ICES WGCRAN Report 2007

ICES Living Resources Committee
ICES CM 2007/LRC:08

Report of the Working Group on *Crangon* Fisheries and Life History (WGCRAN)

22–24 May 2007

Helgoland, Germany

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

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Recommended format for purposes of citation:

ICES. 2007. Report of the Working Group on Crangon Fisheries and Life History (WGCRAN), 22–24 May 2007, Helgoland, Germany. ICES CM 2007/LRC:08. 40 pp.

 https://doi.org/10.17895/ices.pub.8731

Contents

1 Executive summary and statement from WGCRAN Chair

Landings

The Working Group on *Crangon* Fisheries and Life History (WGCRAN) 2007 meeting was successfully held in AWI, Helgoland, Germany in May 2007. Members from Denmark, Germany, the Netherlands, Belgium and the UK were in attendance. The effort and landings statistics for the *Crangon* directed fleets in these countries were updated for 2006. We note that Germany and the Netherlands continue to dominate the fisheries, with each of these nations landing around 15,000 tonnes of *Crangon* in 2006. Denmark, the UK, Belgium and France together caught and landed the remaining 5,000 tonnes, thus totalling around 45,000 tonnes landed from the North Sea.

Progressing towards a biomass estimate of North Sea C. *crangon*

We (WGCRAN) have successfully progressed further in 2006–2007 towards making an estimate of the stock biomass of *C. crangon* in the North Sea. This work was primarily undertaken by colleagues from the Netherlands (Tulp and Cremer) and the results are detailed in this report. During this forthcoming year we aim to further refine and improve upon this estimate as more information becomes available.

Other issues

We note that research on the *C. crangon* fisheries is underway in several nations and describe some of that important work herein. In the recent UK, a review was undertaken of the efficacy of existing technical measures which are currently used in the *C. crangon* fisheries to reduce discards. This review indicates that the existing technical measures are the best available, but are only partially successful in reducing discards. The study indicates the need for the developments of further measures to reduce discards beyond current levels and suggest that the Belgian electric-shrimp beam–trawl may offer a potential future solution. The same UK study also provides some useful quantitative data on technical creep in these fisheries during the last decade.

Colleagues in Germany continue to develop innovative biological models related to *Crangon* (at the University of Hamburg) whilst their counterparts in the German Federal Institute continue to improve, expand upon and make better use of extensive *Crangon* survey data that is routinely conducted each year. This work is partly done in close collaboration with colleagues from the Danish institute.

While our Dutch colleagues continue to improve and develop the *C. crangon* biomass estimates, colleagues from Belgium are progressing with the development of innovative technologies to harvest brown shrimp by using an electric shrimp beam trawl.

Altogether the WGCRAN continues in its tradition as a small but highly active and innovative working group.

Comments on the review of the environmental impacts of C. *crangon* fisheries by WGECO 2007

WGECO made a substantial and much appreciated effort to review the impacts of the *crangon* fishery on benthic habitats and the marine ecosystem. There were however, some statements made in the report, which are either incorrect or give a misleading picture of the *C. crangon* fisheries. We briefly comment on these errors (see Section 4).

2 Terms of Reference for the WGCRAN 2007 meeting

The Working Group on *Crangon* Fisheries and Life History [WGCRAN] (Chair: A. Revill, UK) met in AWI, Helgoland, Germany during the week of 22–24 May 2006 under the following terms of reference. Details of progress made are also shown:

a) update landings and effort data;

b) make progress with the swept area estimate of *Crangon* biomass in the North Sea;

c) initiate a new time series of the number of active vessel in fishery for each nation;

d) review of MSC certification process;

e) review recent *Crangon* R & D activity.

3 List of participants at the WGCRAN 2007 Meeting

A complete list of participants to the WGCRAN meeting is listed in Annex 1 of this report.

4 Comments on Section 7 of the report of WGECO: Review and report on the impacts of *Crangon* shrimp beam trawling on benthic habitats and the marine ecosystem in the North Sea (2007)

In 2007, WGECO made a substantial and much appreciated effort to review the impacts of the *crangon* fishery on benthic habitats and the marine ecosystem. We conclude that there are some statements made in the report, which are either incorrect or give a misleading picture of the *C. crangon* fisheries and we briefly refer to these errors.

NB: Reference numbers are as cited in WGECO report 2007

7.2.2.2 Crangon as a forage species

"Crangonids contributed between 2% and 14% of the food consumed by Norway pout, being most important to the smallest (12–14cm) and largest (20–22cm) sized fish examined. The proportion of Crangonids in the diets of grey gurnards and long rough dabs was clearly related to predator length; varying from 0% in the diets of the largest gurnards examined (35–40cm) to 20% in the smallest gurnards and from 15% in the diets of the smallest long rough dab to 0% in long rough dab of greater than 25 cm in length."

WGCRAN comment: The role of "*crangon*" as a forage species can not be deduced from an analysis of "crangonids" in fish stomachs, since there are two main ecologically important species of *crangon*: the commercially fished *C. crangon* and the smaller, commercially unimportant *c. allmanni*. The latter lives in deeper water and has a more northerly distribution, while *C. crangon* is mostly concentrated in shallow southern waters of the North Sea. Furthermore, other crangonid shrimp species, such as *Pontophilius / Philocheras* spp. regularly occur in North Sea shrimp survey catches and will also be prey species.

The above cited figures for predators Norway pout, grey gurnard and long rough dab will therefore most likely refer to *C. allmanni* and other crangonids. *C. crangon* was mostly preyed upon by whiting and cod, when these stocks were high in the 1970s and 1980s. The decrease of this predation impact due to the over-fishing of the predator stocks has released a lot of production of the *C. crangon* stock that became therefore available to other predators and the fishery. Rough estimates of the order of magnitude of these changes are available from Temming *et al*. (2000) and Wellemann and Daan (2001).

7.2.2.3 Crangon stock

"in the UK the landing statistics make no distinction between brown, pink and deepwater shrimp"

WGCRAN comment: Since the mid 1970s the shrimp species are separated in the UK statistics.

7.2.3.1 bycatch

The bycatch of juvenile fish in the North Sea shrimp fisheries has been identified as a major cause for concern. It has been suggested (e.g. Anon 2005; Horwood, 2000) that the Crangon fishery, as one of the demersal fleets not included in the restrictions, may be detrimental to the achievement of the objectives of the North Sea Plaice Box (see Figure 7.2.3.1.1), which was established in 1989 to protect juvenile sole and plaice.

WGCRAN comment: There is consensus, that the shrimp fishery discards young plaice in high numbers. This problem has existed also prior to the introduction of the box and technical measures such as sieve nets have become mandatory in this fishery. However, the main problem in achieving the objectives of the Plaice Box was the rapid growth of a segment of cutters targeting plaice in the Plaice box, which were designed to meet exactly the hp restrictions set for this area (Euro cutters). To make things worse these hp limits were repeatedly and on purpose exceeded by means of technical modifications of over-dimensioned cutter engines. Over time an increasing number of these plaice targeting Euro cutters shifted due to lack of plaice quota into the crangon fishery and contributed thereby to an increase in the effort of the crangon fishery. With this effect subtracted, the increase of the effort in the traditional shrimp fishery was most likely moderate. A few new vessels were added in the Danish fishery. This suggests that the total plaice discard of the traditional shrimp fishery has most likely not increased over the period in question. However, reliable figures on the effort development of the crangon fishery are missing for large parts of the fleets.

7.2.3.2 Discarding

"We are not aware of any studies on the discards of non-commercial fish species for the shrimp beam trawl fisheries in the North Sea."

WGCRAN comment: This issue has been studied over 35 years by Tiews (1990) and within a variety of national and EU studies, e.g. the RESCUE project (v. Marlen *et al*., 1997)

7.2.3.2 Discarding

"Conversely, species with a clearly estuarine distribution, such as Flounder (Platichthys flesus) and Age 0 Plaice (Pleuronectes platessa), were found in much higher numbers in the catches of the German and UK trawlers, which mostly operate on the inshore and estuarine shrimp fishing grounds in respectively the Waddensea and the Wash and Humber estuaries. Most striking were the large numbers of juvenile Plaice caught in the German shrimp fishery and high numbers of juvenile Dab (Limanda limanda) caught all over the North Sea."

WGCRAN comment: This statement, which originates from the RESCUE-project report, needs clarification. During that project no data were generated for the Dutch fleet. Results from Belgian and Danish waters were used to estimate the Dutch discard levels and species composition. However, the true Dutch discard data will to a large part resemble those of the German fleet, since both fleets have large segments of smaller boats fishing in the Wadden Sea and close to the coast. A graph that details the Dutch fishing grounds can be found in Temming *et al*. (2000).

7.2.4.1.1 Sea grass beds

"In some areas, Crangon is caught in inter-tidal and shallow sub-tidal habitats, either by beam trawl towed by horse or tractor or by wading at low water using a push net. In the UK, the principal coastal fisheries bordering the North Sea are in the Wash and the Thames estuary."

WGCRAN comment: The described fishing pattern is not of any relevance in the North Sea in present times. There is also no more crangon fishery in the Thames estuary.

7.3 Ecologically important impacts

"Whilst acknowledging the paucity of studies on many of the environmental impacts of shrimp beam trawling on the structure and function of the North Sea, WGECO considered that the removal of Crangon was likely to be the most important ecological impact of the fisheries due to the functional importance of Crangon as a predator and forage species (Section 7.2.2). Evidence to support this conclusion is inferred from studies on Crangon ecology and fish stomach data."

"Based on limited evidence, the direct effects appear minimal on both epi-benthic and in-faunal invertebrates, whilst the indirect effects are related to the removal of Crangon as a structuring component of some benthic communities (Section 7.2.5)."

WGCRAN comment: In the absence of reliable information on changes of mean biomass and production such statements have little foundation. Any speculations about consequences of the food web effects of crangon removal can not be made in isolation of a consideration of the effects of the released predation pressure on crangon due to collapsed predator stocks. Based on the available figures this effect was stronger than the increase in landings.

5 ToR a) Update of landings and effort data

5.1 Overview – Germany

German landings of consumption shrimp (*C. crangon*) have levelled down to 14,351 tonnes in 2006, which is a reduction of 15% compared to landings from 2005, which were at the highest level ever recorded. The seasonal distribution of the landings followed the standard pattern, i.e.: very low landings in winter, increasing in spring, with a light depression in June/ July and a strong autumn fishery. The extension of the main fishing season in autumn into November / December was visible again. Also the majority of brown shrimp landings originated from much of the Inner German Bight, i.e. the Jade-Weser, the Elbe estuary and north towards the peninsula of Eiderstedt. Further north in the North Frisian Islands and west in the East Frisian Islands, catches were very low. Therefore the fleets concentrated in the south east of the German Bight during the main season in the second half of the year. However, in winter the active part of the fleet mostly left the near coast areas and fished further off shore as well as in the north within Danish waters.

The newly formed international producer’s organisation incorporating *Crangon* fishers from Denmark to the Netherlands established in 2005 tries to stabilise prices by temporary self imposed landing-limitations. However, only about half of the fleets are affiliated to that PO which is therefore not very effective as non-members benefit form higher landings and possibly higher prices.

Landings might therefore have been a bit lower than they would have been without the PO´s catch limitations. The main point is, however, that not only the total landings have decreased but also LPUE values indicating a slight reduction in stocks as well.

5.2 Overview – The Netherlands

Total effort in the Netherlands in 2006 was 4.4 million hp-days. This value is in the same range as the period since 1988. Total landings amounted to 15,513 ton. This value is slightly lower than 2005 but still substantially higher compared to the period before 1995. The large landings are likely to be caused by the ban on price agreements between shrimp fishers, resulting in extremely low prices. Landings and effort show peaks in March to May and September to November.

LPUE is increasing since 2002, but seems stable in the last two years, which is a pattern that is not restricted to the Dutch shrimp fisheries but also appears in the Danish and German fisheries. The LPUE values are generally much higher in autumn than in spring. The mean number of hp days divided by the mean number of days at sea results in the mean hp value per vessel. This value has increased in the late nineties but has remained constant in the period since 2000 at around 270 hp.

The number of vessels landing brown shrimp is fairly constant in the period 1995 to present with ± 210–230 vessels landing into Dutch harbours (that includes only vessels that land >1 ton per year).

