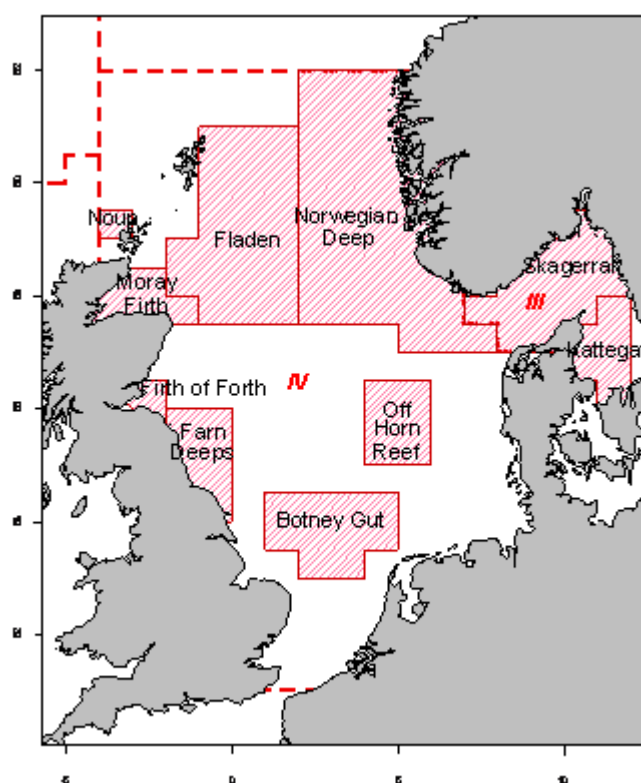


#### 6.4.14 *Nephrops* in Subarea IV (North Sea)

*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 eight separate functional units (Figure 6.4.14.1):

Section	FU no.	Name	ICES area	Statistical rectangles
6.4.14.1*	5	Botney Gut - Silver Pit	IVb,c	36-37 F1-F4; 35F2-F3
6.4.14.2	6	Farn Deep	IVb	38-40 E8-E9; 37E9
6.4.14.3	7	Fladen Ground	IVa	44-49 E9-F1; 45-46E8
6.4.14.4	8	Firth of Forth	IVb	40-41E7; 41E6
6.4.14.5	9	Moray Firth	IVa	44-45 E6-E7; 44E8
6.4.14.6*	10	Noup	IVa	47E6
6.4.14.7*	32	Norwegian Deep	IVa	44-52 F2-F6; 43F5-F7
6.4.14.8*	33	Off Horn Reef	IVb	39-41E4; 39-41E5

\* The advice for these stocks was given in biannual advice in 2008, see ICES (2008a).



**Figure 6.4.14.1** *Nephrops* Functional Units in the North Sea and Skagerrak/Kattegat region (see Section 6.4.13).

#### General features of *Nephrops* in IV.

An overview of advice for different functional units is presented in Table 6.4.14.1.

#### Management 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. 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 Deepes where increased vessel activity from other parts of the UK occurred resulting in low stock levels.

There are no precautionary reference points defined for *Nephrops*. This year ICES has provided advice on a range of catch options including a long term exploitation rate for *Nephrops* based on a number of considerations:

- For many stocks ICES considers that exploitation rates between  $F_{0.1}$  and  $F_{max}$  are an appropriate range of exploitation rates. For *Nephrops* both  $F_{0.1}$  and  $F_{max}$  are often well defined.
- There are a substantial number of studies on exploitation of fin fish indicating that  $F_{0.1}$  is consistent with maximising sustainable long term yield, though this has not been studied directly for *Nephrops* and further work is required to ascertain whether fishing at  $F_{0.1}$  is consistent with the management objective of maximising yield of *Nephrops*.  $F_{max}$  is often considered too high an exploitation rate, leading to increasing risk to SSB without any substantial increases in yield. In addition for stocks with high discard rates a reduction of harvest rates often reduces the rates of exploitation of smaller individuals allowing larger numbers for the fishery in subsequent years.
- A limited number of management simulations have been carried out (Dobby, 2007) on two of the FU in the NS showing that harvest ratios of close to  $F_{0.1}$  are appropriate for sustainable high long term yield with risks that ICES would consider precautionary. Ideally these simulations should be extended to other *Nephrops* FUs. The higher exploitation rates of the order of  $F_{max}$  have not been explicitly tested but its unlikely that they will provided the same stability of yield and will have higher risks. These simulations did not explicitly deal with surveys that had different selection patterns from the fishery, there may be increases in risk associated with this, reinforcing the greater applicability of the lower exploitation rates.
- For a number of FUs in the North Sea (and Celtic Seas) the recent catches have been substantially higher than the rates implied by  $F_{0.1}$ . In the case of Firth of Forth (FU8) these catches have been even higher than the rate implied by  $F_{max}$  but this coincided with an apparent increase in the stock in the last few years.

In light of the above considerations, ICES advises that  $F$  should be in the range of  $F_{0.1}$  to  $F_{max}$  to maximize long term average yield without unduly risking SSB. ICES advice for individual functional units takes account of the current estimate of  $F$  and trend in SSB as follows:

<b>F relative to <math>F_{0.1}</math> and <math>F_{max}</math></b>	<b>SSB Stable or Increasing</b>	<b>SSB Decreasing</b>
$F > F_{max}$	Reduce $F$ to $F_{max}$	Reduce $F$ to $F_{0.1}$
$F_{max} > F > F_{0.1}$	Maintain current $F$	Reduce $F$ to $F_{0.1}$
$F < F_{0.1}$	Increase $F$ to $F_{0.1}$	Maintain current $F$

Where the new advice suggests a large change in landings, a constraint on the year to year change in catches as is typical of management plans and the Communication on Fishing Opportunities for 2010 [COM (2009) 224] might be considered.

Some combinations of  $F$  and trend in SSB are included for completeness, even though not all of these combinations have been applied to North Sea *Nephrops*.

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 subject to high discard mortality. The capture of juvenile fish or other species such as 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.

The advice is presented separately for each Functional Unit. In addition, there are increasing and significant landings from some isolated patches outside the Functional Units, most notably the Devil's Hole area. Table 6.4.14.1 below shows that in 2008 overall landings in Subarea IV were around 22 100 tonnes, similar to landings in 2005. Landings from other rectangles have risen steadily and amounted to over 1 600 tonnes in 2008. To provide some guidance on appropriate future landings for these areas, the use of average landings of no more than 1500 tonnes (2006–2008) could be considered (Table 6.4.14.1).

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 Regulations and their effects below).

The high mud content and soft nature of *Nephrops* grounds means that trawling readily marks the seabed, 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 is likely to have resulted in reduced predation. Multi-species 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 may decrease when cod recovers.

## **Factors affecting the fisheries and the stock**

### *Regulations and their effects*

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 multi-trawl gears (3 or more trawls) for all Scottish boats was introduced from April 2008, limiting the expansion of effective effort.

Days-at-sea regulations and recently introduced effort allocation schemes (kW\*day) have reduced opportunities for directed whitefish fishing. STECF 2008 stated that the overall effort (kW\*days) by demersal trawls, seines and beam trawls shows a substantial reduction since 2002. However, there have also been substantial changes in the usage of the different mesh size categories by the demersal trawls. In particular there has been a sharp reduction in usage of gears with a mesh size of between 100mm and 119mm (targeting whitefish), and a subsequent general increase in effort by vessels using smaller mesh sizes (targeting *Nephrops* for instance) or larger (targeting whitefish).

The development of a Conservation Credits scheme in Scotland (the major contributor to landings from the Fladen Ground) requires all trawlers to implement more selective gears, including the use of 110 mm square mesh panels in 80 mm gear. This measure aims to reduce catches (and discards) of small fish, including whiting, haddock, and juvenile cod.

## **Scientific basis**

### *Data and methods*

Assessments of the *Nephrops* Functional Units of Subarea IV utilized a number of approaches, including Underwater UWTV surveys (UWTV) surveys, length composition information, and basic fishery data such as landings and effort. Owing to uncertainties in the accuracy of historic 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 analysis of length compositions, trends in mean length for recruit classes and commercial CPUE. Biennial advice for these stocks was given in 2008 so no new advice is given this year.

There have been 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) had 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, ICES 2009b). 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 UWTV surveys detect the burrows of *Nephrops* considerably smaller than the sizes of those 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  $F_{0.1}$  were in the range of 15-20% whereas the revised values from the benchmark in 2009 are in the range of 8-10%.

#### *Information from the fishing industry*

Trends according to the North Sea fishers' survey indicate disparate patterns of stock development. Long term increases in stock have been observed over most areas, but since 2007 the majority of areas show a small decline, except for Farn Deep (FU6) that shows a sharp decline (Figure 6.4.14.3).

#### *Uncertainties in assessment and forecast*

For moderate exploitation rates the UWTV assessment provides an adequate basis for predicting catches. ICES groups WKNephTV (ICES 2007), WKNephBid (ICES 2008b), SGNepS (ICES 2009a) have progressively 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.

The UWTV survey does not cover the complete spatial distribution of the stock, covering 4 out of 8 Functional Units and not the area outside the Functional Units. The area covered by the UWTV survey accounts for 79% of the landings in 2008. Landings from outside the FUs account for 8% of total landings. Vessel Monitoring System (VMS) data for vessels > 15 meters are being successfully used to match survey and fishery areas.

The calculations of harvest ratio and  $F_{0.1}$  are all based on yield-per-recruit analyses from length cohort analyses. These analyses utilise average length frequency data taken over a 3 year period and therefore apply to stocks in equilibrium. However, it is unlikely that the *Nephrops* stocks to which the approach has been applied are actually in equilibrium due to variable recruitment.  $F_{0.1}$  estimates may vary in time due to changes in selection pattern.

Prior to the implementation of "Buyers and Sellers" legislation in 2006 reporting rates are considered to have been low and hence the estimated Harvest Ratios prior to 2006 are also likely to have been underestimated. The reliability of fishery statistics is improving but the transition period is accompanied in some cases by large changes in landings which produce significant changes in the lpue and cpue series that cannot be completely attributed to changes in stock. Until a sufficient time series of reliable data has built up, use of fishery catch and effort data in the assessment process should be avoided.

#### *Comparison with previous assessment and advice*

For those stocks without UWTV surveys, advice given in 2008 was biennial and therefore no new advice is given this year.

The advice basis for stocks with UWTV surveys has fundamentally changed since 2008. In 2008, ICES considered the UWTV indices to show relative trends and not absolute abundance. Consequently the advice was given in terms of maintaining landings at or below recent levels..

#### **Sources of information**

ICES 2007. Workshop on the Use of UWTV Surveys for Determining Abundance in *Nephrops* Stocks throughout European Waters. WKNepHTV. ICES CM 2007/ACFM:14.

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ICES 2008b. Workshop and training course on *Nephrops* burrow identification (WKNepHBID). ICES CM 2008/LRC:03

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ICES 2009b. ICES. 2009. Report of the Benchmark Workshop on *Nephrops* (WKNepH), 2–6 March 2009, Aberdeen, UK. ICES CM 2009/ACOM:33. (awaiting publication).

