in the assessment but available for monitoring (Scottish TR1 and TR2 fleets (2009 and 2010))</td>
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<td>Size structure information; lpue.</td>
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<td>Latest benchmark was performed in 2013.</td>
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</table>

**Working group report**

WGNSSK (ICES, 2013a)

**Sources**


**Table 6.4.15.9.1**  *Nephrops* in Devil’s Hole (FU 34). ICES advice, management, and landings.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted landings corresp. to advice</th>
<th>ICES landings ¹</th>
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<td>2009</td>
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<td>2013</td>
<td>Average landings (last 10 yrs)</td>
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<tr>
<td>2014</td>
<td>No new advice, same as 2013</td>
<td>&lt; 0.6</td>
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</table>

Weights in thousand tonnes.

¹ Provisional international landings, only available from 2009. Does not include discards.