5.3 Overview – Denmark

The annual and monthly Danish landings of *C. crangon* and by other EU-vessels are reported by the industry. The data on landings from Danish waters are given for 2006 and the Danish landings amounts to 4,236 tonnes and the landings by other EU-countries were 3,208 tonnes. These landings are included in the respective national figures. The Danish landings increased in 2006 compared to 2005 by 1% and to 2004 by 27%.

Based on logbook information the reported catch, effort and LPUE for the Danish fleet is given. In 2006, 28 Danish vessels fished and landed *C. crangon*. Total fleet effort decreased from around average 842,249 (hp-days) in 2005 to 715,508 in 2006. The LPUE the previous 12 years was in average 2.14 and increased to 5.78 Kg/hp-day in 2006. The highest landings took place in September, October and November months and during the summer and winter months the landings were lower except for April where the landing was comparable to the autumn levels. The Danish effort is accordingly high in spring and in autumn.

Danish LPUE's were 2006 high in both the second and the fourth quarter in 2006. Similar to the previous years, a large number of German vessels (43) and Dutch vessels (73) too fished shrimps in Danish waters and landed the catches in Danish harbours.

A couple of Belgian vessels have also in 2006 been fishing and landing *C. crangon* in Danish waters. Their landings although only represent 0.1% of the total landings. The effort and LPUE data for the other EU countries are based on logbook information from the respective EU-Countries.

5.4 Overview – United Kingdom

The Wash fishery in the North Sea is the source of ~90% of the recorded landings for the UK with ICES squares F034 and F035 the most important areas for the UK *Crangon* fishery. Annual landings of *Crangon* have been variable over time with a recent trend of decreased landings since 2001, which was the year of the highest recorded landings (1 865 tonnes). UK landings in 2004 and 2005 were ~500 t in each year but the annual landing for 2006 was ~430 t, the lowest value since 1992. Lower landings in recent years have been attributed to the low prices in the mainland European market combined with high fuel prices in the UK. However, the low landings in 2006 are in part due to the success of The Wash cockle fishery (*Cerastoderma edule*), which provided a better economic alternative for much of the shrimp fleet.

Since 1989, effort information in terms of hp-days is available for over 80% (and up to 99%) of the recorded landings. Total effort was estimated from the ratio of total landings to observed LPUE. Estimated total effort for 2004 and 2005 are lower than in previous years in line with landings at just over 500,000 hp-days. Estimated effort for 2006 was only ~250,000 hp-days because of the redirected effort into the alternative cockle fishery.

5.5 Overview – Belgium

Crangon landings by Belgian shrimp trawlers into Belgian harbours amounted 407 tonnes for the year 2006. The associated effort was 6.2 million hp-days. The seasonal distribution of the landings followed the standard pattern, i.e.: very low landings in winter, increasing landings in spring and summer, ultimately followed by a very strong autumn fishery. Landings by the Belgian fleet have been declining over the last thirty years. They have been below 1,000 tonnes since the mid eighties. Prior to this period landings ranged between approx. 1,000 and 1,800 tonnes.

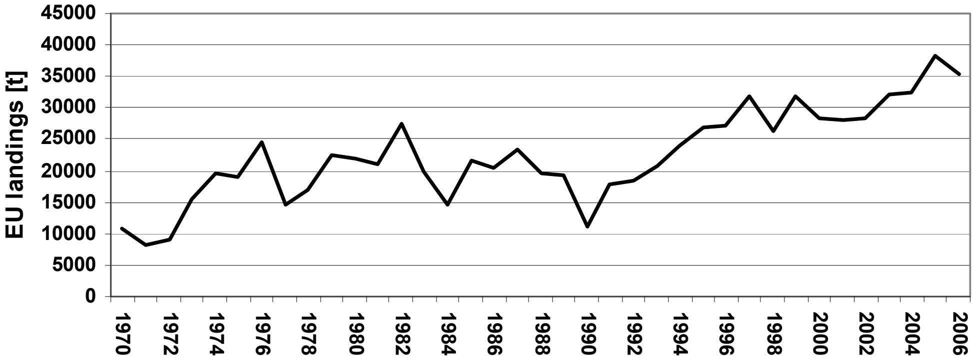
It has to be borne in mind that all data refer to landings (and associated effort) by Belgian shrimp trawlers into Belgian harbours only. Landings into foreign ports thus are not included. Over the past years however, these have been of major importance. In some years they even exceeded the landings into Belgium. These figures were not included in previous landing statistics of the Working Group.

Up to the late 1990s, almost all landings into Belgian harbours came from the Belgian coastal waters. In recent years however, there has been a shift to the North, with a considerable part of the landings into Belgium now coming from the Southern Dutch coast and sometimes even as far North as the Danish coast. In the past, the LPUEs in the tables could be considered as being a reasonable index of the relative abundance of brown shrimp in the Belgian coastal waters, but because of the spatial shift in exploitation, this no longer is the case.

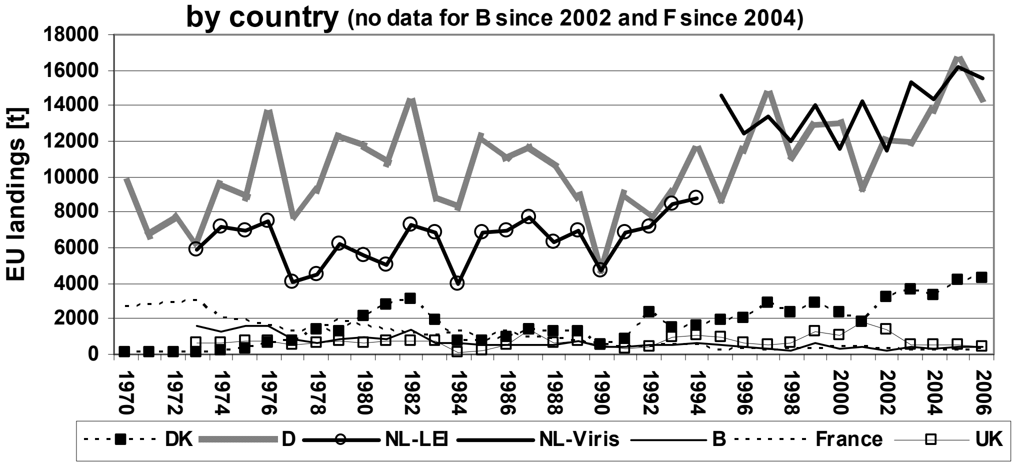
Current revision and quality-check of the landings and effort data coming from the Belgian administration brought up quite some inconsistencies. The decision was now made to set up a completely new validation system and to apply this retrospectively to all years in the database (i.e. back to 1990). This is a long process, but should be finalized by next year’s meeting.

5.6 Total EU landings of *C. crangon*

Total landings of C.crangon from the North Sea [t] by all countries (no data for B since 2002 and F since 2004)



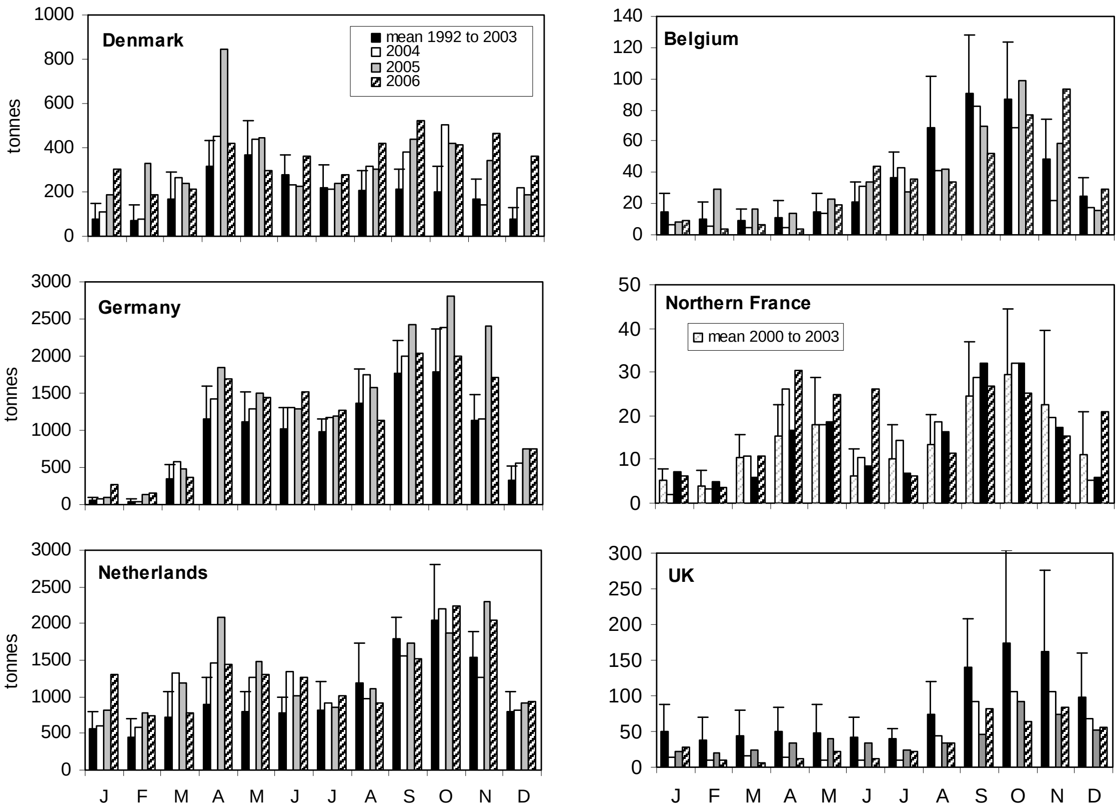
Total landings of C.crangon from the North Sea [t] by country (no data for B since 2002 and F since 2004)



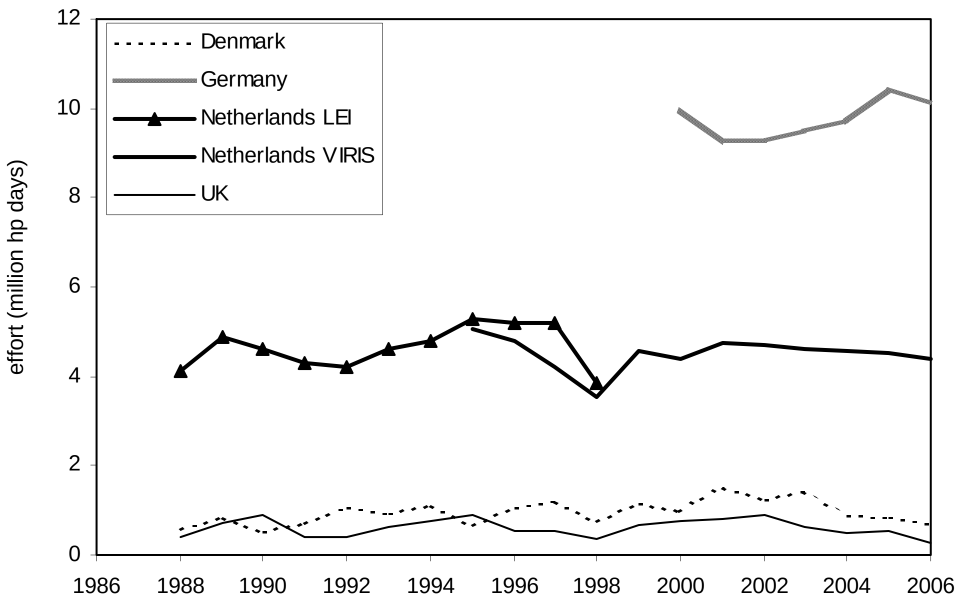
Legend:

All data are in landed (cooked) weight
DK official statistics
DE official statistics
NL-VIS from Producer organisations (inclusion of foreign landings unclear)
NL-VIRIS source VIRIS log book data (1995-2003) including landings in foreign harbours
BE official statistics
FR official statistics (France IV+VIId)
UK official statistics, including Irish sea landings