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STECF – PLEN-08-03 – EUR 23624 EN, ISBN 978-79-10940-9, ISSN 1018-5593, DOI 10.2788/3484, 2008

**Table 6.4.14.1** *Nephrops* in Subarea IV. Summary of the advice by Functional Unit plus Other rectangles.

Year	Moray Firth (FU9)	Noup (FU10)	Fladen Ground (FU7)	Norwegian Deeps (FU32)	Farn Deeps (FU6)	Firth of Forth (FU8)	Botney Gut-Silver Pit (FU5)	Off Horn's Reef (FU33)	Other rectangles <sup>2)</sup>	Total advice <sup>5)</sup>	Agreed TAC <sup>1)</sup>	ICES landings
Mgt Area	MA F		MA G	MA S	MA I		MA H					
1992	~2.4		~2.7			~4.6		0.87		10.6	12.0	9.5
1993	2.4		2.7			4.17		0.87		10.2	12.0	12.7
1994	2.4		5.0			4.17		0.87		12.5	13.0	14.2
1995	2.4		5.0			4.17		0.87		12.5	15.2	14.7
1996	2.4		5.0			4.17		0.87		12.5	15.2	13.7
1997	2.4		5.0			4.17		0.87		12.5	15.2	15.2
1998	2.4		7.0			4.17		1.0		14.6	15.2	13.7
1999	2.4		7.0			4.17		1.0		14.6	15.2	16.5
2000	1.85		9.0			4.17		1.6		16.7	17.2	15.1
2001	1.85		9.0			4.17		1.6		16.7	15.48	15.9
2002	2.0		9.0	1.2		4.17		2.1		18.5	16.623	15.7
2003	2.0		9.0	1.2		4.17		2.1		18.5	16.623	15.6
2004	2.0		12.8	1.5		4.17		2.38		22.9	21.350	18.6
2005	2.0		<12.8	1.5		4.17		2.38		22.9	21.350	21.9
2006	-		-	NA		-		2.38		NA	28.147	24.4
2007	2.4	0.2	<10.9	NA	3.5	1.5	NA	NA	24.6 <sup>6)</sup>	NA	26.144	24.6
2008	2.4	0.2	<10.9	NA	3.5	1.5	NA	NA	9.5 <sup>6)</sup>	NA	26.144	22.1
2009	< 1.8	< 0.24	< 11.3	-- <sup>3)</sup>	< 3.0	< 2.5	-- <sup>3)</sup>	-- <sup>3)</sup>	< 1.4	NA	24.837	
2010	<1.37	< 0.24 <sup>4)</sup>	<16.4	-- <sup>4)</sup>	<1.2	<1.57	-- <sup>4)</sup>	-- <sup>4)</sup>	< 1.5	NA		

Weights in '000 t.

<sup>1)</sup> EU zone of Division IIa and Subarea IV.

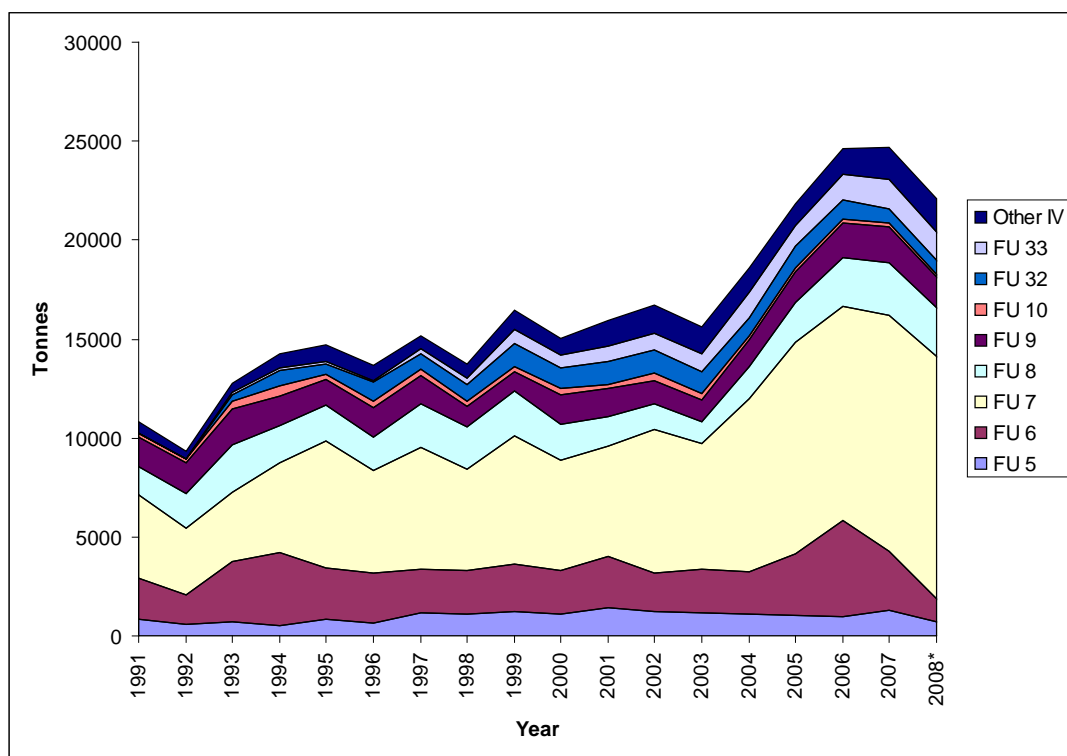
<sup>2)</sup> Prior to advice for 2009, landings for other rectangles were included in 'Management Areas (MA)'.

<sup>3)</sup> No increase in effort.

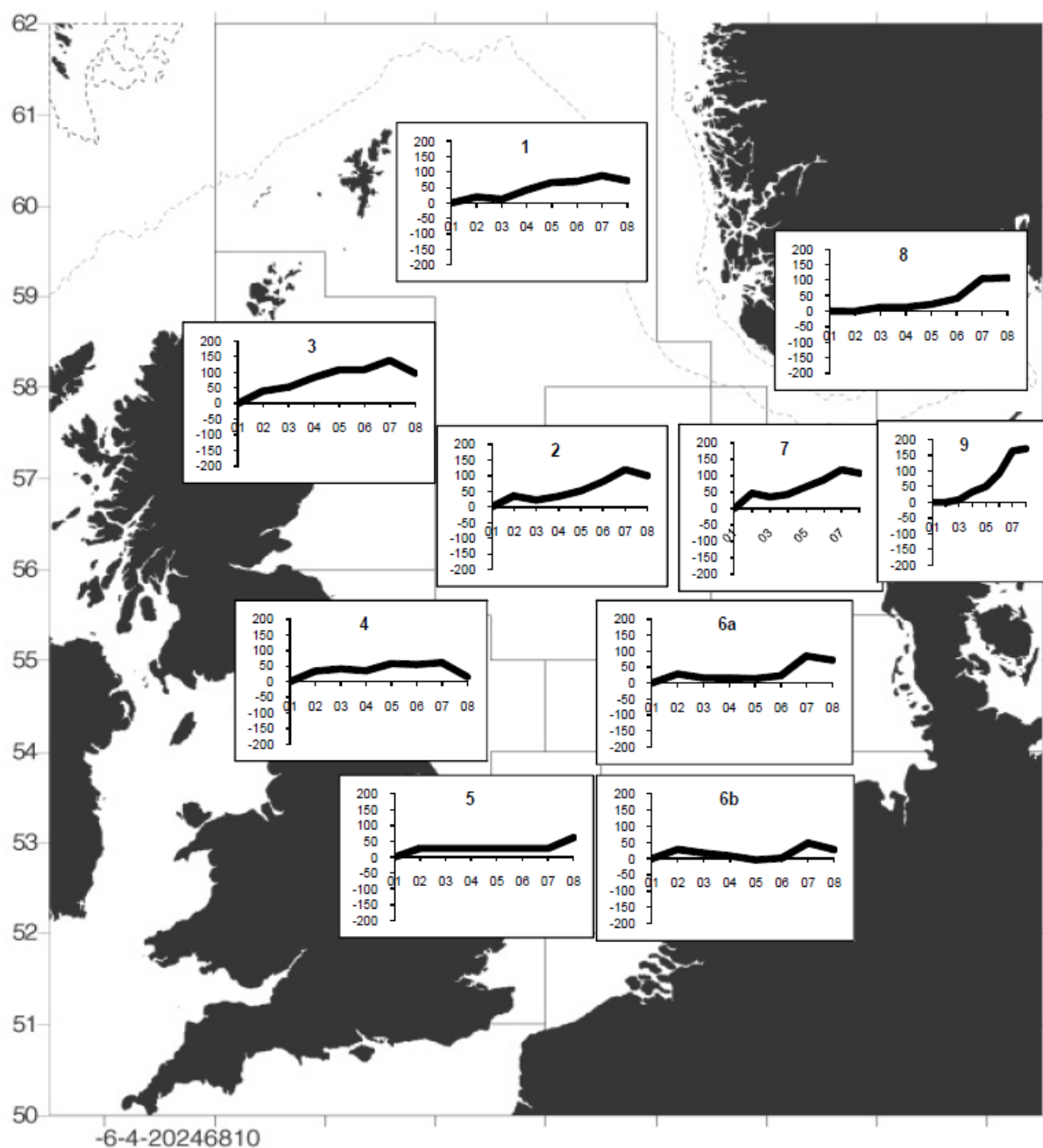
<sup>4)</sup> Biennial advice given in 2008.

<sup>5)</sup> It is not advised to manage these stocks as a single unit.

<sup>6)</sup> refers to advice for FU 5, 32 and 33



**Figure 6.4.14.2** *Nephrops* in Subarea IV. Total landings divided into Functional Units and Other rectangles (tonnes).



**Figure 6.4.14.3** *Nephrops* in Subarea IV. Results of the North Sea Commission fishers' survey 2008.

**Table 6.4.14.2** *Nephrops* in Subarea IV. Officially reported landings (tonnes) by Functional Unit plus Other rectangles.

Year	FU 5	FU 6	FU 7	FU 8	FU 9	FU 10	FU 32	FU 33	Other IV	Total
1981		1073	373	1006	1416	36			76	3980
1982		2524	422	1195	1120	19			157	5437
1983		2078	693	1724	940	15			101	5551
1984		1479	646	2134	1170	111			88	5628
1985		2027	1148	1969	2081	22			139	7386
1986		2015	1543	2263	2143	68			204	8236
1987		2191	1696	1674	1991	44			195	7791
1988		2495	1573	2528	1959	76			364	8995
1989		3098	2299	1886	2576	84			233	10176
1990		2498	2537	1930	2038	217			222	9442
1991	862	2063	4220	1404	1519	196			560	10824
1992	612	1473	3338	1757	1591	188			401	9360
1993	721	3030	3521	2369	1808	376	339	160	434	12759
1994	503	3683	4566	1850	1538	495	755	137	703	14230
1995	869	2569	6442	1763	1297	280	489	164	844	14717
1996	679	2482	5220	1688	1451	344	952	77	808	13701
1997	1149	2189	6171	2194	1446	316	760	276	662	15163
1998	1111	2177	5138	2145	1032	254	836	350	694	13736
1999	1244	2391	6505	2205	1008	279	1119	724	988	16463
2000	1121	2178	5580	1785	1541	275	1084	597	900	15060
2001	1443	2574	5545	1528	1403	177	1190	791	1268	15919
2002	1231	1953	7234	1340	1118	401	1170	861	1383	16691
2003	1144	2245	6305	1126	1079	337	1089	929	1390	15644
2004	1070	2152	8733	1658	1335	228	922	1268	1224	18590
2005	1058	3094	10685	1990	1605	165	1089	1050	1120	21855
2006	986	4858	10789	2458	1803	133	1028	1288	1249	24591
2007	1311	2966	11910	2652	1842	155	755	1467	1637	24695
2008*	695	1213	12240	2450	1514	173	675	1444	1673	22077

\* Preliminary



#### 6.4.14.1 *Nephrops* in Botney Gut – Silver Pit (FU 5)

The advice for 2009 is biannual and valid for 2009 and 2010 (see ICES, 2008).

**Table 6.4.14.1.1** *Nephrops* in Botney Gut – Silver Pit (FU 5). Single-stock exploitation boundaries (advice), management, and landings.

Year	ICES advice	Recommended landings	ICES Landings <sup>1</sup>
1991			0.9
1992		0.87	0.6
1993		0.87	0.7
1994		0.87	0.5
1995		0.87	0.9
1996		0.87	0.7
1997		0.87	1.1
1998		1.0	1.1
1999		1.0	1.2
2000		1.6	1.1
2001		1.6	1.4
2002		2.1	1.2
2003		2.1	1.1
2004		2.38	1.1
2005		2.38	1.1
2006		2.38 <sup>2)</sup>	1.0
2007	No increase in effort	-	1.3
2008	No new advice, same as for 2007	-	0.7
2009	No increase in effort	-	
2010	No new advice, same as for 2009	-	

Weights in '000 t.

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

<sup>2)</sup> Includes Off Horns Reef FU 33.

#### 6.4.14.2 *Nephrops* in Farn Deep (FU 6)

##### State of the stock

The UWTV survey, fishery data and length frequency data all point to the stock at the start of the 2008 fishing season continuing to be at a low level. Recruitment signals for *Nephrops* in 2008 appear to indicate low recruitment.

##### Reference points

<i>F</i> reference point	Harvest ratio	Technical basis
$F_{0.1}$	8.2%	WKNEPH 2009
$F_{max}$	13.3%	WKNEPH 2009

(unchanged since 2009)

##### Single-stock exploitation boundaries

ICES advises on the basis of exploitation boundaries in relation to high long term yield and low risk of depletion of production potential that the Harvest Rate for *Nephrops* fisheries should not exceed  $F_{2008}$ . This corresponds to landings of no more than 1 210 t for the Farn Deep stock.

Basis: Bias corrected survey index (2008) = 965

Rationale	Harvest ratio	Landings 2010 (tonnes)
	2%	318
	4%	637
	6%	955
$F_{2008}$	7.6%	1210
	8%	1274
$F_{0.1}$	8.2%	1305
	10%	1592
	12%	1910
$F_{max}$	13%	2117
	14%	2229
	16%	2547
	18%	2866
	20%	3184

##### Management considerations

To protect the stock in this Functional Unit, management is required to be implemented at the Functional Unit level.

Increases in abundance in other FUs (i.e. Firth of Forth and the Fladen grounds) are likely to translate to increases in TAC, increasing the risk of higher effort being deployed in this FU. The high cost of fuel combined with the relative coastal proximity of this ground may result in it attracting additional fishing effort which would be inadvisable given the current low level of the stock.

Fishing effort in 2008 declined considerably due to fewer vessels visiting from Scotland and Northern Ireland. This brought the Harvest Rate in 2008 down to below the level considered to be equivalent to fishing at  $F_{0.1}$ . Without suitable controls on the movement of effort between Functional Units there is nothing to prevent the effort in 2010 returning to levels observed prior to 2008 all of which have been above the  $F_{0.1}$  level and some of which have been considerably above the level of  $F_{max}$ .

##### *Changes in fishing technology and fishing patterns*

Increases in the numbers of vessels using twin-rig gears observed in this area are likely to have increased the effective fishing power per kW hour.

Poor catch rates during the 2007–2008 and 2008–2009 seasons resulted in several Scottish and Northern Irish vessels leaving the fishery early.

## **Scientific basis**

### *Data and methods*

The UWTV survey has been conducted since 2002. Potential bias in survey design has been detected and accounted for in the assessment this year (see “Data and methods” section at the start of section 6.4.14).

Length composition data from catch and discard sampling programmes have been used from 2002 to estimate the length composition of landings. Data prior to 2002 were raised using landings sampling due to insufficient discard sampling in this period.

### *Information from the fishing industry*

The North Sea Stock Survey by the fishing industry showed a long term increase in abundance since 2001 followed by a marked decrease in abundance in 2008. This is consistent with the assessment. Fishing industry opinions appear divided regarding incoming recruitment with some respondents considering it to be good and some poor.

### *Uncertainties in assessment and forecast*

General comments are found at the start of section 6.4.14

Direct landings sampling is likely to have missed portions of the landings landed as tails (as opposed to whole), leading to a significant overestimate of discarding above MLS.

### *Comparison with previous assessment and advice*

The perception of the state of the stock has not changed since the assessment in 2008. The indicators show that the stock has been substantially reduced from a relatively high abundance in 2006.

The advice in 2008 was based on recent landings as the UWTV surveys were considered inappropriate to use as absolute indices of abundance. Following the outcome of the benchmark in 2009, the major concerns of the UWTV survey have been addressed and the survey is now considered a reliable estimate of absolute abundance.

The landings forecast has changed considerably; in 2008 (for landings in 2009) it was less than 3000 t whereas the current advice for 2010 is for less than 1210 t based on  $F_{2008}$ .

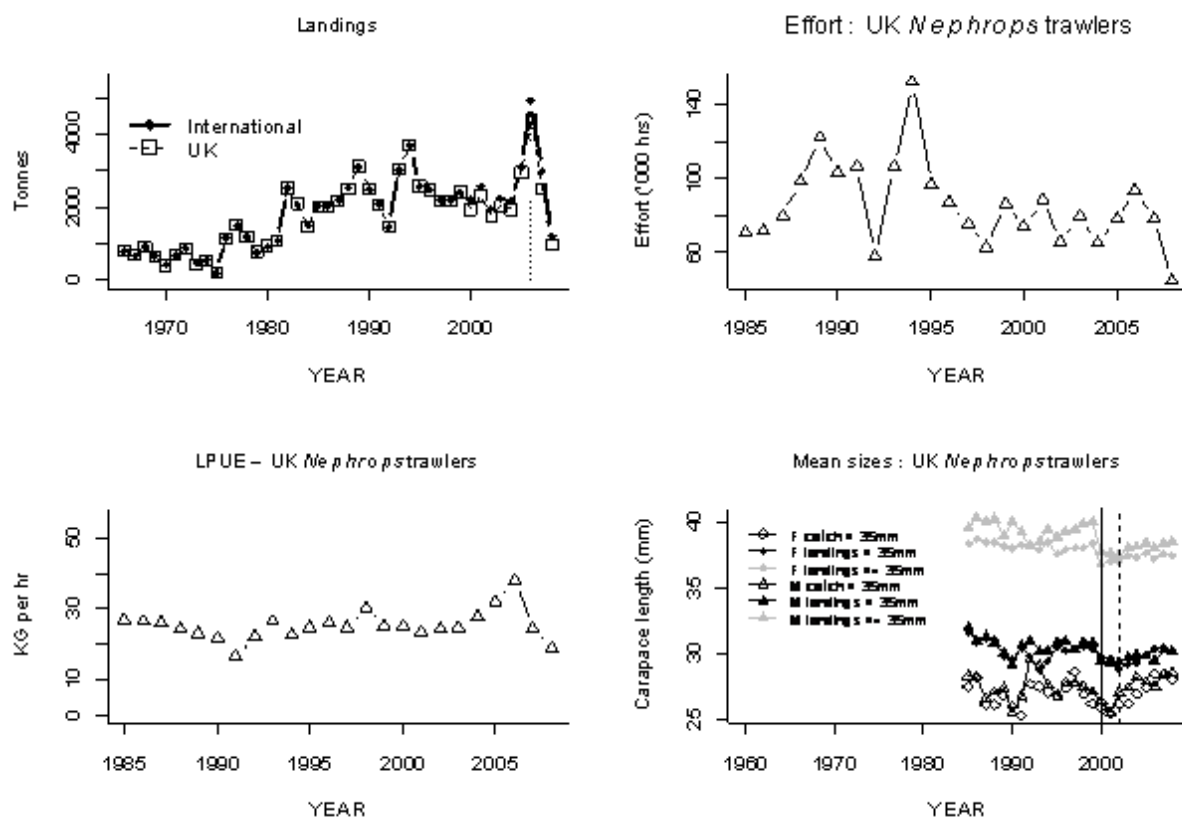
**Table 6.4.14.2.1** *Nephrops* Farn Deeps (FU 6). Single-stock exploitation boundaries (advice), management, and landings.

Year	ICES advice	Recommended landings Farn Deeps (FU6)	Recommended landings FU6+FU8	ICES Landings FU6 <sup>1)</sup>
1987				2.2
1988				2.5
1989				3.1
1990				2.5
1991				2.1
1992			~4.6	1.5
1993			4.17	3.0
1994			4.17	3.7
1995			4.17	2.6
1996			4.17	2.5
1997			4.17	2.2
1998			4.17	2.2
1999			4.17	2.4
2000			4.17	2.2
2001			4.17	2.6
2002			4.17	2.0
2003			4.17	2.2
2004			4.17	2.2
2005			4.17	3.1
2006	No increase in effort		-	4.9
2007	No increase in effort, harvest rate <15%	3.5	5.0	3.0
2008	No new advice, same as for 2007	3.5	5.0	1.2
2009	No increase in effort and landings (2007)	< 3.0	NA <sup>2)</sup>	
2010	Harvest Rate no greater than that equivalent to fishing at F <sub>2008</sub>	<1.2	NA <sup>2)</sup>	

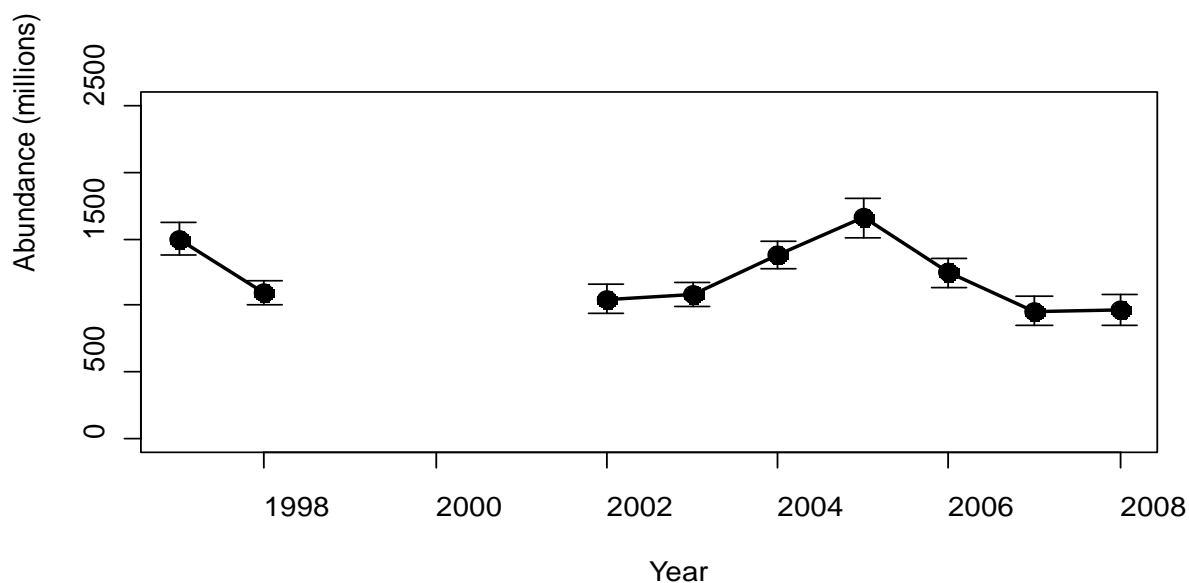
Weights in '000 t.