5.7 Seasonal EU landings of *C. crangon*



5.8 Total fleet effort in the EU *C. crangon* fishing fleets

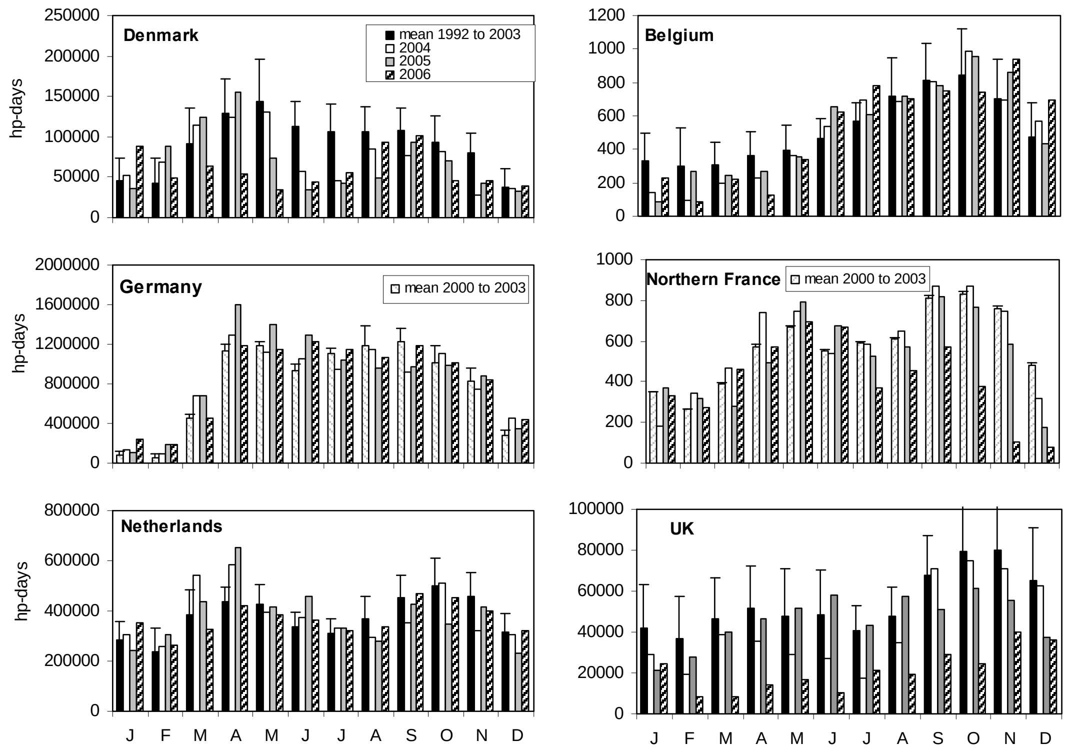


Legend:

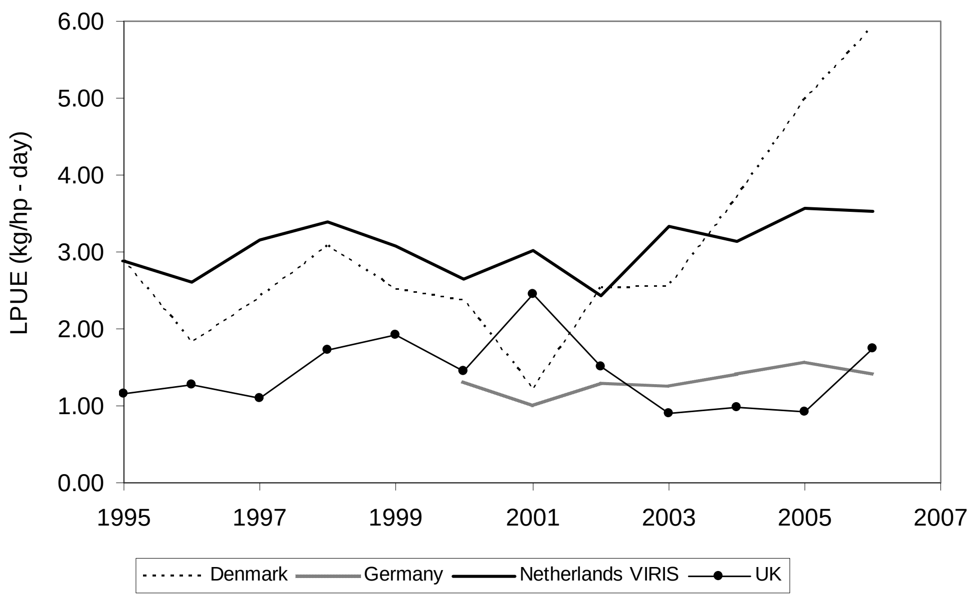
Netherlands LEI based on data collated by LEI institute

Netherlands VIRIS based on VIRIS data

5.9 Seasonal fleet effort in the EU *C. crangon* fishing fleets



5.10 Landings per unit effort in the EU *C. crangon* fishing fleets



6 ToR b) Progress made with the swept area estimate of *crangon* biomass in the North Sea

6.1 Swept area estimate of *Crangon crangon* stocks in the North Sea

Ingrid Tulp and Jenny Cremer

In the 2006 report of WGCRAN we formulated that we intend to produce swept area estimates of *C. crangon* biomass and its distribution, thus improving our biological understanding of this species while providing a useful tool for management. This year we made a first effort.

6.1.1 Methods

Surface areas per DFS area code and depth stratum (0–5 m, 5–10 m, 10–15 m, 15–20 m, 20–25 m and 25–30 m) were calculated in ARCGIS. To enable coverage the entire international Wadden Sea and adjacent coastal areas, we made a combination of Dutch, German and Danish datasets.

Data from the Dutch Demersal Fish Survey (DFS) were used to produce estimates of densities of *Crangon* by DFS area code (Figure 6.1) and 5 m depth strata. Densities were calculated for commercial size class (> 54 mm) of *Crangon* caught. Total stock abundance was estimated by the sum of the stratified arithmetic means of the catch weights multiplied by the surface of each depth stratum. The catchability of the gear is assumed to equal 1. Catch numbers by size class (mm) were converted to weights (g) according to the length-weight relationship $W= 2x10^{-6}xL^{3.3119}$ in all areas representative sampling starts from 2 m depth onwards. Therefore tidal flats are excluded in the calculation. Missing values (combinations of areas and depth strata) were imputed using the program TRIM (Pannekoek and van Strien, 1998).

6.1.2 Results

The distribution of the surface areas per depth strata differ among the DFS areas (Figure 6.2). Total biomass estimates shows strong year-to-year variations and varied between 5000 and 35000 tonnes in the period since 1970 (Figure 6.3). The long-term average is 17000 tonnes. Biomass estimates of *Crangon* >54 mm vary between 2000 and 17000 tonnes, with an overall long-term mean of 7000 tonnes (Figure 6.4).

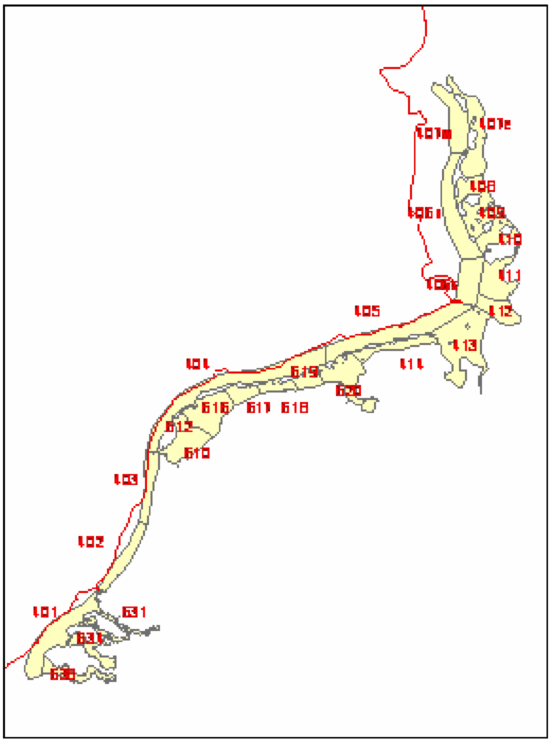


Figure 6. 1. DFS areas used. The red line is the 20 m depth line.

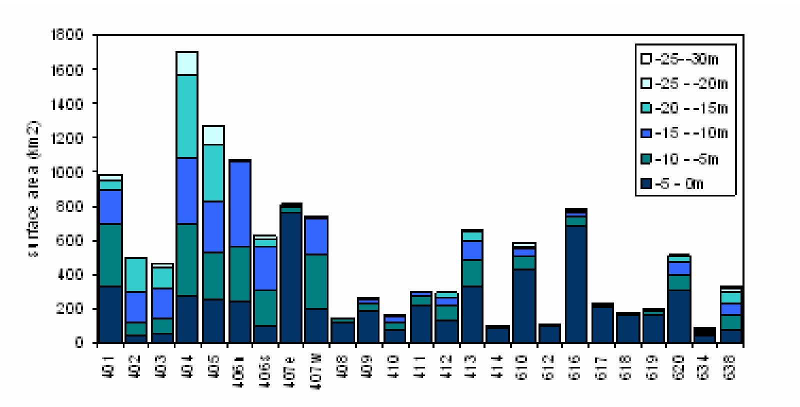


Figure 6.2. Surface area per DFS area code.

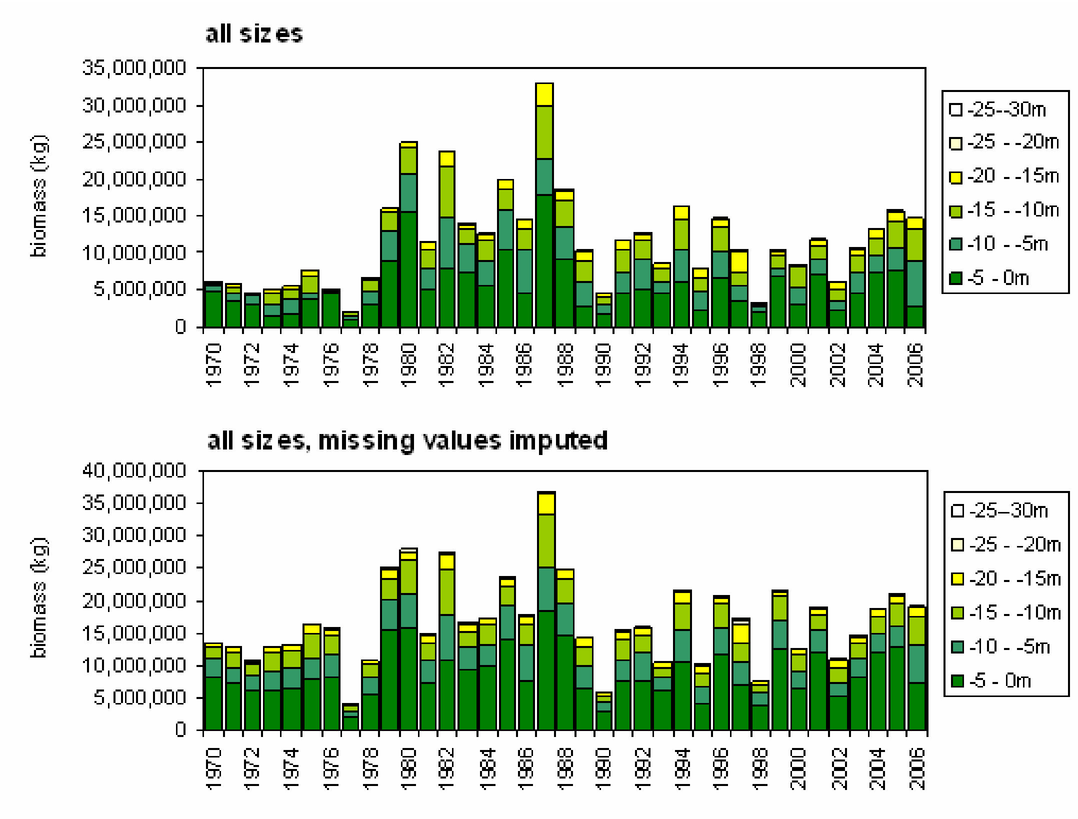
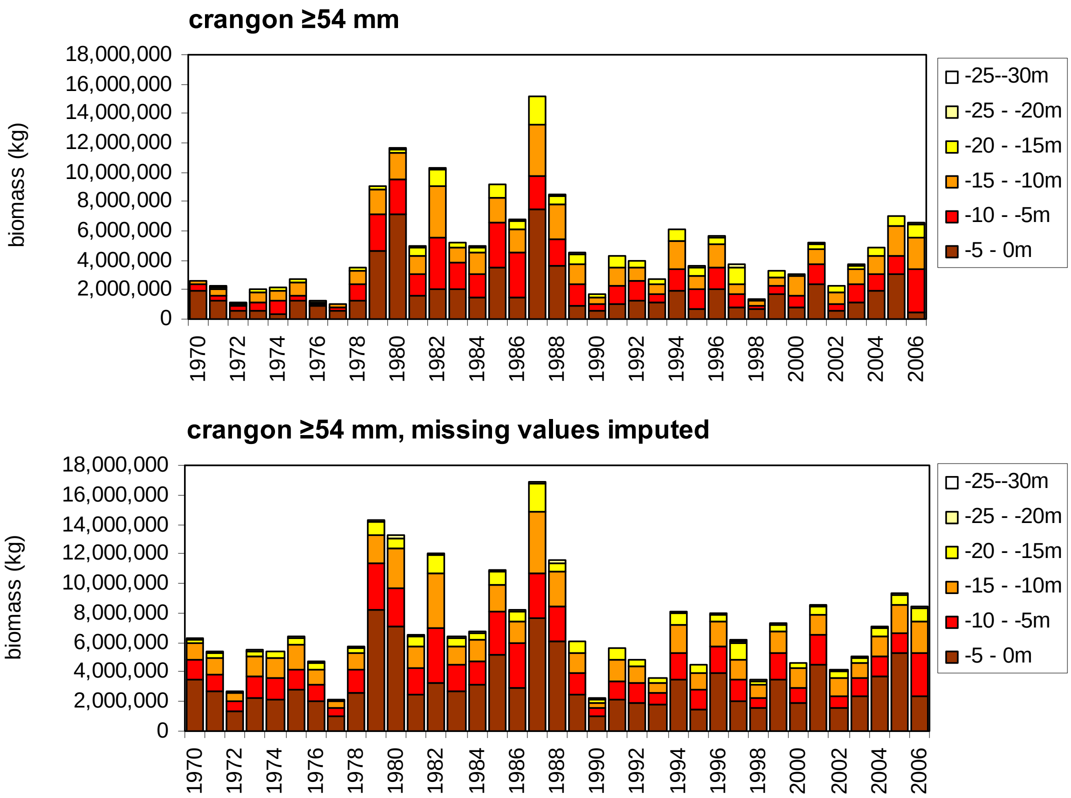