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

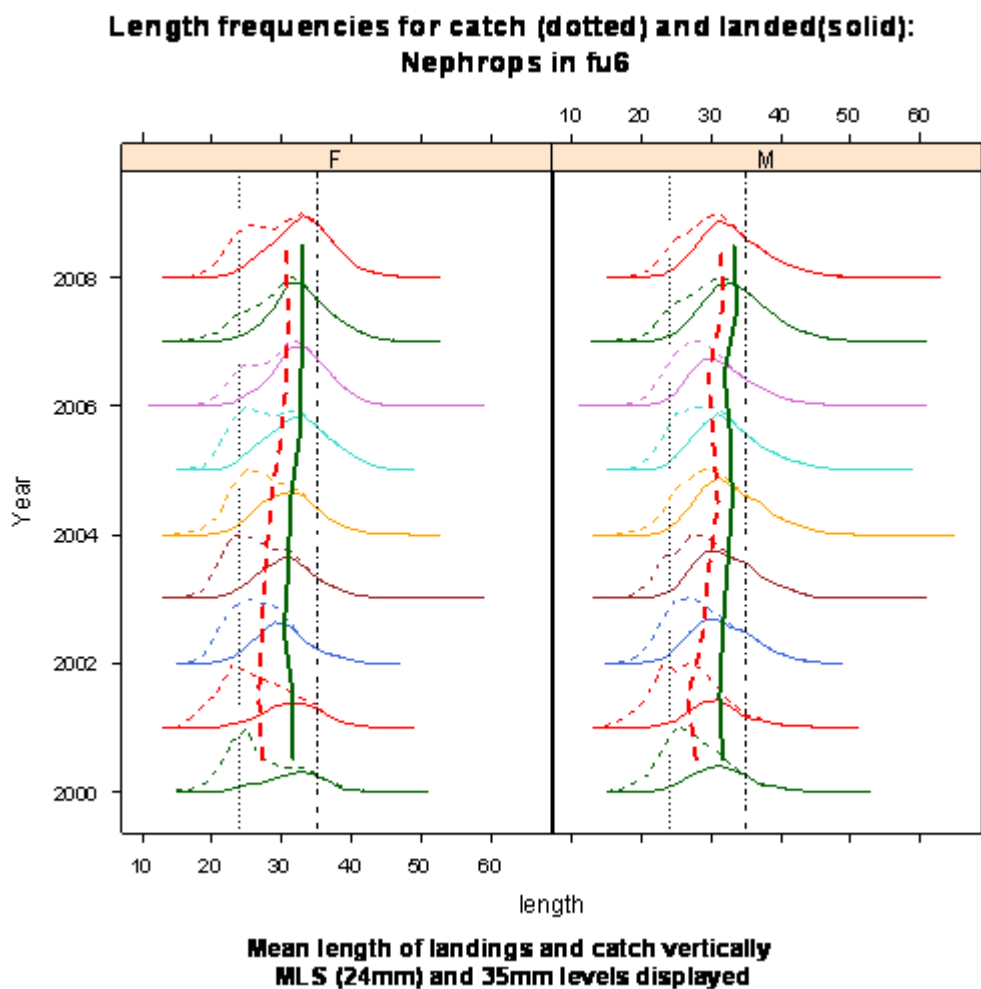
<sup>2)</sup> Advice given at FU level only.



**Figure 6.4.14.2.1** *Nephrops* Farn Deep (FU 6): Long-term trends in landings, effort, lpues, and mean sizes of *Nephrops*.



**Figure 6.4.14.2.2** *Nephrops* Farn Deep (FU 6). Time-series of the bias adjusted UWTV survey index estimates, with 95% confidence intervals.



**Figure 6.4.14.2.3** *Nephrops* Farn Deep (FU 6). Length composition of catch (dotted) and landed (solid) of males (right) and females left from 1996 (bottom) to 2007 (top). Mean sizes of catch and landings (using same line types ) is shown in relation to Minimum Landing Size (MLS).

**Table 6.4.14.2.2** *Nephrops* Farn Deepes (FU 6). Official landings (tonnes).

Year	UK England	UK Scotland	Sub total	Other countries**	Total
1981	1006	67	1073	0	1073
1982	2443	81	2524	0	2524
1983	2073	5	2078	0	2078
1984	1471	8	1479	0	1479
1985	2009	18	2027	0	2027
1986	1987	28	2015	0	2015
1987	2158	33	2191	0	2191
1988	2390	105	2495	0	2495
1989	2930	168	3098	0	3098
1990	2306	192	2498	0	2498
1991	1884	179	2063	0	2063
1992	1403	60	1463	10	1473
1993	2941	89	3030	0	3030
1994	3530	153	3683	0	3683
1995	2478	90	2568	1	2569
1996	2386	96	2482	1	2482
1997	2109	80	2189	0	2189
1998	2029	147	2176	1	2177
1999	2197	194	2391	0	2391
2000	1947	231	2178	0	2178
2001	2319	255	2574	0	2574
2002	1739	215	1953	0	1953
2003	2031	214	2245	0	2245
2004	1952	201	2152	0	2152
2005	2936	158	3093	0	3094
2006	4385	434	4819	39	4858
2007	2525	437	2962	4	2966
2008*	969	244	1213	0	1213
* provisional na = not available					
** Other countries includes Ne, Be and Dk					

**Table 6.4.14.2.3** *Nephrops* Farn Deepes (FU 6). Survey indices with and without bias adjustment

Year	Bias. adjusted		Unadjusted	
	Abundance (millions)	± 95% CI	Abundance (millions)	± 95% CI
1997	1500	125	1800	150
1998	1090	89	1308	107
1999	NA	NA	NA	NA
2000	NA	NA	NA	NA
2001	1685	67	2022	80
2002	1048	112	1258	134
2003	1085	90	1302	108
2004	1377	101	1652	121
2005	1657	148	1988	177
2006	1244	114	1492	137
2007	958	114	1149	137
2008	965	112	1158	134

### 6.4.14.3 *Nephrops* Fladen Ground (FU 7)

#### State of the stock

UWTV observations indicate that the stock is fluctuating without obvious trend with estimates for the last 2 years increasing to the highest abundance in the series. Considering the UWTV result alongside the indications of stable or slightly increasing mean sizes in the length compositions of catches (of individuals >35mm carapace length) suggests that the stock is being exploited sustainably. The decline in mean length of smaller individuals in the catch may be indicative of recent good recruitment.

#### Reference points

<i>F</i> reference point	Harvest ratio	Technical basis
$F_{0.1}$	9.3%	WKNEPH 2009
$F_{\max}$	15.8%	WKNEPH 2009

(unchanged since 2009)

#### Single-stock exploitation boundaries

ICES advises on the basis of exploitation boundaries in relation to high long term yield and low risk of depletion of production potential that the Harvest Rate for *Nephrops* fisheries should not exceed  $F_{0.1}$ . This corresponds to landings of no more than 16 419t for the Fladen Ground

Basis: Bias corrected survey index (2008) = 7302

Rationale	Harvest rate	Landings 2010 (tonnes)
	5.0%	8827
$F_{2008}$	8.0%	14124
$F_{0.1}$	9.3%	16419
	10.0%	17655
	15.0%	26482
$F_{\max}$	15.8%	27895
	20.0%	35310

#### Management considerations

To protect the stock in this Functional Unit, management is required to be implemented at the Functional Unit level.

*Nephrops* fisheries in this area have a bycatch of cod. In 2005, high abundance of 0 group cod was recorded in Scottish surveys near to this ground. This year class of cod has subsequently contributed to slightly improved cod stock biomass and efforts are being made to avoid the capture of cod so that the stock can build further. In 2008 over 90% of the Scottish industry was operating under a voluntary Conservation Credits scheme and has implemented real time closures with a view to reducing unwanted bycatch of cod.

#### Factors affecting the fisheries and the stock

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 Ground is the largest known *Nephrops* ground where fishing activity can shift spatially so that effort can vary on parts of the ground.

Nearly three quarters of the landings are made by single-rig vessels and one-quarter by twin-rig vessels. 80 mm mesh is the commonest mesh size. Nearly 40% of the *Nephrops* landings at Fladen are reported as bycatch, in fisheries which may be described as mixed.

#### *The effects of regulations*

The minimum landing size for *Nephrops* on the Fladen Ground is 25 mm carapace length. Discarding takes place at sea, and rates averaged over the period 2005 to 2007 for this stock were 18% by number, or 11% by weight.



### *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 NE coast of Scotland. In recent years, logbook information and GPS loggers show that vessels are fishing more widely over the ground, including to the far eastern and northern edges of the extensive mud area. High fuel prices may limit steaming to some of these areas in 2008.

### **Scientific basis**

#### *Data and methods*

The UWTV survey has been conducted since 1992. Potential bias in survey design has been detected and accounted for in the assessment this year (see “Data and methods” section at the start of section 6.4.14.)

#### *Information from the fishing industry*

The NSCFP stock survey shows an increase in *Nephrops* between 2001 and 2002, a slight decrease to 2003, and a marked increase up to 2007. Stock levels are considered to be similar or slightly less in 2008 (Figure 6.4.14.3). This information is broadly consistent with trends in the UWTV survey results.

#### *Uncertainties in assessment and forecast*

General comments are found at the start of section 6.4.14

The UWTV survey is conducted over the main part of the ground, representing an area of around 28 200 km<sup>2</sup> of suitable mud substrate (the largest ground in Europe). 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<sup>2</sup>. 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 stock in 2008 is similar to that in 2007 from the assessment in 2008.

The advice in 2008 was based on recent landings as the UWTV surveys were considered inappropriate to use as absolute indices of abundance. Following the outcome of the benchmark in 2009, the major concerns of the UWTV survey have been addressed and the survey is now considered a reliable estimate of absolute abundance.

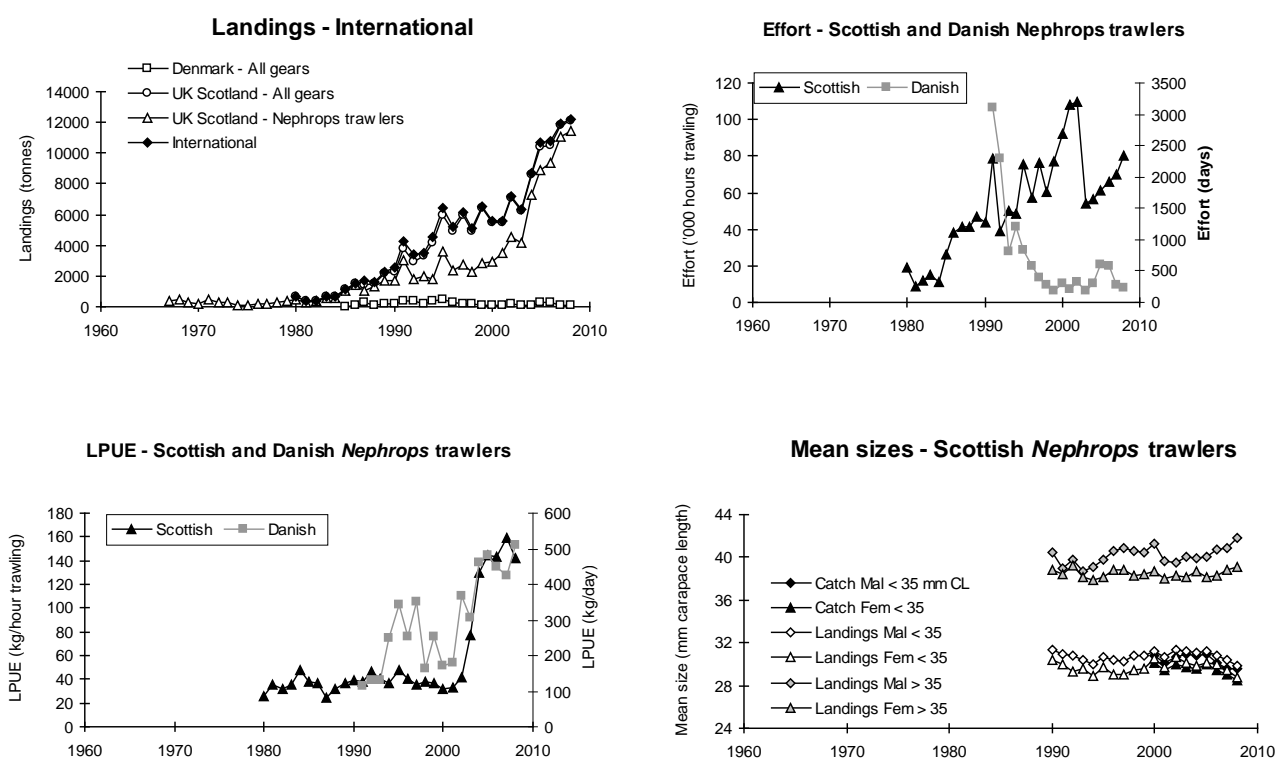
The landings forecast for 2010 (equivalent to fishing at  $F_{0.1}$ ) is 16,419 tonnes. This is an increase of almost 4,000 tonnes on the reported landings in 2008.