Figure 6.3. Results of swept area estimates without (upper panel) and with corrections for missing area depth class combinations (lower panel).



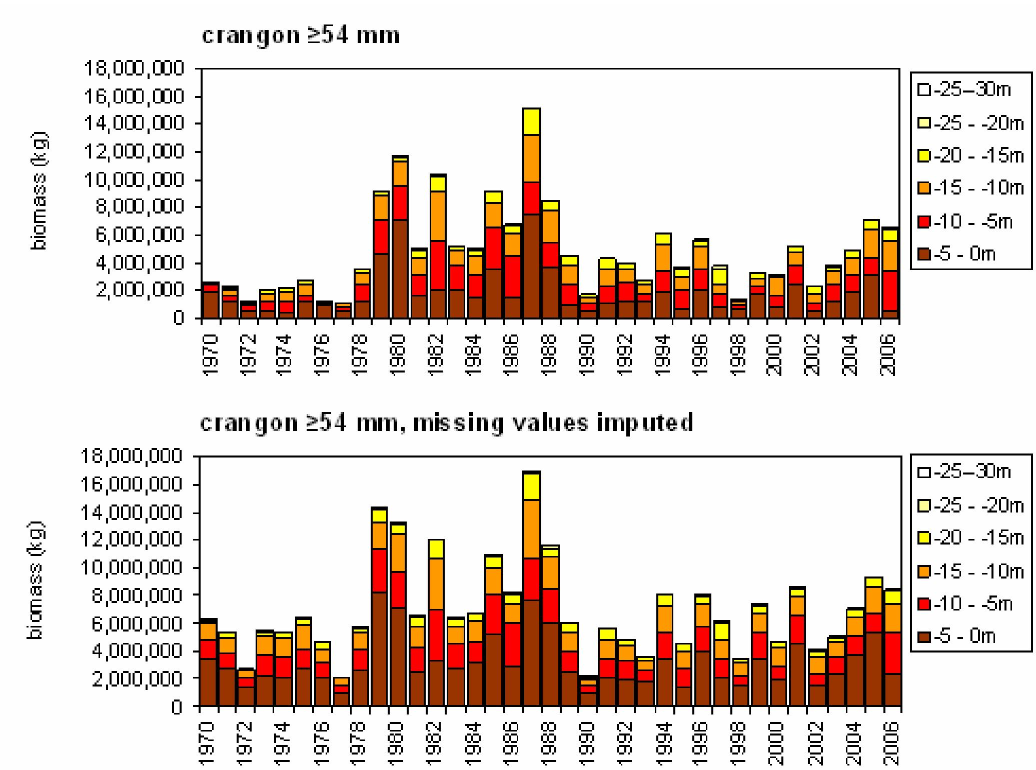


Figure 6.4. Results of swept area estimates for *Crangon* ≥54mm without (upper panel) and with corrections for missing area depth class combinations (lower panel).

6.1.3 Discussion

The total biomass estimates are considerable lower than estimated by (Welleman and Daan, 2001), who arrived at a long-term mean of 25,000 tonnes. Since it is based on the same data, the cause for this difference must be methodological. One difference is our use of a more up to date LW relationship. Welleman and Daan (2001) used (van Lissa 1977). The latter results in 13% higher biomasses for *Crangon* of 54 mm. From measurements we know that LW relationships can vary considerable between years and sites. From the study of Welleman and Daan (2001) it is also not clear to what surface area they extrapolated the density values. Also they used a rather crude way of estimating missing values. The resulting biomass values are therefore quite sensitive to the way of calculation.

The swept area estimate could be improved in various ways:

- Include data from the German Bight, Danish coast (north of the Horns Reef) and Belgian coast. The Dutch DFS does not include the German Bight, Danish coast nor the Belgian coast. Data from these areas are available and can be used to improve the estimate
- Include data from deeper areas. Currently the area covered by the estimate only covers part of the fishing area. There are very limited data from further offshore. The Dutch Sole Net Survey samples further out, but with a different gear and mesh size that is too wide to sample Crangon correctly.
- Include a better estimate of gear efficiencies
- Include a better estimate of catchability (presently assumed to be 1.0)

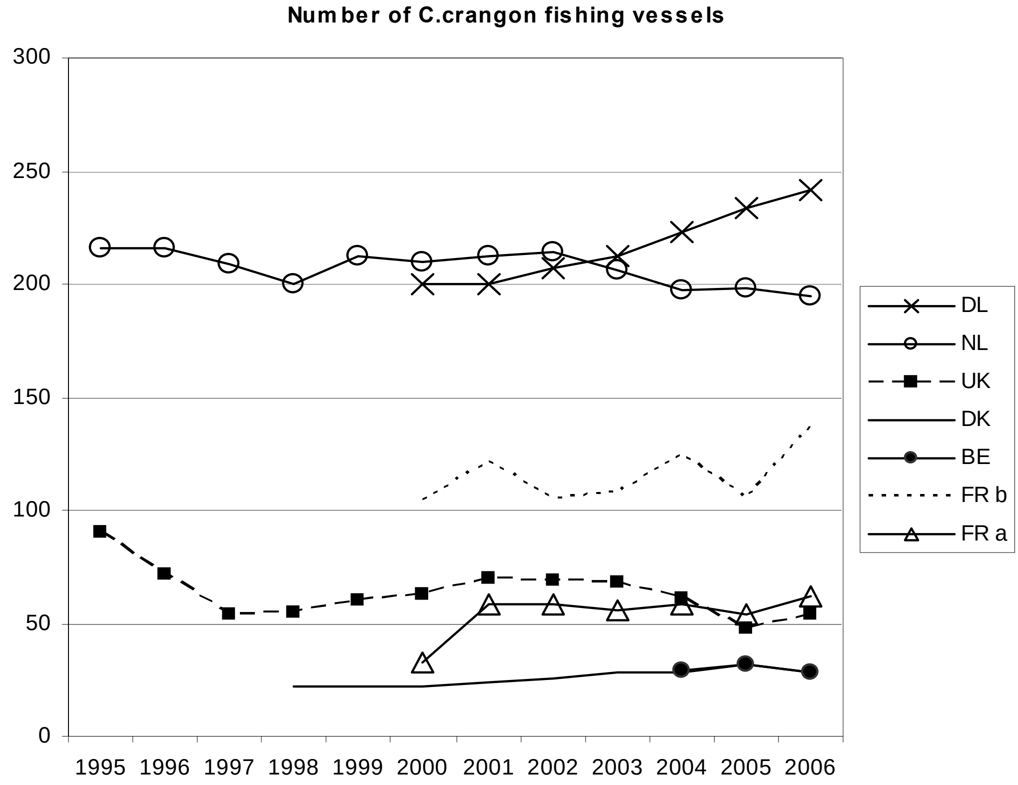
6.1.4 References

Pannekoek, J., and van Strien, A. 1998. TRIM 2.0 for Windows. (Trends and Indices for Monitoring data). Voorburg/Heerlen.

van Lissa, J. H. L. 1977. Aantallen, voedslopname, groei en produktie van de garnaal (*Crangon crangon* L.) in een getijdengebied, alsmede de voedselopnaem en groei onder laboratoriumomstandigheden. Intern Report. Den Burg.

Welleman, H. C., and Daan, N. 2001. Is the Dutch shrimp fishery sustainable? Senckenbergiana Maritima, 31: 321–328.

7 ToR c) New time series – Number of active vessels in the EU *C. crangon* fisheries



Legend

DL	Threshold one tonne
NL	Number of Dutch vessels landing CSH into The Netherlands (>1t per year per vessel)
BE	2004 only 3 vessels catching Crangon all year in 2005/06 one vessel catching Crangon
FR a	French vessels Area IV and VIIId only – from log book data
FR b	All French vessels – from log book data
UK	UK figures may be an under-estimate

8 ToR d) Review of Marine Stewardship Council (MSC) certification process which is underway in the Dutch *C. crangon* fisheries

Very little information was available on the progress on the MSC certification of the Dutch *C. crangon* fisheries. No-one from the certification body was able to attend the WGCRAN meeting to provide an update. Various workers had indicated that the MSC certification process was still in its early stages and a final outcome had not been determined.

9 ToR e) Summary of recent *Crangon* research and development activities

9.1 UK – An evaluation of the efficacy of technical measures introduced in the *Crangon* fisheries

In January 2003, legislation was introduced requiring all fishers in the European *Crangon crangon* (brown shrimp) fisheries to use selective gear (sieve net or selection grid) that reduces the incidental bycatch of juvenile commercial fish species. Each member state was responsible for implementing their own legislation enforceable within their national waters. The efficacy of the UK legislation, The Shrimp Fishing Nets Order was evaluated in a multidisciplinary study using social, biological and economic methods.

The social analysis was used to identify changes in fleet structure (Tables 9.1.1, and 9.1.2) and fishing patterns since the legislations introduction and the extent of compliance and enforcement. A survey of the fleet, first conducted in 1995 was repeated in 2006, at which time, interviews with fishers and with enforcement officers were also conducted.

Table 9.1.1. Specifications and fishing patterns of UK brown shrimp fleet in 1996 and 2006.

	1996 (N=78)			2006 (N=35)		
VESSEL SPECIFICATION	MIN	MAX	MEAN	MIN	MAX	MEAN
Length overall (m)	6.8	19.1	11.9	9.4	17.9	12.3
Main engine power (KW)	22	223	112	46	226	149
Gearbox ratio (x:1)	2	5	2.6	2	5	2.9
Fuel tank (litres)	45	10,000	1558	168	10,000	3,097
Beam length (m)	3.6	9	5.9	4	9	6.4
Fishing pattern						
Days shrimp fishing per yr	30	275	131	6	270	147
Tows per day	3	12	5.8	3	14	7.1
Duration of tow (hrs)	0.5	2.5	1.3	1	3	1.6
Towing speed (knots)	1	4	2.3	1	4	2.5

Table 9.1.2. Percentage number of vessels with various wheelhouse and deck equipment in 1996 and 2006.

VESSELS WITH	1996 (%)	2006 (%)
Twin beams	88	100
Shaking sieve	85	74
Rotary sieve	33	40
Power take off	73	81
Vhf	100	100
Autopilot	46	82
Fish finder	42	74
Colour echo sounder	52	82
Ground discrimination	13	26
Track plotter	40	94
Radar	90	100

There was evidence of strong compliance with The Shrimp Fishing Nets Order. In 2006, 91% of skippers reported using sieve nets. No vessels used selection grids. Some skippers disabled the sieve nets when weed was prevalent and some modified the exit hole to retain marketable fish. The full extent of this non-compliant behaviour could not be ascertained. The high level of compliance by UK skippers was apparent despite a low level of enforcement.