Table 6.4.14.3.1. *Nephrops*, Fladen (FU 7). Single-stock exploitation boundaries (advice), management, and landings.

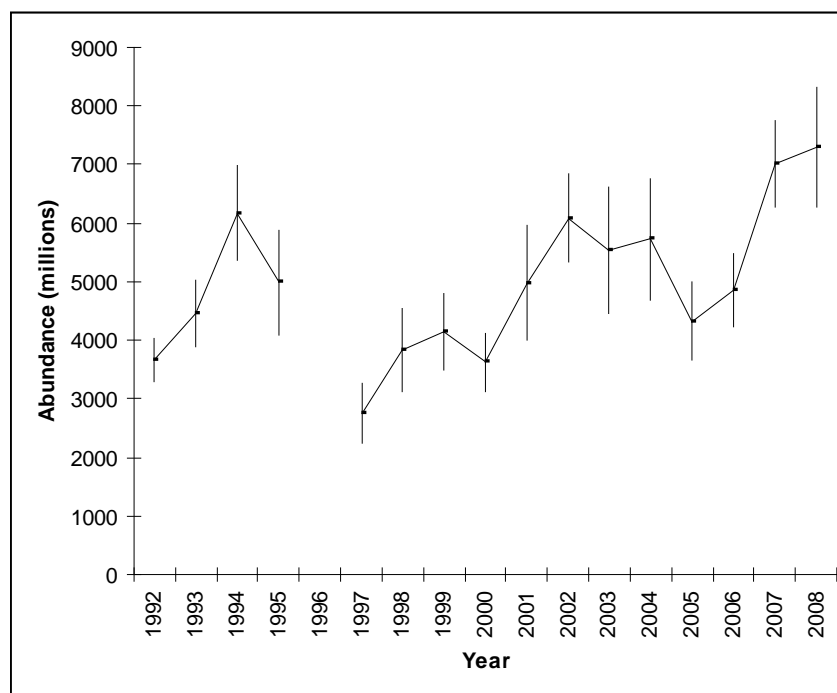
Year	ICES advice	Recommended Landings Fladen grounds (FU7)	ICES Landings FU7 <sup>1)</sup>
1989			2.3
1990			2.5
1991			4.2
1992		~2.7	3.4
1993		2.7	3.5
1994		5.0	4.6
1995		5.0	6.4
1996		5.0	5.2
1997		5.0	6.2
1998		7.0	5.1
1999		7.0	6.5
2000		9.0	5.6
2001		9.0	5.5
2002		9.0	7.2
2003		9.0	6.3
2004		12.8	8.7
2005		<12.8	10.7
2006	No increase of effort	-	10.8
2007	No increase in effort and harvest rate below 7.5%	<10.9	11.9
2008	No new advice, same as for 2007	<10.9	12.24
2009	No increase in effort and recent average landings	<11.3	
2010	Harvest Rate no greater than that equivalent to fishing at $F_{0.1}$	<16.4	

Weights in '000 t.

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



**Figure 6.4.14.3.1** *Nephrops*, Fladen (FU 7). Long-term trends in landings, effort, lpues, and mean sizes of *Nephrops*.



**Figure 6.4.14.3.2** *Nephrops*, Fladen (FU 7). Time-series of the bias adjusted UWTW survey index estimates, with 95% confidence intervals.

**Table 6.4.14.3.2** *Nephrops*, Fladen (FU 7). Total landings (tonnes).

Year	<b>All <i>Nephrops</i> gears combined</b>			<b>Single rig</b>			<b>Multirig</b>		
	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE
1981	304	8.6	35.3	304	8.6	35.3	na	na	na
1982	382	12.2	31.3	382	12.2	31.3	na	na	na
1983	548	15.4	35.6	548	15.4	35.6	na	na	na
1984	549	11.4	48.2	549	11.4	48.2	na	na	na
1985	1016	26.6	38.2	1016	26.6	38.2	na	na	na
1986	1398	37.8	37.0	1398	37.8	37.0	na	na	na
1987	1024	41.6	24.6	1024	41.6	24.6	na	na	na
1988	1306	41.7	31.3	1306	41.7	31.3	na	na	na
1989	1719	47.2	36.4	1719	47.2	36.4	na	na	na
1990	1703	43.4	39.2	1703	43.4	39.2	na	na	na
1991	3024	78.5	38.5	410	11.4	36.0	2614	67.1	39.0
1992	1794	38.8	46.2	340	9.4	36.2	1454	29.4	49.5
1993	2033	49.9	40.7	388	9.6	40.4	1645	40.3	40.8
1994	1817	48.8	37.2	301	8.4	35.8	1516	40.4	37.5
1995	3569	75.3	47.4	2457	52.3	47.0	1022	23.0	44.4
1996	2338	57.2	40.9	2089	51.4	40.6	249	5.8	42.9
1997	2713	76.5	35.5	2013	54.7	36.8	700	21.8	32.1
1998	2291	60.0	38.2	1594	39.6	40.3	697	20.5	34.0
1999	2860	76.8	37.2	1980	50.3	39.4	880	26.5	33.2
2000	2915	92.1	31.7	2002	62.9	31.8	913	29.2	31.3
2001	3539	108.2	32.7	2162	65.8	32.9	1377	42.4	32.5
2002	4513	109.6	41.2	2833	58.9	48.1	1680	50.7	33.1
2003	4175	53.7	77.7	3388	42.8	79.2	787	10.9	72.2
2004	7274	56.1	129.7	6177	47.5	130.2	1097	8.6	127.6
2005	8849	61.3	144.4	6834	43.4	157.5	2015	17.9	112.7
2006	9396	65.7	143.0	7149	50.2	142.4	2320	15.5	149.7
2007	11055	69.6	158.8	8232	52.2	157.7	2822	17.4	162.2
2008	11432	80.3	142.4	8247	58.8	140.3	3185	21.5	148.1

**Table 6.4.14.3.3** *Nephrops*, Fladen (FU 7). Survey indices with and without bias adjustment. Values after 2002 have been adjusted for revised camera parameters

Year	Mean density	Abundance	95% confidence interval	Adjusted for bias	95% confidence interval
	burrows/m <sup>2</sup>	millions	millions	millions	millions
1992	0.17	4942	508	3661	376
1993	0.21	6007	768	4450	569
1994	0.30	8329	1099	6170	814
1995	0.24	6733	1209	4987	896
1996					
1997	0.13	3736	689	2767	510
1998	0.18	5181	968	3838	717
1999	0.20	5597	876	4146	649
2000	0.17	4898	663	3628	491
2001	0.23	6725	1310	4981	970
2002	0.29	8217	1022	6087	757
2003	0.27	7488	1452	5547	1076
2004	0.27	7729	1391	5725	1030
2005	0.21	5839	894	4325	662
2006	0.23	6564	836	4862	619
2007	0.34	9473	986	7017	730
2008	0.35	9857	1377	7302	1020

#### 6.4.14.4 *Nephrops* in Firth of Forth (FU 8)

##### State of the stock

The evidence from the UWTV survey suggests that the population has been at a relatively high level since 2003. The UWTV survey information, taken together with information showing stable mean sizes, suggest that the stock is being exploited sustainably.

##### Reference points

<i>F</i> reference point	<i>Harvest</i> <i>ratio</i>	<i>Technical basis</i>
$F_{0.1}$	8.0%	WKNEPH 2009
$F_{\max}$	13.7%	WKNEPH 2009

(unchanged since 2009)

##### Single-stock exploitation boundaries

ICES advises on the basis of exploitation boundaries in relation to high long term yield and low risk of depletion of production potential that the Harvest Rate for *Nephrops* fisheries should not exceed  $F_{\max}$ . This corresponds to landings of no more than 1 567 tonnes for the Firth of Forth stock.

Basis: Bias corrected survey index (2008) = 881

Rationale	Harvest rate	Landings 2010 (tonnes)
	5.0%	572
$F_{0.1}$	8.0%	915
	10.0%	1144
	15.0%	1715
$F_{\max}$	13.7%	1567
	20.0%	2287
$F_{2008}$	24.5%	2802

##### Management considerations

To protect the stock in this Functional Unit, management is required to be implemented at the Functional Unit level.

The advised landings for 2010 imply a reduction of 37% relative to the 2008 landings (2 500 t). ICES advice is for  $F_{\max}$  instead of  $F_{0.1}$  because increased landings in earlier years have coincided with an increase in stock implying perhaps that the present level of exploitation could be sustainable. Even though in the longer term the differences in total catch are expected to be small, the move to  $F_{0.1}$  as a target would imply significant initial reductions in catch. In this case a stepwise approach could be considered. A reduction of the catch corresponding to  $F_{\max}$  could be an intermediate step toward  $F_{0.1}$  (as a proxy for  $F_{\text{msy}}$ ). Alternatively, a constraint on the year to year change in catches as is typical of management plans and the Communication on Fishing Opportunities for 2010 [COM (2009) 224] might be considered.

*Nephrops* discard rates in this Functional Unit are high and there is a need to reduce these and to improve the exploitation pattern. An additional reason for suggesting improved selectivity in this area relates to bycatch. It is important that efforts are made to ensure that other fish are not taken as unwanted bycatch in this fishery which uses 80mm mesh. Larger square mesh panels implemented as part of the Scottish Conservation Credits scheme should help to improve the exploitation pattern for some species such as haddock and whiting.

##### 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. There is a risk that owing to fuel costs vessels which would normally fish further offshore will locate to inshore grounds. The Firth of Forth is close inshore and is of small geographic size so that significant influx of effort will have deleterious effects.

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 are 31% by number in the Firth of Forth in 2008. 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.

#### *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 ( an offshore ground not included as part of a Functional Unit).

### **Scientific basis**

#### *Data and methods*

The UWTV survey has been conducted annually since 1993 (no surveys in 1995 and 1997). Monthly market sampling and quarterly on-board observer sampling provides good coverage of length compositions. Potential bias in survey design has been detected and accounted for in the assessment this year (see "Data and methods" section at the start of section 6.4.14.)

#### *Information from the fishing industry*

The NSCFP survey (Figure 6.4.14.3) does not include specific information for the Firth of Forth.