The biological analysis evaluated the performance of commercially used selective gear and also identified changes in fish stocks of bycatch species. A total of 106 hauls were sampled in 2006/2007 on board five commercial vessels. Catch comparison trials were conducted whereby the sieve net in one of two beam trawls was disabled. The sieve was cut away from the exit hole and the hole was closed ensuring the sieve net did not affect the escape of organisms from the trawl.

For each haul, the proportions of plaice, whiting, dab and cod at-length in the trawl without the sieve relative to the total number caught by both the trawls (the split parameter) were analysed using glmmPQL. An equivalent glmm analysis was performed on data from these previous gear trials of the experimental sieve designs. Percentage differences between the total catch numbers for the beam with the sieve and without were calculated for all other species (Table 9.1.3) Estimates of recruitment were taken from ICES reports and local density estimates from the English Young Fish Survey.

Table 9.1.3. Numbers of the most common species caught in trawls with and without sieve nets and % reduction in total number from all hauls when using sieve nets.

Species	Common name	% Hauls present	No sieve Mean	Sieve Mean	Overall % Reduction
Pomatoschistus minutus	Sand goby	100	647±966	492±647	24
Pleuronectes platessa	Plaice	99	307±337	206±244	33
Merlangius merlangus	Whiting	96	99±96	72±71	27
Clupea herengus	Herring	92	171±324	141±264	17
Limanda limanda	Dab	82	103±139	57±100	45
Sprattus sprattus	Sprat	78	142±231	113±176	20
Agonus cataphractus	Pogge	74	22±43	10±26	53
Osmerus eperlanus	Smelt	72	70±174	74±222	-6
Carcinus maenas	Shore crab	65	57±123	16±36	71
Gadus morhua	Cod	60	19±49	5±13	70
Syngnathidae	Pipefish	60	37±70	32±72	14
Platichthys flesus	Flounder	59	9±29	2±7	72
Pegusa lascaris	Sand sole	54	16±34	9±18	40
Liparis liparis	Sea-snail	52	14±46	2±4	83
Taurulus spp	Scorpion fish	36	3±11	0.7±2	73
Liocarcinus spp	Swimming crab	35	79±451	15±84	81
Asterias rubens	Starfish	33	4±10	2±4.9	51
Ophiothrix fragilis	Brittlestar	18	8±30	5±18.7	28
Dicentrachus lebrax	Bass	18	5±23	4±15	26
Echiichthys vipera	Lesser weaver	18	3±12	0.8±3	66
Sepiola atlantica	Little cuttlefish	14	3±10	3±7.8	-4
Macropodia spp	Tiny spider crab	13	0.8±3	0.3±1.4	59
Solea solea	Sole	13	0.3±1.1	0.04±0.3	86
?Gaidropsarus vulgaris	3 bearded rockling	11	0.6±2	0.2±1.2	48
Raja clavata	Thornback ray	11	0.2±0.6	0.01±0.1	92
Lycodes esmarkii	Eelpout	10	1±3	0.1±0.8	77

There is no indication that recruitment of North Sea plaice has increased since 2003 or that localised densities of plaice have increased in the study area. Catch comparison trials of sieve nets illustrated a mean loss of 14% (uncooked weight) when compared with trawls without sieves. The commercially used sieve nets worked as effectively as the experimental versions. The number of fish caught by trawls with sieves was significantly less than by trawls without, however, substantial numbers of 0 group fish were still retained when using sieves.

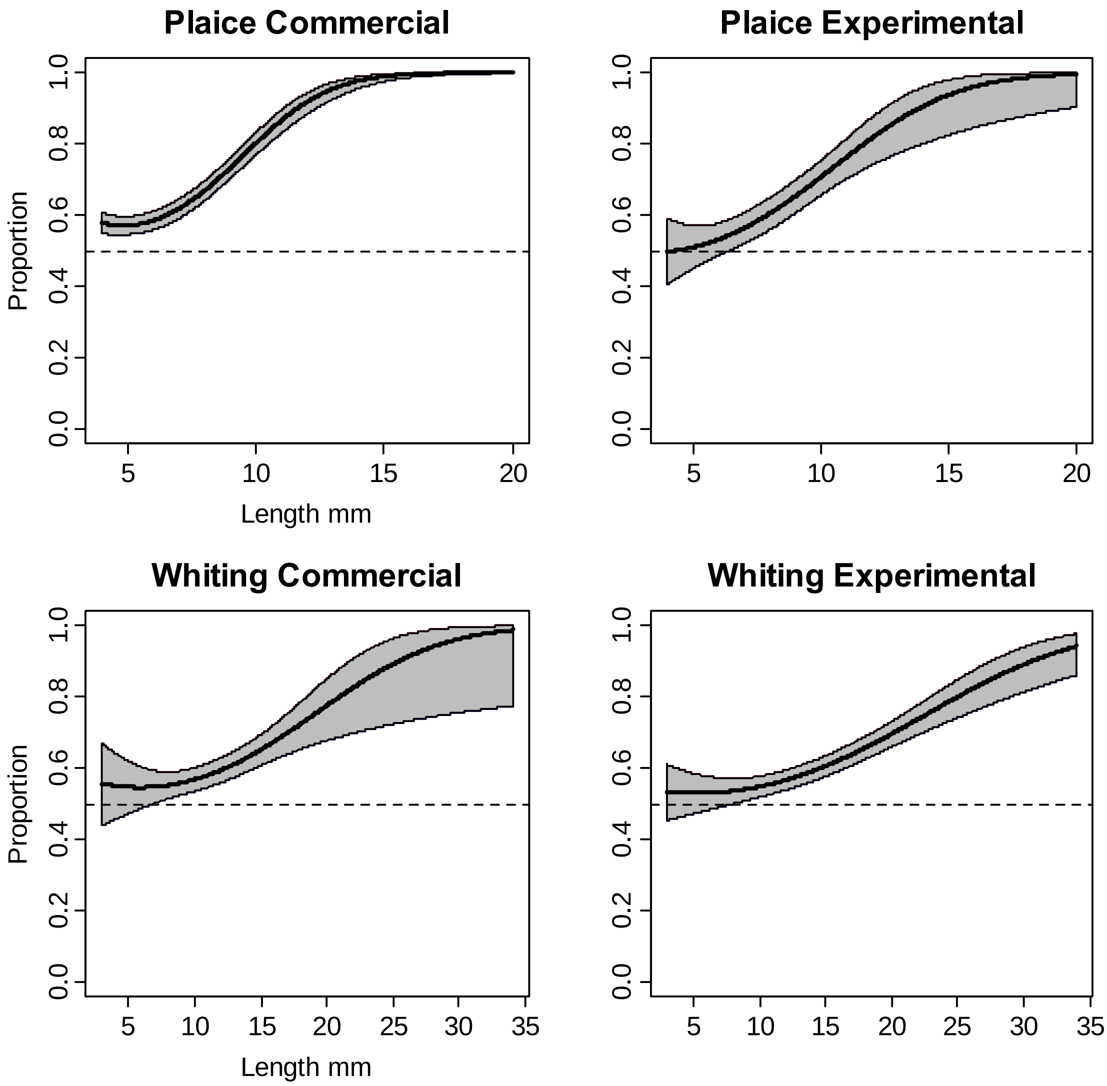


Figure 9.1.1. Modelled proportion of the number of plaice and whiting at length caught in trawls without sieves relative to the total in both trawls (with and without sieves) (i.e. 0.5 indicates an equal number caught in both trawls). Grey shaded area is area of significance around the modelled fit; dotted line is length frequency of the population (pooled total catch in trawls without sieves). 'Commercial' data are from commercially used sieve nets (2006/2007), and 'Experimental' data are from experimental versions of sieve nets (1999/2000).

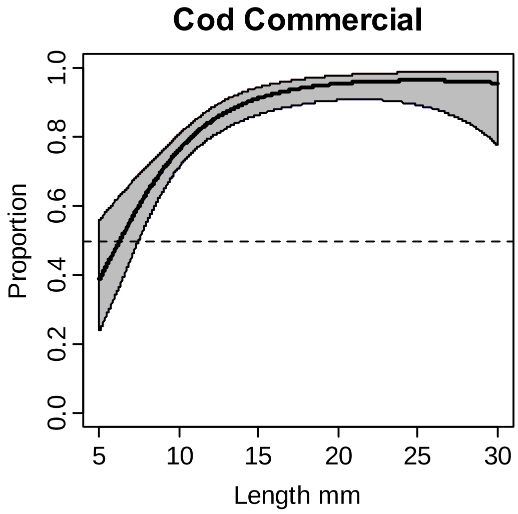


Figure 9.1.2. Modelled proportion of the number of cod at length caught in trawls without commercially used sieve nets relative to the total in both trawls (with and without sieves). Grey shaded area is area of significance around the modelled fit; dotted line is length frequency of the population (pooled total catch in trawls without sieves).

The economic analysis assessed the economic implications of the legislation. The retrospective change in productivity of the brown shrimp fleet as a consequence of the use of sieve nets was estimated using a production function approach. The analysis utilized vessel logbook data detailing brown shrimp landings by individual trip during the period January 1999 to August 2006. The analysis of the two models was performed using FRONTIER 4.1 and showed a reduction in fleet productivity of 14% following the introduction of the legislation.

Assuming comparable levels of compliance and gear performance the results from this study can be extrapolated to other member states. The prevalence of group 0 fish on the fishing grounds, suggests that many small fish, in the size range for which the sieves are least effective, are still caught by shrimp beam trawlers in European waters. This is compounded by the exemptions applying to the main EU brown shrimp fleets of Germany and The Netherlands which state that no selection device is required for up to half of the year.

Overall, the legislation reduces the unnecessary capture of unwanted marine organisms and, as such, is consistent with the requirements of the precautionary principle and ecosystem-approach as defined in EU legislation. It is particularly effective at reducing bycatch levels of cod and relatively large fish of all species, but less so at reducing 0 group plaice, which make up the largest component of the bycatch. The legislation has had a positive effect, and it represents the best available solution, but it does not sufficiently address the bycatch issue in the *Crangon* fishery.

Above is a summary of:

Catchpole, T. L., Revill, A. S., Innes, J., and Pascoe, S. 2007. Evaluating the efficacy of technical measures – A case study of selection device legislation in the UK *Crangon crangon* (brown shrimp) fishery, (In preparation).

9.2 Germany – Advances in developing a yield / recruit (Y/R) lifecycle model of North-Sea brown shrimp (*Crangon crangon*) – A Status Report

In the modelling part of a *Crangon* Project, funded by the German Federal Ministry of Nutrition, Agriculture and Consumer Protection, which is ongoing at the Institute for Hydrobiology and Fisheries Science (IHF) in Hamburg, the 2003 Y/R-model was further developed by Chris Rückert. Additional sub-models were implemented, the most important being the separate treatment of the sexes, a closed life-cycle and length-related fishing- and natural mortalities.

Furthermore, a graphical user-interface was developed, which allows users to modify model and simulation settings without altering the source codes. Settings can be saved in a database and be exported to text-files. Separate predators can be included into the simulation, defining lower and upper prey-lengths and monthly mortality coefficients. Individual fleets can be defined exerting a monthly varying fishing mortality on the simulated stock. Again, upper and lower prey size can be given. Here, also two different kinds of net-selectivity can be applied. Individual temperature-regimes can be assigned to adults as well as to juveniles and larvae. Growth parameters can be set specifically for females, males and juveniles. An interface to incorporate outputs from a 3D-hydrodynamic model was created. Every individual model status is kept in an output database. This is achieved by writing every cohort's properties to this database daily. Before applying the new simulation program in scenario-runs, it will be tested for bugs and additional program-parts will be implemented (e.g. a report-system and the possibility to use a previous simulated model status as initialisation for a future simulation). Finally, the performance of the simulation-program in terms of simulation time will be enhanced.