#### *Uncertainties in assessment and forecast*

General comments are found at the start of section 6.4.14

#### *Comparison with previous assessment and advice*

The perception of the stock in 2008 is very similar to that of the stock in 2007

The advice in 2008 was based on recent landings as the UWTV surveys were considered inappropriate to use as absolute indices of abundance. Following the outcome of the benchmark in 2009, the major concerns of the UWTV survey have been addressed and the survey is now considered a reliable estimate of absolute abundance..

The landings forecast for 2010 (<1 567 t) is considerably lower than for 2009 (<2500t). This is due to using  $F_{\max}$  as the target F for this stock in the current advice.

**Table 6.4.14.4.1** *Nephrops*, Firth of Forth (FU 8). Single-stock exploitation boundaries (advice), management, and landings.

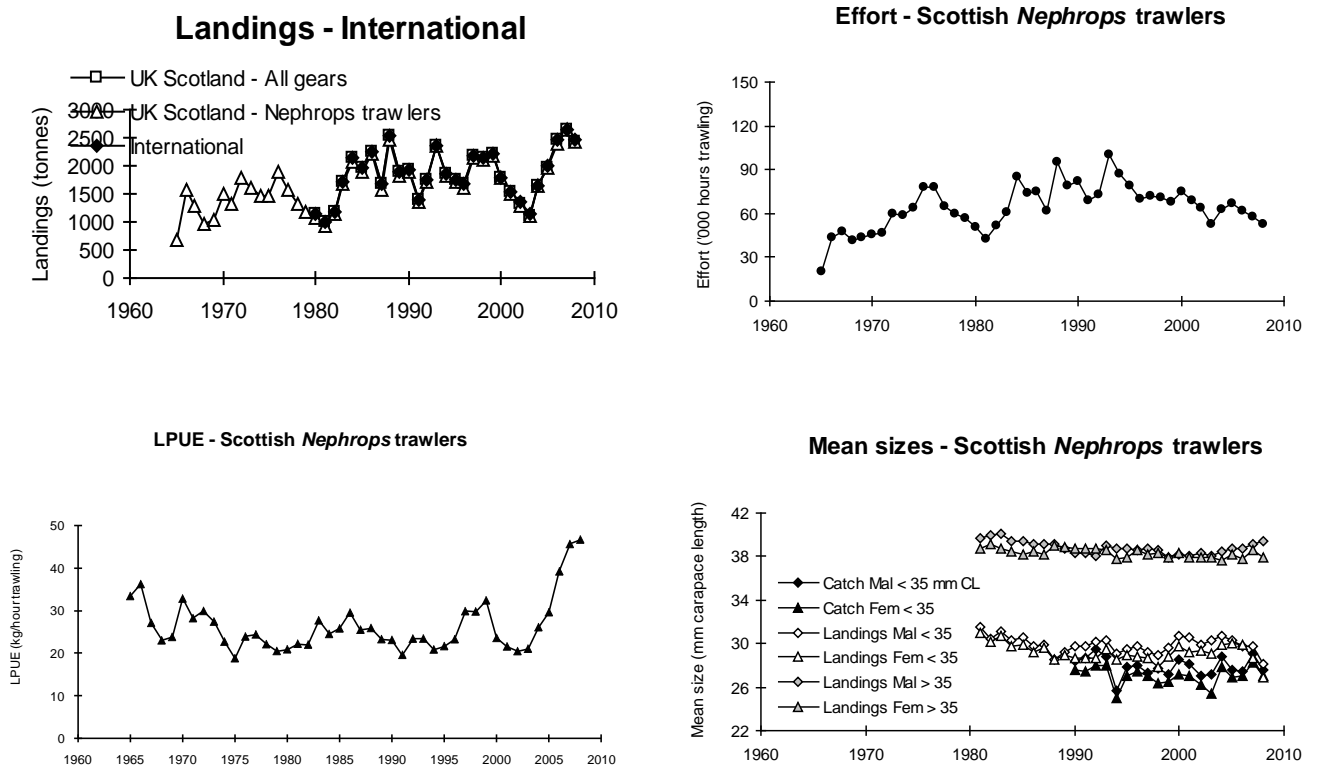
Year	ICES advice	Recommended landings Firth of Forth (FU8)	Recommended landings FU6+FU8	ICES Landings FU8 <sup>1)</sup>
1992			~4.6	1.8
1993			4.17	2.4
1994			4.17	1.9
1995			4.17	1.8
1996			4.17	1.7
1997			4.17	2.2
1998			4.17	2.1
1999			4.17	2.2
2000			4.17	1.8
2001			4.17	1.5
2002			4.17	1.3
2003			4.17	1.1
2004			4.17	1.7
2005			4.17	2.0
2006	No increase in effort		-	2.4
2007	No increase in effort, harvest rate <15%	1.5	5.0	2.6
2008	No new advice, same as for 2007	1.5	5.0	2.5
2009	No increase in effort and recent average landings	< 2.5	2.4	
2010	Harvest Rate no greater than that equivalent to < 1.6 fishing at $F_{max}$		-- <sup>2)</sup>	

Weights in '000 t.

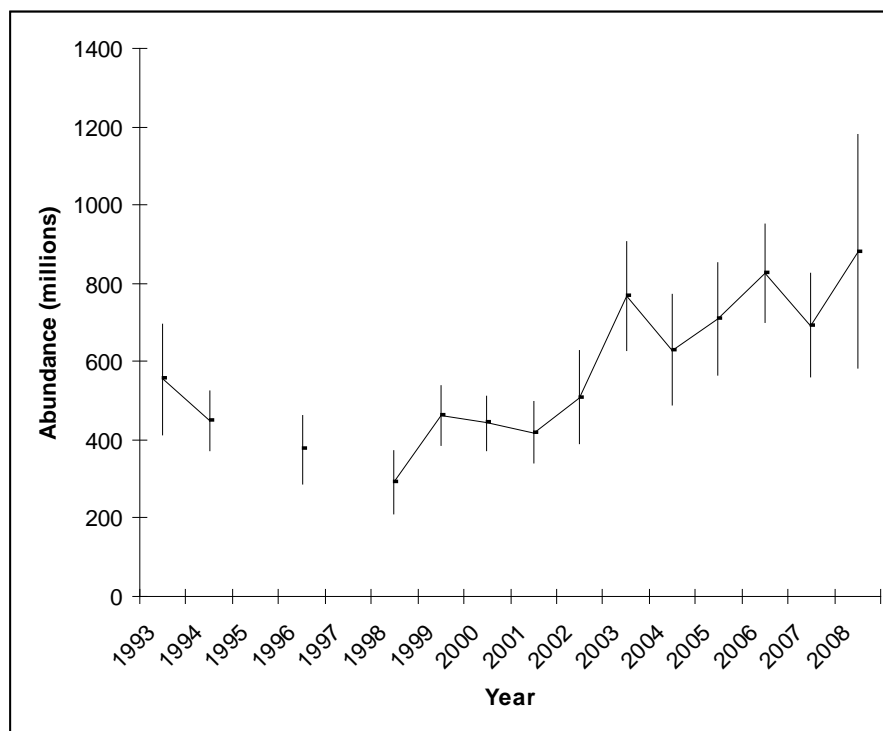
<sup>1)</sup> Does not include discards.

<sup>2)</sup> It is not advised to manage these stocks as a single unit.

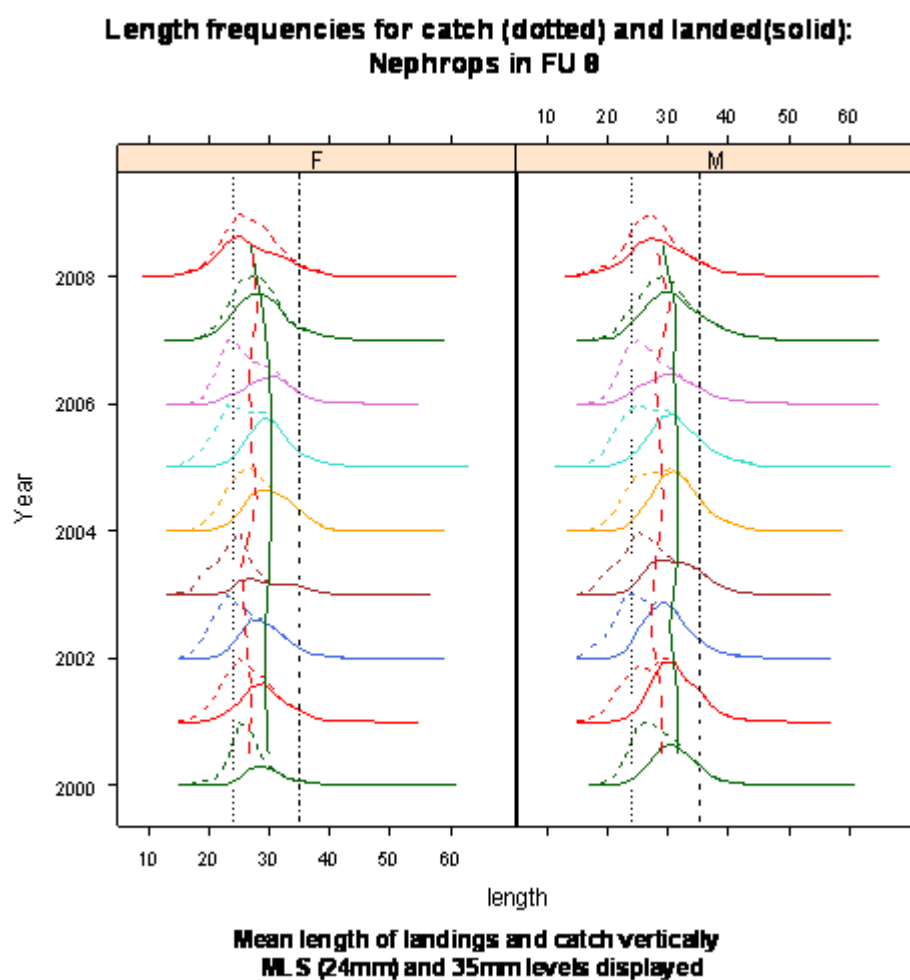




**Figure 6.4.14.4.1** *Nephrops*, Firth of Forth (FU 8). Long-term trends in landings, effort, lpues, and mean sizes of *Nephrops*.



**Figure 6.4.14.4.2** *Nephrops*, Firth of Forth (FU 8). Time-series of bias adjusted UWTV survey abundance estimates (in millions), with 95% confidence intervals, 1993–2008.



**Figure 6.4.14.4.3** *Nephrops*, Firth of Forth (FU 8). Catch length frequency distribution and mean sizes (red line).

**Table 6.4.14.4.2** *Nephrops*, Firth of Forth (FU 8). Total landings (tonnes).

Year	All <i>Nephrops</i> gears combined			Single rig			Multirig		
	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE
1981	945	42.6	22.2	945	42.6	22.2	na	na	na
1982	1138	51.7	22.0	1138	51.7	22.0	na	na	na
1983	1681	60.7	27.7	1681	60.7	27.7	na	na	na
1984	2078	84.7	24.5	2078	84.7	24.5	na	na	na
1985	1908	73.9	25.8	1908	73.9	25.8	na	na	na
1986	2204	74.7	29.5	2204	74.7	29.5	na	na	na
1987	1582	62.1	25.5	1582	62.1	25.5	na	na	na
1988	2455	94.8	25.9	2455	94.8	25.9	na	na	na
1989	1833	78.7	23.3	1833	78.7	23.3	na	na	na
1990	1901	81.8	23.2	1901	81.8	23.2	na	na	na
1991	1359	69.4	19.6	1231	63.9	19.3	128	5.5	23.3
1992	1714	73.1	23.4	1480	63.3	23.4	198	8.5	23.3
1993	2349	100.3	23.4	2340	100.1	23.4	9	0.2	45.0
1994	1827	87.6	20.9	1827	87.6	20.9	0	0.0	0.0
1995	1708	78.9	21.6	1708	78.9	21.6	0	0.0	0.0
1996	1621	69.7	23.3	1621	69.7	23.3	0	0.0	0.0
1997	2137	71.6	29.8	2137	71.6	29.8	0	0.0	0.0
1998	2105	70.7	29.8	2105	70.7	29.8	0	0.0	0.0
1999	2192	67.7	32.4	2192	67.7	32.4	0	0.0	0.0
2000	1775	75.3	23.6	1761	75.0	23.5	14	0.3	46.7
2001	1484	68.8	21.6	1464	68.3	21.4	20	0.5	40.0
2002	1302	63.6	20.5	1286	63.3	20.3	16	0.3	53.3
2003	1115	53.0	21.0	1082	52.4	20.6	33	0.6	55.0
2004	1651	63.2	26.1	1633	62.9	26.0	18	0.4	49.7
2005	1973	66.6	29.6	1970	66.5	29.6	3	0.1	58.8
2006	2437	61.4	39.7	2432	61.0	39.9	5	0.4	14.2
2007	2628	57.6	45.6	2607	57.1	45.7	21	0.5	43.2
2008	2435	52.2	46.6	2405	51.7	46.5	30	0.5	60.0

**Table 6.4.14.4.3** *Nephrops*, Firth of Forth (FU 8). Survey indices with and without bias adjustment. Values after 2002 have been adjusted for revised camera parameters

Year	Mean density	Abundance	95% confidence interval	Adjusted for bias	95% confidence interval
	burrows/m <sup>2</sup>	millions	millions	millions	millions
1993	0.72	655	167	555	142
1994	0.58	529	92	448	78
1995					
1996	0.48	443	104	375	88
1997					
1998	0.38	345	95	292	81
1999	0.60	546	92	463	78
2000	0.57	523	83	443	70
2001	0.54	494	93	419	78
2002	0.66	600	140	508	119
2003	0.99	905	163	767	138
2004	0.81	743	166	630	140
2005	0.92	838	169	710	143
2006	1.07	976	148	827	126
2007	0.90	816	156	692	132
2008	1.14	1040	350	881	297

#### 6.4.14.5 *Nephrops* in Moray Firth (FU 9)

##### State of the stock

The evidence from the UWTV survey suggests that the population is stable, but at a lower level than that evident from 2003-2005. The UWTV survey information, taken together with information showing stable mean sizes, suggest that the stock is being exploited sustainably.

##### Reference points

<i>F</i> reference point	<i>Harvest</i> <i>ratio</i>	<i>Technical basis</i>
$F_{0.1}$	8.9%	WKNEPH 2009
$F_{\max}$	16.6%	WKNEPH 2009

(unchanged since 2009)

##### Single-stock exploitation boundaries

ICES advises on the basis of exploitation boundaries in relation to high long term yield and low risk of depletion of production potential that the Harvest Rate for *Nephrops* fisheries should not exceed  $F_{2008}$ . This corresponds to landings of no more than 1 372 tonnes for the Moray Firth stock.

Basis: Bias corrected survey index (2008) = 478

Rationale	Harvest rate	Landings 2010 (tonnes)
	5.0%	520
$F_{0.1}$	8.9%	926
	10.0%	1040
$F_{2008}$	13.2%	1372
	15.0%	1560
$F_{\max}$	16.6%	1727
	20.0%	2080

##### Management considerations

To protect the stock in this Functional Unit, management is required to be implemented at the Functional Unit level.

A reduction of the catch corresponding to  $F_{2008}$  can be considered as an intermediate step toward  $F_{0.1}$  (as a proxy for  $F_{\text{msy}}$ ). Alternatively, a constraint on the year to year change in TAC as is typical of management plans and the Communication on Fishing Opportunities for 2010 [COM (2009) 224] might be considered.

There is a bycatch of other species in the Moray Firth area. It is important that efforts are made to ensure that unwanted bycatch is kept to a minimum in this fishery. Current efforts to reduce discards and unwanted bycatches of cod under the Scottish Conservation credits scheme, include the implementation of larger meshed square mesh panels and real time closures to avoid cod.

##### *Factors affecting the fisheries and the stock*

In the Moray Firth area the *Nephrops* stock inhabits a single continuous area of muddy sediment extending from north of Fraserburgh to Inverness.

The Moray Firth *Nephrops* ground is located close to the Scottish coast and is exploited almost exclusively by UK vessels. Landings from this fishery are predominantly reported from Scotland, with very small contributions from England in the mid-1990s, but none recently.

##### *Regulations and their effects*

Discarding rates averaged over the period 2006 to 2008 for this stock were about 6% by number. This represents a marked reduction in discarding rate compared to the average for the period 2003 to 2005. This may arise from the increasing use of larger size meshes in the northern North Sea, although reduction in recruitment may also account for this change.

## Scientific basis

### Data and methods

UWTV survey estimates are available for 1993–1994 and from 1996 onwards. Length compositions from the commercial fishery are available from 1980. Potential bias in survey design has been detected and accounted for in the assessment this year (see “Data and methods” section at the start of section 6.4.14.)

### Uncertainties in assessment and forecast

General comments are found at the start of section 6.4.14

### Information from the fishing industry

The NSCFP survey (Figure 6.4.14.3) does not include specific information for the Moray Firth.

### Comparison with previous assessment and advice

The perception of the stock in 2008 is similar to that of the stock in 2007

The advice in 2008 was based on recent landings as the UWTV surveys were considered inappropriate to use as absolute indices of abundance. Following the outcome of the benchmark in 2009, the major concerns of the UWTV survey have been addressed and the survey is now considered a reliable estimate of absolute abundance.

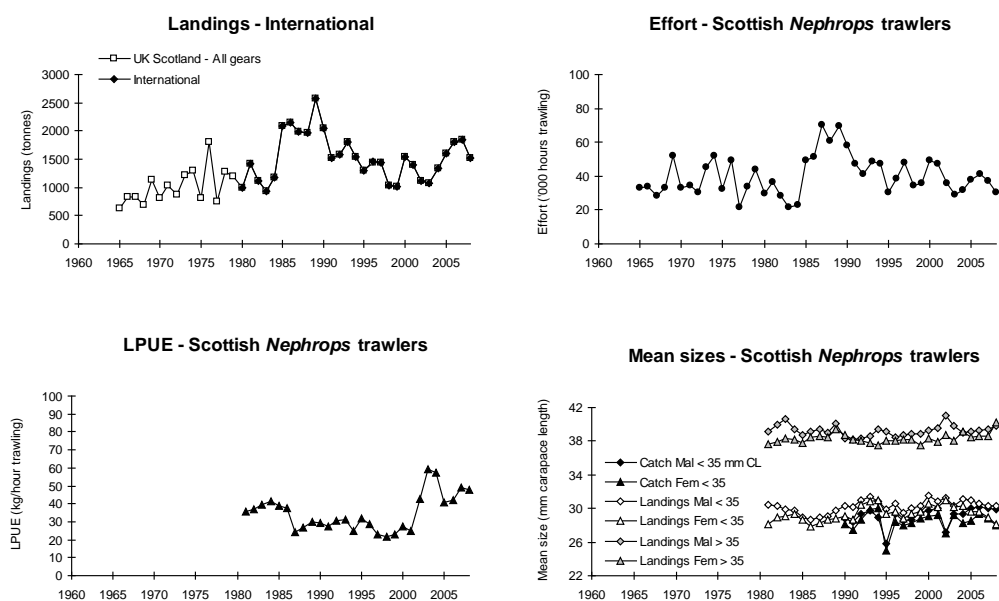
The landings forecast for 2010 (< 1 372 t) is considerably lower than for 2009 (< 1 800t). This is due to using the status quo  $F$  ( $F_{2008}$ ) as the target  $F$  for this stock in the current advice.

**Table 6.54.14.5.1** *Nephrops*, Moray Firth (FU 9). Single-stock exploitation boundaries (advice), management, and landings.

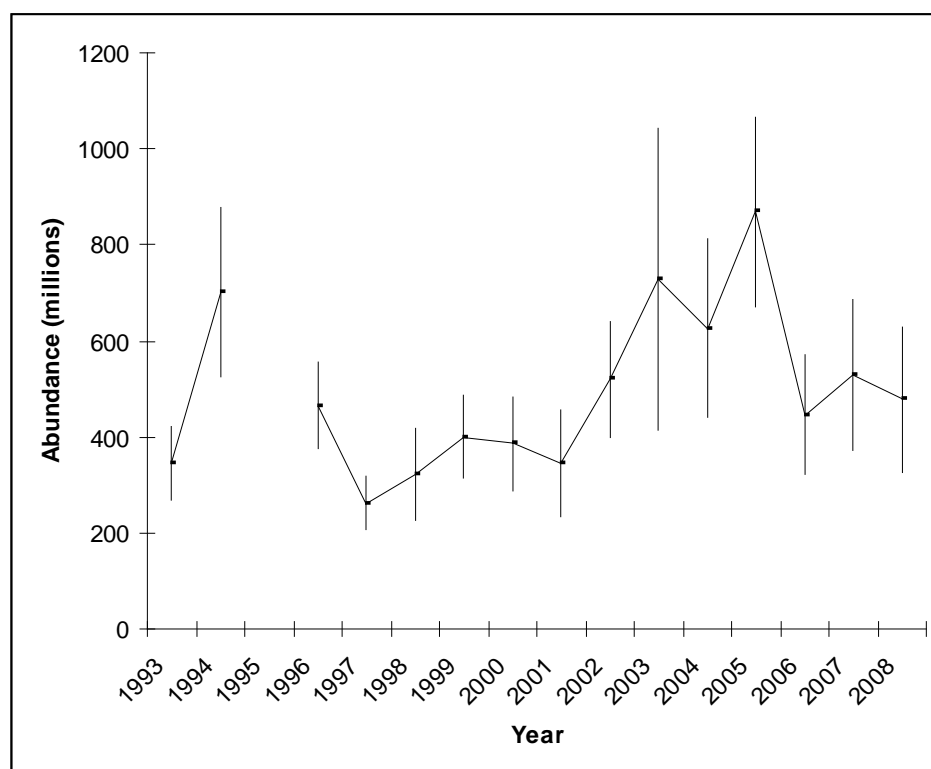
Year	ICES advice	Recommended landings Moray Firth (FU9)	Recommended landings FU9+FU10	ICES landings FU9 <sup>1)</sup>
1987				2.0
1988				2.0
1989				2.6
1990				2.0
1991				1.5
1992			~2.4	1.6
1993			2.4	1.8
1994			2.4	1.5
1995			2.4	1.3
1996	Status quo TAC		2.4	1.5
1997	Status quo TAC		2.4	1.4
1998			2.4	1.0
1999			2.4	1.0
2000			1.85	1.5
2001			1.85	1.4
2002	Catches to be maintained at the 2000 level		2.0	1.1
2003	Catches to be maintained at the 2000 level		2.0	1.1
2004	Catches to be maintained at the 2000 level		2.0	1.3
2005	Catches to be maintained at the 2000 level		2.0	1.6
2006	No increase in effort		-	1.8
2007	No increase in effort, and harvest rate below 15%	2.4	2.64	1.8
2008	No new advice, same as for 2007	2.4	2.64	1.5
2009	No increase in effort and recent average landings	< 1.8		
2010	Harvest Rate no greater than that equivalent to fishing at $F_{2008}$	< 1.4	-- <sup>2)</sup>	

Weights in '000 t.