For a more accurate parameterisation of the Y/R model mentioned above, several trials to determine the maximum growth rates of *Crangon crangon* were performed at the IHF by Marc Hufnagl. A feeding trial where *Crangon crangon* (20 mm) was fed with *Sprattus sprattus*, *Cerastoderma edule*, *Littorina littorea*, *Crangon crangon*, pellets (Dana Feed) or *Artemia salina* respectively, showed that the shrimps grow fastest when feeding on *Artemia* and pellets (mean 0.2 and 0.25 mm/d at 15°C). Using this fodder within a first trial at two different temperatures (15 and 18°C) for different sized shrimps (15 to 55 mm) did not reveal a distinct pattern regarding length and temperature. The overall mean was 0.22 mm d^{-1} at both temperatures and for all length classes. The standard deviation was high and ranged from 0.0 to nearly 0.5 mm d^{-1}. Different trials were performed to find out whether this scatter was a rearing effect or natural variability. One revealed that as with living copepods the growth rates could almost be doubled. This observation led to the conclusion that feeding the shrimps with freshly caught plankton would be the best solution as rearing copepods in the afforded amount is space and time consuming. Therefore *Crangon crangon* from 20 to 60 mm were reared in temperate (5–5°C) re-circulation systems, at the Biologische Anstalt Helgoland from May to August, and fed with *Nereis sp*., plankton and green algae. These trials, separated into three sub-experiments, delivered very different results. In the first experiment the shrimps were marked with small coloured plastic plates glued to the carapax or abdomen, to determine individual growth rates, moult intervals and increments. The second experiment was a control of the first experiment where shrimps of the same group as in experiment one were used but not marked. The third experiment was performed with shrimps of 20 and 30 mm size, because the 20 mm size class was not present when catching the shrimps for the first and the second experiment. This experiment delivered the highest growth rates (30 mm, 20°C, 0.5 mm d^{-1}) which nearly tripled those, observed in the first and second experiment (30 mm, 20°C, 0.18 d^{-1}). The reason for that was determined to be the amount of small copepods available in the plankton samples (lower in the beginning and higher at the end of the first and second trial and high during the entire third trial) or the age of the shrimps used (first and second trial shrimps were over-wintered shrimps from the last fall and winter caught in May, those in the third trial were recruits from June caught in July). To get a good parameterisation of the model anyhow, a literature research was performed and all observed growth rates will be combined in a temperature and size dependent model. Analyses of these data are not finished so far, but will be available for the next WGCRAN report in 2008.

9.3 UK – Towards estimating shrimp biomass from trawl surveys in The Wash (UK) using a swept area method.

A quick but course method for estimating shrimp biomass in The Wash using a swept area technique and utilising historic shrimp density data was presented with the aim of stimulating discussion on key issues. Shrimp densities between the coastline and the 10m depth contour for annual surveys carried out each November (1995 to 2002) were interpolated using a kriging method. Densities of shrimps beyond the 10m contour were generally low (or zero) and were excluded. In the absence of reliable information catchability was assumed to be one, despite acceptance this is likely to lead to underestimation. As the coordinates for the GIS maps were expressed in metres and the densities of shrimps in tonnes per square metre, integrating the densities computed by the interpolation method over the surface area produced a biomass estimate for each survey. A number of key problems with the estimates were considered with catchability and gear efficiency being identified as being likely the most serious. An experimental approach and a modelling technique that highlighted problems with catchability were presented. Despite these concerns biomass estimates for the 8 years correlated well with abundance indices computed using LPUE data from the commercial fleet for each corresponding fishing season ($r^2 = 0.8247$). Although giving no indication as to the accuracy of the biomass estimates, this correlation l with a suitable and independent abundance index provides some confidence in the survey results. Survey catch rates that are related to shrimp abundance rather than shrimp behaviour and catchability are a prerequisite of a swept area estimation of biomass. Refinements and data requirements necessary to produce more robust biomass estimates with confidence intervals were discussed.

9.4 Belgium – The use of electric pulses in *Crangon* fisheries

Technical modifications for bycatch reduction focus on catch separation or filtering after species have entered the trawl. Damage incurred by contact, or stress caused during the capture and escape process may lead to higher discard and escape mortality. Alternative measures are therefore needed. A proposed measure is the use of electric pulses as means of stimulation for the target species. Whereas formerly tested modifications are based on physical size differences between the target species and the bycatch, is the latter based on different behavioural responses. The purpose is to avoid the entrance in the net of non-target and undersized species.

Experiments with electric pulses have been carried out in the past in many areas in the world. The main purpose of these experiments was to obtain higher commercial catches, with no or very little attention to selectivity and bycatches.

The potential of electric pulses as a means to develop a species selective electro-shrimp trawl was first studied in Polet (2003). The basic idea was to invoke selectively a startle response for shrimp with electric ticklers and to allow non-reacting species to escape underneath a raised ground rope

A feasibility study was set up aiming at the development of a shrimp trawl with the following aims:

- improving species and length selection;
- reducing discards;
- reducing the impact of shrimp trawling on the environment;

- improving the quality of the commercial catches.

This project enclosed observation experiments, survival tests and sea trials.

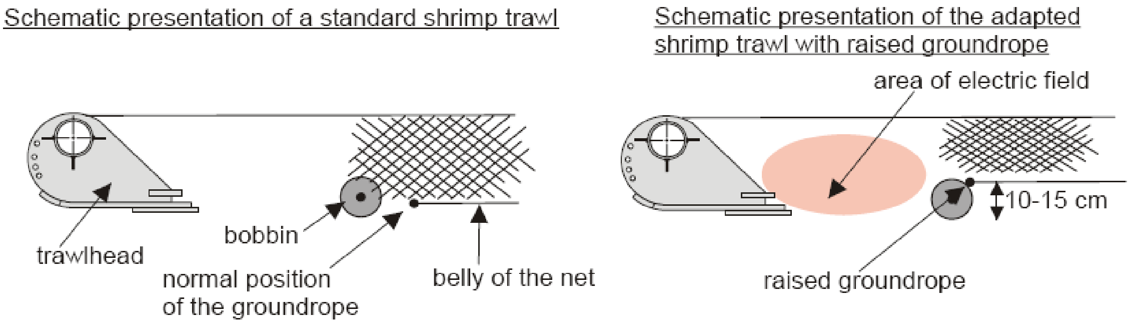


Figure 9.4.1. Shrimp beam trawl, altered for electro-fishing (Modified from Polet, 2003).

It was concluded that the experimental electro-trawl with raised ground rope and small meshes in the top panel gave satisfactory results. The losses of commercial shrimp catches were small or even non-existent. Part of the undersized commercial fish catch could escape and especially non-commercial fish and invertebrates were caught in lower numbers compared to standard nets (Polet, 2003).

It should, however, be borne in mind that the sea trials in this project only covered a short time range and a narrow range of conditions such as water temperature, currents, degree of activity of the shrimps etc. For this reason, it was recommended to elaborate this research. An extensive range of sea trials on commercial vessels in different conditions should precede commercial application.

A national, follow-up project was initiated in January 2007 in Belgium, named “Pulskor”. The objectives are the further development of an electric shrimp trawl optimised for the use in commercial *Crangon* fisheries in the North Sea and to overcome the drawbacks of currently used net modifications, such as the sieve net. The objectives are:

- Further reduction of the bycatches, especially the bycatch of very young fish;
- Reduction of bottom-impact;
- Improvement of the catch quality.

The development and construction of a new optimised pulse generator, on board infrastructure and the modified beam trawl itself is ongoing. Extensive experimental testing at sea in commercial circumstances is planned for 2008. The potential for adverse effects on non-target species by the use of electricity will be further investigated.

9.4.1 References

Polet, H. 2003. Evaluation of by-catch in the Belgium brown shrimp (*Crangon crangon*) fishery and of technical means to reduce discarding. Ph.D. thesis University of Gent, Belgium.

9.5 Germany – Autumn distribution of brown shrimp *Crangon crangon* along the German Coast in 2006

The DYFS was conducted in 2006 again on a routine basis and in the same areas as the year before, when after 30 years the spring survey had been dropped and the autumn part was continued including the two added regions. These were the DYFS code areas 408, the tidal system south of Sylt (Hörnum Deep) including off shore parts west of the isle of Amrum (northern part of 406), and in the Weser – Jade region respectively (DYFS-area 413).

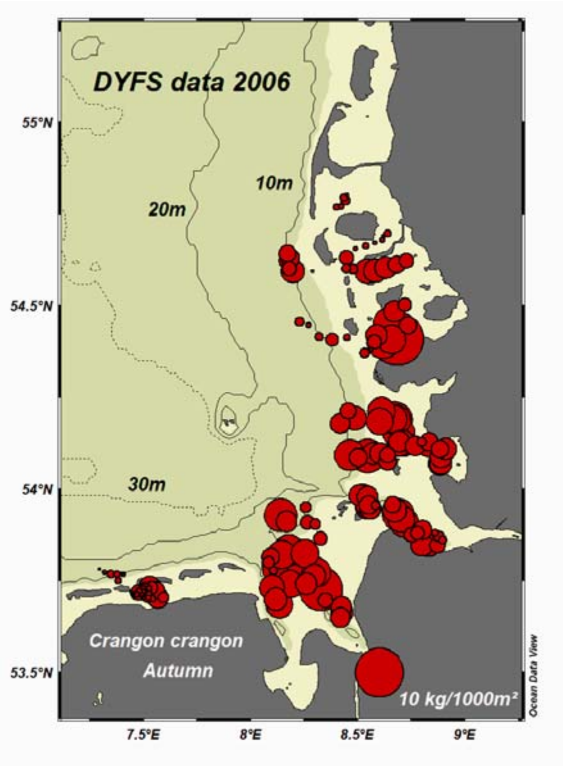
Preliminary results concerning the catches of brown shrimp [kg/1000m²] are shown in the graph below. These data reveal that the catches of the 15 min.-hauls are relatively similar in size in the inner part of the German Bight from the estuaries of Jade-Weser, Elbe to the Husum (Hever) region (DYFS areas 413, 412, 411 and 410), while East and North Frisian areas show considerably lower catches (DYFS areas 414, 405, 406, 409 and 408).

The situation was little different in 2005 as the shrimps had concentrated a bit more in the Jade-Weser and Elbe and Büsum region.

Mean abundance indices [kg/1000m²] for the five campaign parts were found to be in 2006:

HUS	(406,408,409,410):	1.211	(41 hauls)
BUS	(406, 411):	2.345	(28 hauls)
Cux	(412):	1.715	(22 hauls)
Weser	(413):	2.626	(26 hauls)
OF	(414, 405):	0.445	(30 hauls)

Further evaluations of the 30-year time series data are planned for the next 12 months by a masters thesis looking at interannual changes, regional and depth dependent shifts with the aim to assess the biomass of brown shrimp in the Wadden Sea areas of Schleswig-Holstein.



9.6 Germany – Comparison of brown shrimp *Crangon crangon* catches with DYFS 3-m standard net and the same net with one tickler chain along the German Coast in September 2006

As recommended by WGCRAN as well as WGBEAM a study should be initiated to determine relative as well as absolute efficiencies of the gears in use. Former comparisons date back to 1985 and were insignificant for about half of the comparisons concerning flat fish results.

The presently known seven types are (in the programmes (bold =combined international index)):

COUNTRY	DK		NL	B	UK
2-m beam					
2-m beam					3 (DFS)
3-m beam		**DYFS**, WiKu			
3-m beam tickler			1 (**DFS**)		
6-m beam					
6-m beam tickler			1 (**DFS**)		
7-m beam	(WiFi)	SOLEA-WiFi			
7-m beam tickler		SOLEA-WiFi			

As neither an EU nor national study could be started only the German DYFS 3-m beam types could be tested in a preliminary approach. During the routine DYFS in September 2006 at some selected stations a second net had been used to find out about possible differences in catchability that could occur if a tickler chain is used in the survey. The station were selected for comparatively flat and homogenous grounds in the outer parts of the DYFS survey areas to avoid differences that could be expected to occur due to slopes within the channels resulting in e.g. differing fishing depths.

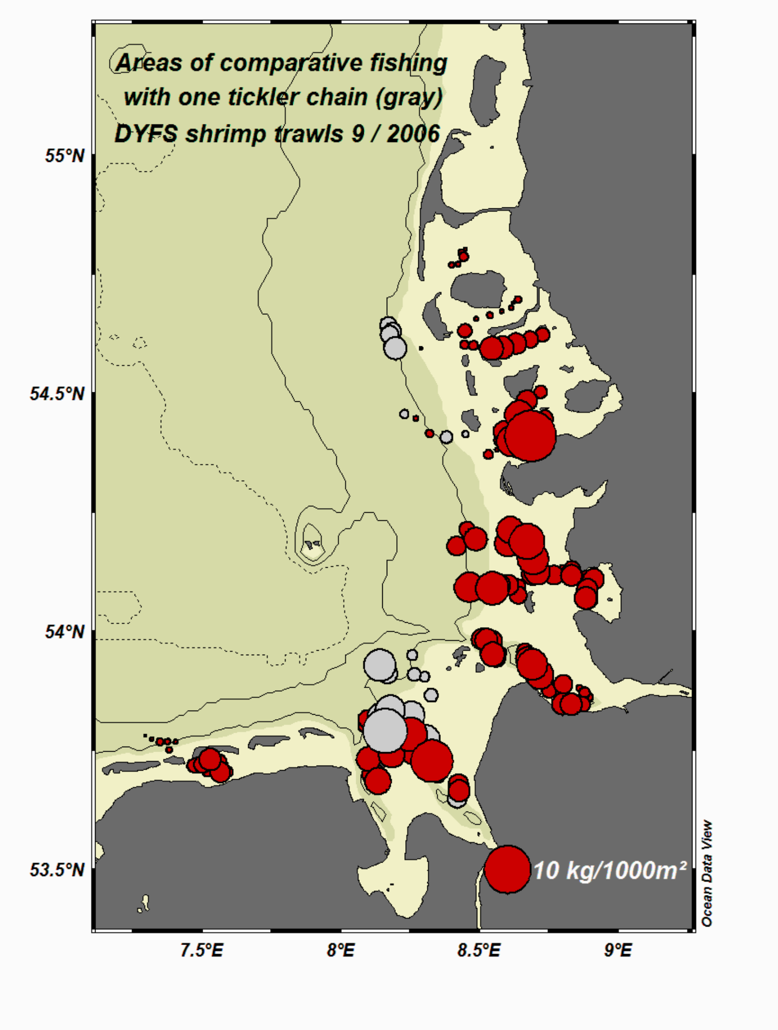


Figure 9.6.1. Stations of comparative fishing with 3-m-beam trawls are marked gray for three of the four areas (DYFS areas 405, 406, 413). The Elbe estuary is not included here (DYFS area 412).

In four DYFS areas 32 parallel tows were done and worked up along the standard procedures.

Preliminary results are given for the total catches of brown shrimp *Crangon Crangon* in Table 1.

They clearly show that no statistically difference can be observed between the results concerning brown shrimp catches from the two different beam trawls.

Table 1: **Comparison of the total catches of *Crangon crangon* in the German DYFS standard nets to the same net with 1 tickler chain (15 minute hauls one side standard net, other side experimental net)**

Area	DYFS code	Station	Date	Crangon catch [kg] standard net	Crangon catch [kg] with chain	Difference [kg]	Difference %	t-test
WE	413	38	20060912	8.127	7.64	-0.487	-6.37	
WE	413	39	20060912	18.441	22.052	3.611	16.37	
WE	413	40	20060912	1.882	2.197	0.315	14.34	
WE	413	41	20060912	2.976	2.569	-0.407	-15.84	
WE	413	42	20060912	2.033	1.456	-0.577	-39.63	
WE	413	43	20060912	3.524	4.651	1.127	24.23	
WE	413	44	20060912	14.683	18.711	4.028	21.53	
WE	413	45	20060912	15.708	17.928	2.22	12.38	
WE	413	57	20060914	7.76	5.196	-2.564	-49.35	
WE	413	58	20060914	3.988	3.071	-0.917	-29.86	
WE	413	59	20060914	41.383	36.659	-4.724	-12.89	
WE	413	60	20060914	13.222	13.379	0.157	1.17	
WE	413	61	20060914	17.086	18.733	1.647	8.79	
Sum	413			150.813	154.242	3.429	2.22	
Mean	413			11.601	11.865	0.264	2.22	0.70
OF	405	64	20060919	0.06	0.016	-0.044	-275.00	
OF	405	65	20060919	0.665	1.074	0.409	38.08	
OF	405	66	20060919	0.914	1.061	0.147	13.85	
OF	405	67	20060919	0.24	0.192	-0.048	-25.00	
OF	405	68	20060919	0.068	0.108	0.04	37.04	
Sum	405			1.947	2.451	0.504	20.56	
Mean	405			0.3894	0.4902	0.1008	20.56	0.30
HU	406	94	20060925	0.82	1.477	0.657	44.48	
HU	406	95	20060925	2.527	1.582	-0.945	-59.73	
HU	406	98	20060925	1.382	2.237	0.855	38.22	
HU	406	99	20060925	0.126	0.328	0.202	61.59	
HU	406	100	20060925	7.074	6.891	-0.183	-2.66	
HU	406	101	20060925	2.473	3.888	1.415	36.39	
HU	406	102	20060925	4.099	5.602	1.503	26.83	
HU	406	103	20060925	3.879	5.154	1.275	24.74	
HU	406	104	20060925	3.314	5.762	2.448	42.49	
Sum	406			25.694	32.921	7.227	21.95	
Mean	406			2.855	3.658	0.803	21.95	0.04
CU	412	185	20061012	9.05	7.43	-1.62	-21.80	
CU	412	186	20061012	16.453	13.658	-2.795	-20.46	
CU	412	187	20061012	14	13.25	-0.75	-5.66	
CU	412	189	20061012	10.55	7.58	-2.97	-39.18	
CU	412	190	20061012	10.75	10.35	-0.4	-3.86	
Sum	412			60.803	52.268	-8.535	-16.33	
Mean	412			12.161	10.454	-1.707	-16.33	0.03
Sum	all			239.257	241.882	2.625	1.09	
Mean	all			7.477	7.559	0.082	1.09	0.80
SD	all			8.5	8.2	1.8		

9.7 Germany – Preliminary results from the Winter Survey on brown shrimp *Crangon* in the Bight, January 2007

The Winter Survey on brown shrimp was again conducted in January to February 2007 with a total of 30 days at sea planned. Due to unfavourable weather conditions, however, fishing took place only at 10 days resulting in 62 hauls from the Dutch border up to the west coast of Denmark. Corresponding to the observed activity of the fleets of The Netherlands, Denmark and Germany best shrimp catches were realized north-west of Helgoland and off the Jutland coast as presented in Figure 9.71. Compared to few previous surveys in that area the northernmost fishing grounds off the Danish coast are much more heavily fished indicating a possible shift of the distribution of the shrimp. The very large specimens of 100 mm total length observed in a former survey could not been found any more north of Horns Reef and there were only relatively few and smaller shrimp in the East-Frisian area.

The data are under evaluation and will be supplemented by trawl data from shallower waters in the East-Frisian region were considerable abundances had been repeatedly found within the island chain. *C. allmanni* were observed only in the northern most and off shore hauls while in previous years they had been found also closer to the coast which might be a result of the mild winter situations.

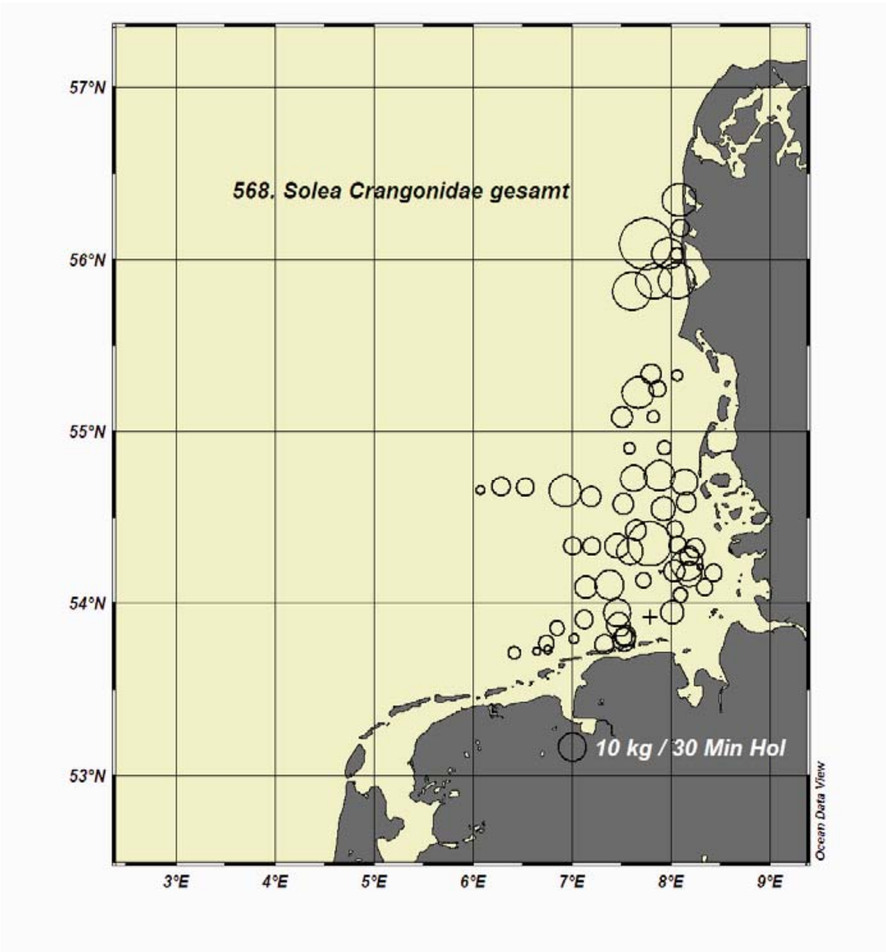


Figure 9.7.1. Trawl stations and catches of shrimps (Crangonidae) January 2007, SOLEA 568.

9.8 Germany – Preliminary results from German log book data on the distribution of brown shrimp landings

Log book data from fisheries are recorded and computerized in the German Federal Agency for Agriculture and Nutrition (BLE). They contain all information delivered by the fishermen according to the European regulations. That includes monthly data on landing by ICES squares from January 2000 onwards. These data were retrieved concerning brown shrimp catches (life weight recalculated by using landings data (cooked weight) multiplied by 1.18) and plotted by ICES square and month using OcenData® and EXCEL® software.

The graphs show despite the rather coarse information on the fishing grounds (only ICES squares and not positions) seasonal shifts from more offshore locations in the winter period to a nearer to the coast fishery in the main fishing season in late summer and autumn (Figures 9.8.2 and 9.8.3). Moreover it can be seen, that in recent years the activity of those parts of the German fleet fishing also in winter has extended its range from the Amrum Bank area towards the north into the Danish area west of Jutland (compare Figures 9.8.1 and 9.8.3).

So the information given by fishermen, the fishery control vessels and the observation of the fleets during the brown shrimp winter surveys seem to be proven by the log book data. That indicates – as the fleets usually follow the highest densities of the commercial sized shrimps – that a northern directed shift of the brown shrimp stocks could have occurred.

It has to be checked by survey data, however, if that is at all possible, whether that shift is only an extension of the former fishing grounds into newly fished areas or whether the abundance indices of the brown shrimp winter surveys also reflect that northern directed shift.

The selected graphs below are given to illustrate the above mentioned information.

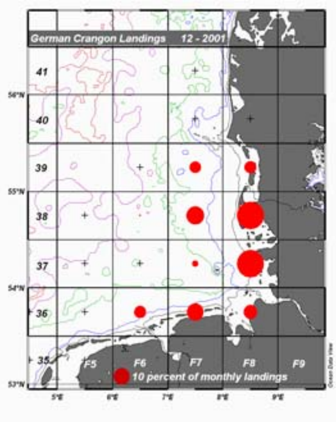


Figure 9.8.1. Percent landings in December 2001.

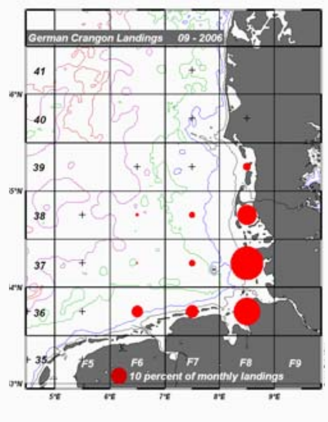


Figure 9.8.2. Percent landings in September 2006.

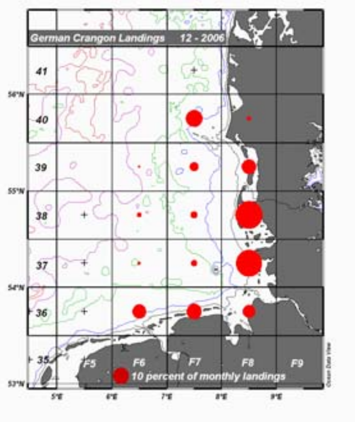


Figure 9.8.3. Percent landings in December 2006.