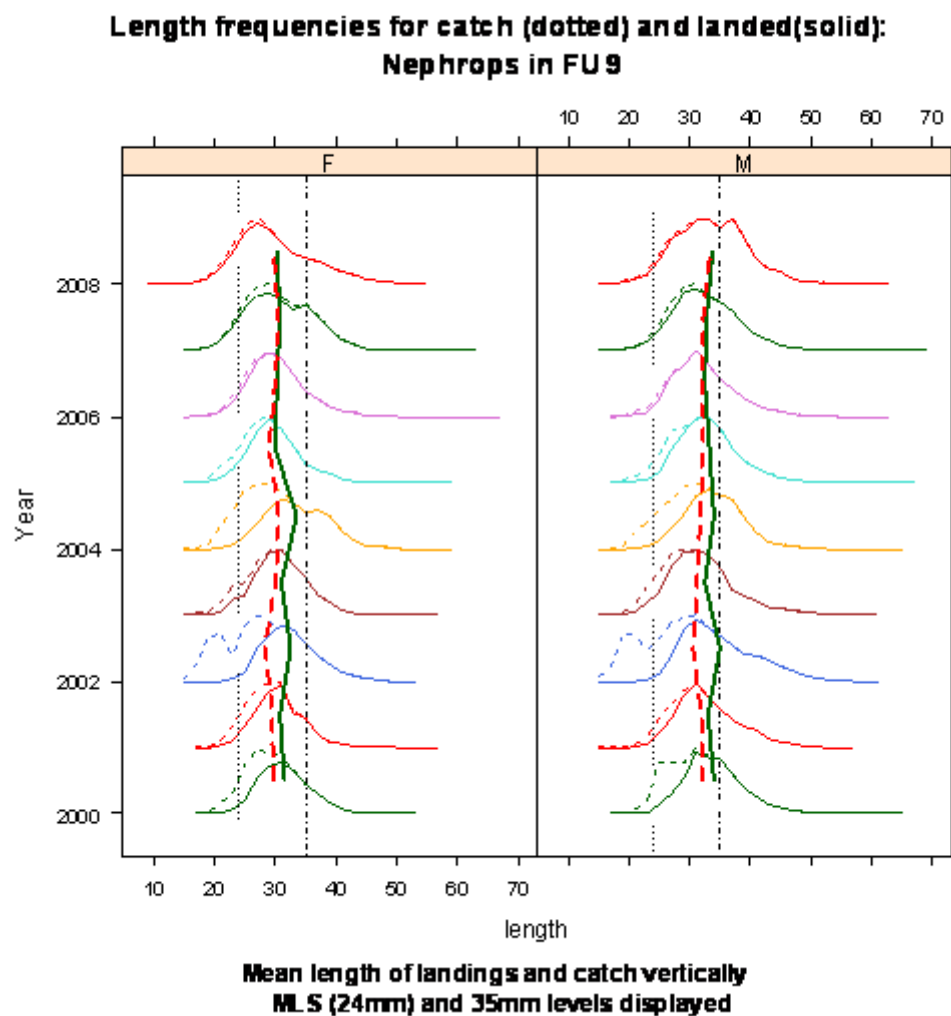
<sup>1)</sup> Does not include discards. <sup>2)</sup> It is not advised to manage these stocks as a single unit.



**Figure 6.4.14.5.1** *Nephrops*, Moray Firth (FU 9). Long-term trends in landings, effort, lpues, and mean sizes of *Nephrops*.



**Figure 6.4.14.5.2** *Nephrops*, Moray Firth (FU 9). Time-series of bias adjusted UWTW survey abundance estimates (in millions), with 95% confidence intervals, 1993–2008



**Figure 6.4.14.5.3** *Nephrops*, Moray Firth (FU 9), Catch length frequency distribution and mean sizes (red line).



**Table 6.4.14.5.2** *Nephrops*, Moray Firth (FU 9). Nominal landings as officially reported (tonnes).

Year	<b>All <i>Nephrops</i> gears combined</b>			<b>Single rig</b>			<b>Multirig</b>		
	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE
1981	1298	36.7	35.4	1298	36.7	35.4	na	na	na
1982	1034	28.2	36.7	1034	28.2	36.7	na	na	na
1983	850	21.4	39.7	850	21.4	39.7	na	na	na
1984	960	23.2	41.4	960	23.2	41.4	na	na	na
1985	1908	49.2	38.8	1908	49.2	38.8	na	na	na
1986	1933	51.6	37.5	1933	51.6	37.5	na	na	na
1987	1723	70.6	24.4	1723	70.6	24.4	na	na	na
1988	1638	60.9	26.9	1638	60.9	26.9	na	na	na
1989	2102	69.6	30.2	2102	69.6	30.2	na	na	na
1990	1700	58.4	29.1	1700	58.4	29.1	na	na	na
1991	1284	47.1	27.3	571	25.1	22.7	713	22.0	32.4
1992	1282	40.9	31.3	624	24.8	25.2	658	16.1	40.9
1993	1505	48.6	31.0	783	28.1	27.9	722	20.6	35.0
1994	1178	47.5	24.8	1023	42.0	24.4	155	5.5	28.2
1995	967	30.6	31.6	857	27.0	31.7	110	3.6	30.6
1996	1084	38.2	28.4	1057	37.4	28.3	27	0.8	33.8
1997	1102	47.7	23.1	960	42.5	22.6	142	5.1	27.8
1998	739	34.4	21.5	576	28.1	20.5	163	6.3	25.9
1999	813	35.5	22.9	699	31.5	22.2	114	4.0	28.5
2000	1343	49.5	27.1	1068	39.8	26.8	275	9.7	28.4
2001	1188	47.6	25.0	913	37.0	24.7	275	10.6	25.9
2002	1526	35.5	43.0	649	27.2	23.9	234	7.9	29.6
2003	1718	41.1	41.8	737	25.3	29.1	135	3.6	37.5
2004	1818	36.9	49.3	1100	29.2	37.7	123	2.5	49.2
2005	1526	37.6	40.6	1309	34.0	38.5	217	3.6	60.3
2006	1718	41.1	41.8	1477	37.4	39.5	241	3.7	65.1
2007	1816	36.9	49.2	1502	32.4	46.4	314	4.5	69.8
2008	1443	30.1	47.9	1125	25.3	44.5	318	4.8	66.3

**Table 6.4.14.5.3** *Nephrops*, Moray Firth (FU 9). Survey indices with and without bias adjustment. Values after 2002 have been adjusted for revised camera parameters

Year	Mean density	Abundance	95% confidence interval	Adjusted for bias	95% confidence interval
	burrows/m <sup>2</sup>	millions	millions	millions	millions
1993	0.19	418.0	94	345	78
1994	0.39	850.0	213	702	176
1995					
1996	0.26	563.0	109	465	90
1997	0.14	317.0	66	262	55
1998	0.18	391.0	115	323	95
1999	0.22	483.8	105	400	87
2000	0.212	466.8	118	386	98
2001	0.19	416.9	135	345	112
2002	0.29	629.7	146	520	121
2003	0.40	882.5	380	729	314
2004	0.35	757.5	225	626	186
2005	0.48	1051.8	239	869	198
2006	0.25	539.1	150	446	124
2007	0.29	641.6	189	530	157
2008	0.26	578.9	183	478	151

#### 6.4.14.6 *Nephrops* in Noup (FU 10)

The advice for 2009 is biannual and valid for 2009 and 2010 (see ICES, 2008).

**Table 6.4.14.6.1** *Nephrops*, Noup (FU 10). Single-stock exploitation boundaries (advice), management, and landings.

Year	ICES advice	Recommended landings Noup (FU10)	Recommended landings FU9+FU10	ICES Landings FU10 <sup>1)</sup>
1987				0.04
1988				0.08
1989				0.08
1990				0.22
1991				0.19
1992			~2.4	0.19
1993			2.4	0.38
1994			2.4	0.50
1995			2.4	0.28
1996	<i>Status quo</i> TAC		2.4	0.34
1997	<i>Status quo</i> TAC		2.4	0.32
1998			2.4	0.25
1999			2.4	0.28
2000			1.85	0.28
2001			1.85	0.18
2002	Catches to be maintained at the 2000 level		2.0	0.40
2003	Catches to be maintained at the 2000 level		2.0	0.34
2004	Catches to be maintained at the 2000 level		2.0	0.23
2005	Catches to be maintained at the 2000 level		2.0	0.17
2006	No increase in effort		-	0.13
2007	No increase in effort, and recent average landings	0.24	2.64	0.15
2008	No new advice, same as for 2007	0.24	2.64 <sup>2)</sup>	0.17
2009	No increase in effort, and average landings 2003–2005	< 0.24		
2010	No new advice, same as for 2009	< 0.24	-- <sup>3)</sup>	

Weights in '000 t.

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

<sup>2)</sup> Based on a 15% harvest rate applied to UWTV survey abundance data. Includes Moray Firth (FU 9).

<sup>3)</sup> It is not advised to manage these stocks as a single unit.

#### 6.4.14.7 *Nephrops* in Norwegian Deeps (FU 32)

The advice for 2009 is biannual and valid for 2009 and 2010 (see ICES, 2008).

**Table 6.4.14.7.1** *Nephrops* in the Norwegian Deep (FU 32). Single-stock exploitation boundaries (advice), management, and landings.

Year	ICES advice	Recommended Landings FU32	TAC Agreed <sup>1</sup>	ICES Landings FU32 <sup>2)</sup>
1987				< 0.1
1988				< 0.1
1989				< 0.1
1990				0.2
1991				0.2
1992				0.2
1993				0.3
1994				0.8
1995				0.5
1996				1.0
1997				0.8
1998				0.8
1999				1.1
2000				1.1
2001				1.2
2002		1.2	No TAC agreed	1.2
2003		1.2	No TAC agreed	1.1
2004		1.5	1.0	0.9
2005		1.5	1.0	1.1
2006	No increase in effort	-	1.3	1.0
2007	No increase in effort	-	1.3	0.8
2008	No new advice, same as for 2007	-	1.3	0.7
2009	No increase in effort	-	1.2	
2010	No new advice, same as for 2009	-		

Weights in '000 t. Norwegian zone of Subarea IV.

<sup>1)</sup> TAC for EU vessels only.

<sup>2)</sup> Does not include discards.

#### 6.4.14.8 *Nephrops* off Horn's Reef (FU 33)

The advice for 2009 is biannual and valid for 2009 and 2010 (see ICES, 2008).

**Table 6.4.14.8.1** *Nephrops*, FU 33 (Off Horn Reef). Single-stock exploitation boundaries (advice), management, and landings.

Year	ICES advice	Recommended Landings FU33	ICES Landings FU33 <sup>1)</sup>
1992		0.87	
1993		0.87	0.2
1994		0.87	0.1
1995		0.87	0.2
1996		0.87	<0.1
1997		0.87	0.3
1998		1.0	0.3
1999		1.0	0.7
2000		1.6	0.6
2001		1.6	0.8
2002		2.1	0.9
2003		2.1	0.9
2004		2.38	1.3
2005		2.38	1.1
2006		2.38 <sup>2)</sup>	1.3
2007	No increase in effort	-	1.5
2008	No new advice, same as for 2007	-	1.4
2009	No increase in effort	-	
2010	No new advice, same as for 2009	-	

Weights in '000 t.

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

<sup>2)</sup> Includes Farn Deepes (FU6).