9.9 Germany – Preliminary results from German log book data on landings and prices in the brown shrimp fishery

Log book data from fisheries are recorded and computerized in the German Federal Agency for Agriculture and Nutrition (BLE). They contain besides landings (cooked weight) also revenues by month which allows for the calculation of mean monthly prices form January 2000 onwards.

Figure 1 shows the time series for landings and prices per kilogram for the period January 2000 to December 2006. The seasonality of the landings including the slight depression during the summer months can clearly be seen. However, the normal market situation, i.e. that price is high when the product is scarce and vice versa is only partly reflected by the price curve. This is especially visible if prices are plotted against the landings for the same month (compare Figure 2). In most cases, when landings are low the prices remain at a very low level indicating that the either the supply of shrimp from other areas (or fleets) is high and keeps the price low or that the amount of frozen shrimp meat in the holds is high or that the (few) buyers have such a strong market position that they are able to dictate (low) prices. Only in the spring of 2001 when landings were comparatively low prices reached an unusually high level. That might, however, have been an effect of the struggle between the trilateral producer's organisation and the Dutch "market regulation authority" over the landings limitations which is still not finally settled.

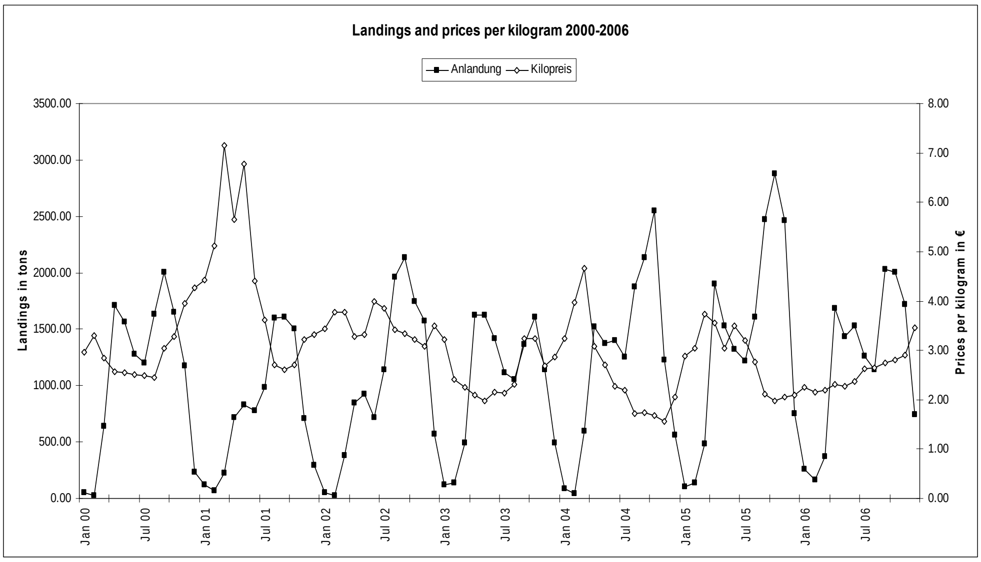


Figure 1. Monthly landings and prices for brown shrimp in Germany from January 2000 to December 2001.

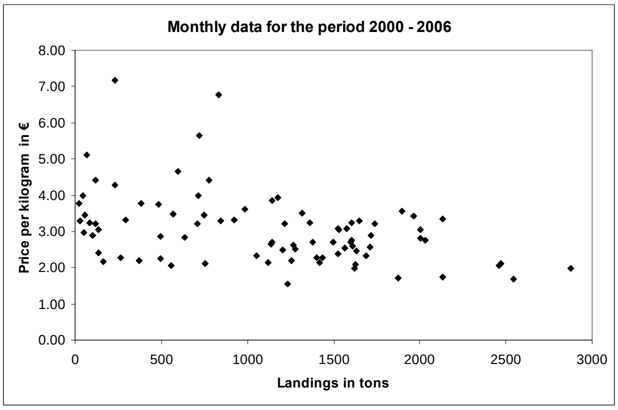


Figure 2. Monthly prices against landings for brown shrimp (Germany, January 2000 to December 2001).

How stable mean prices and revenues are in brown shrimp fisheries for the period 2000 to 2006 can be seen in Figures 3 and 4. Standard deviations are given in Figures 5–7. Figure 7 demonstrates again the price stability especially during the main season where the standard deviation is lowest.

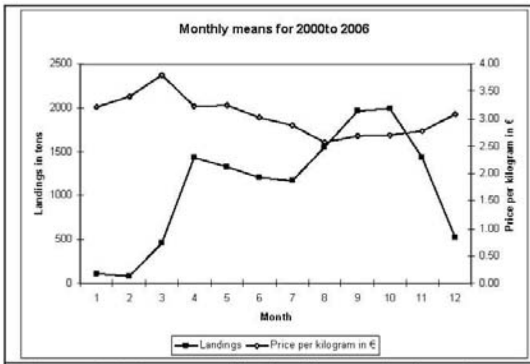


Figure 3: Mean monthly landings and prices for brown shrimp (Germany, period 2000 to 2006)

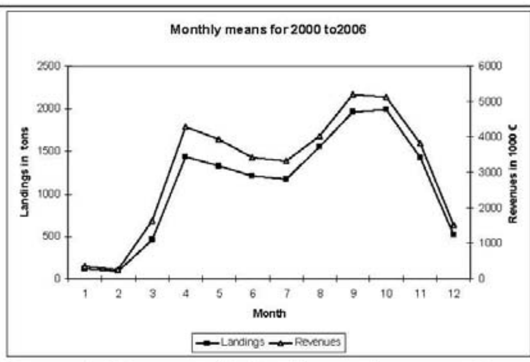


Figure 4: Mean monthly landings and revenues for brown shrimp (Germany, period 2000 to 2006)

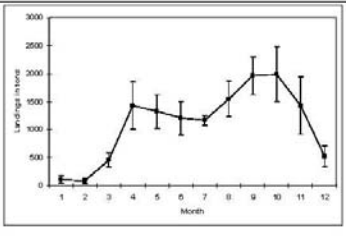


Figure 5: Mean monthly landings and standard deviation (Germany, period 2000 to 2006)

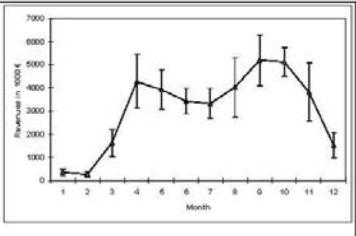


Figure 6: Mean monthly revenues and standard deviation (Germany, period 2000 to 2006)

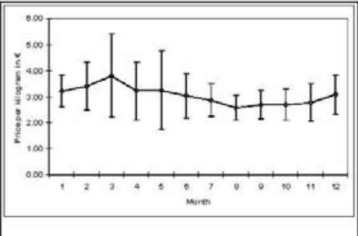


Figure 7: Mean monthly prices and standard deviation (Germany, period 2000 to 2006)

Annex 1: List of Participants

NAME	INSTITUTE	E-MAIL
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Annex 2: Proposed Terms of Reference for the WGCRAN 2008 meeting

The **Working Group on *Crangon* Fisheries and Life History** [WGCRAN] (Chair: Andy Revill, UK) will meet at the Netherlands Institute for Sea Research, Texel, during the week of 26–30 May 2008 to:

a) explore and make available data sources required for the development of a *Crangon* biomass estimate;

b) further improve the current swept-area estimate of *Crangon* biomass developed by Ingrid Tulp;

c) develop an alternative estimate of *Crangon* biomass in the Wadden Sea area;

d) enhance knowledge of *Crangon* catchability;

e) review of MSC certification process;

f) collate and update landings and effort data;

g) review recent *Crangon* related R & D activity.

WGCRAN will report by xxxxx 2008 for the attention of the Living Resources Committee.

Supporting Information

PRIORITY:	*C. crangon* fisheries are economically important with landings value that rank this species in the top three species caught from the North Sea.
SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:	Action Plan (Terms of Reference) a) Explore and make available data sources useful to the development of a *Crangon* biomass estimate b) To further improve the current swept-area estimate of *Crangon* biomass developed by Ingrid Tulp c) Use German Wadden Sea data to develop alternative estimate of biomass d) Improve knowledge of *Crangon* catchability e) Review of MSC certification process f) Collate and update landings and effort data g) Review recent *Crangon* related R & D activity Justification for the action plan TOR is as follows: Despite the economic importance and regional dependencies of this species, we still have much to learn and understand on the natural history of this species, particularly in respect of its ecology, stock dynamics, mortality patterns, distribution etc. We (WGCRAN) know much more about the fishery itself, how much is caught, who catches it, where and when etc. Such information, has limited utility however, and ICES will continue to have a retarded capacity to produce sound effective management advice in relation to these fisheries, if we use such information in isolation.

SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN CONTINUED:	For the production of more robust and flexible managerial advice, we need to combine our current knowledge of fisheries landings and effort with a good supportive biological understanding of the *Crangon* stocks and their ecological interactions. To this end, we make this our priority for the WGCRAN. Substantial progress has been made in the development of a *Crangon* biomass estimate. The initial calculation was a first step to formulating a more probable estimate. The first improvement to the estimate will be through the inclusion of survey data from Germany. Several other sources of data have also been identified which may be useful in the development of the current model, including the Sole Net Survey (SNS), Belgian survey and the North Sea Epibenthic Survey. These data sources will be explored, useful information will be identified and made available for the biomass estimate model. Resources have become available to generate an independent estimate of *Crangon* biomass in the Wadden Sea area. This work will be used to compliment and aid the development of the initial estimate. As a means to improve both of estimates, additional work will be undertaken to enhance understanding of the catchability of *Crangon*. The initial biomass estimate used catch efficiencies of 1. It is necessary to use catch efficiency values derived from scientific investigation. This work will take the form of a reviewing existing literature and conducting at-sea experiments. The *C. crangon* fishery may also become a focus of further attention in the future, particularly in relation to its discarding practices, impacts upon benthic communities, technological innovations (i.e. electric shrimp beam trawl), the efficacy of existing technical measures, economic performance, and the sustainability of stocks. This attention may arise directly from the current process of MSC (Marine Stewardship Council) certification that is now underway, renewed NGO activity and interest, licensing of fisheries activities within Wadden Sea Marine Protected Areas, etc. It is considered important to fully keep informed updated on the MSC certification process.
RESOURCE REQUIREMENTS:	The research programmes which provide the main input to this group are already underway, and resources already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
PARTICIPANTS:	The Group is normally attended by ~12 members and guests.
SECRETARIAT FACILITIES:	None.
FINANCIAL:	No financial implications.
LINKAGES TO ADVISORY COMMITTEES:	There are no obvious direct linkages with the advisory committees.
LINKAGES TO OTHER COMMITTEES OR GROUPS:	There is linkage to the Living Resources Committee and WGBEAM
LINKAGES TO OTHER ORGANIZATIONS:	CWSS = Common Wadden Sea Secretariat, TMAP= Trilateral Monitoring and Assessment Programme

Annex 3: Recommendations arising from the WGCRAN 2007 meeting

RECOMMENDATION	ACTION
WGCRAN recommends that Germany extend the DYFS Autumn survey for two extra days to gain additional data from deeper water areas.	Survey coordinators at Bundesforschungsanstalt für Fischerei
WGCRAN recommends that catch sampling be undertaken by all nations on *Crangon* fishing vessels in-line with EU data collection regulations. Both bycatch and *crangon* are important. WGCRAN recommend that standardised protocol be used for sampling *Crangon* vessels. Sampling should be stratified to sub-sample a representative cross-section of fleet, especially seasonal and depth variation.	Chair STECF Chair of Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS)
WGCRAN recommends that a progress update on the current MSC certification process be given to the WGCRAN at the next meeting of the WGCRAN during May 26–30 2008.	North Sea Foundation (Esther Luiten) e.luiten@noordzee.nl.
WGCRAN recommends that the next meeting be held at the Netherlands Institute for Sea Research, Texel, during the week of 26–30 May 2008.	Secretariat ICES Henk W. van der Veer veer@nioz.nl Royal Netherlands Institute for Sea Research P.O. Box 59; 1790 AB Den Burg Texel; The Netherlands Visitors: Landsdiep 4; 1797 SZ 't Horntje Texel; The Netherlands Tel: + 31-222-369575; Fax: + 31-222-319674; http:/www.nioz.nl/