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

10–13 May 2009

Oostende, Belgium

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Executive summary

Landings

The Working Group on *Crangon* Fisheries and Life History (WGCRAN) 2009 meeting was successfully held at ILVO, Oostende, Belgium from 10–13 May 2009. 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 2008. We note that Germany and the Netherlands continue to dominate the fisheries, with each of these nations landing around 12,000–14,000 tonnes in 2008 which is slightly lower than in the period 2004–2008, but similar to the period from 1996–2004. Denmark, the UK, Belgium and France together caught and landed the remaining 4,600 tonnes, thus totalling around 32,000 tonnes landed from the North Sea.

Distribution of effort

For the first time maps of the distribution of the effort were produced based on the Dutch VMS data. In winter and spring the fisheries is concentrated off the Danish coast, whereas later, in summer, the Dutch fishers stay closer to the coast and inside the Wadden Sea. The combination of all national VMS data into one effort map was adopted as a term of reference for next year's meeting.

Crangon in deeper water

In recent years there have been indications that Crangon fisheries take place in deeper water at certain times of the year. Therefore identifying the potential importance of the full geographic distribution of *Crangon crangon* is important in relation to swept-area estimates of population size and the possibility of an unexploited component of the spawning stock. In response to reports last year of presumed densities of *Crangon Crangon* reported for deep areas in the North Sea there were several presentations that showed that this must have been a faulty analysis. Reanalysis of BTS data and comparison with the original MAFCONS report show that these samples did not contain *Crangon Crangon* and must have been mixed up by *Crangon allmanni* in the data selection. At the moment it looks like work has gone into discovering there are no Crangon in deep water. The areas however that are frequented by especially the Dutch fleet (the Sylt area) in winter have not been sampled by research vessels at the right time of year. Given the size of this fleet segment we may miss an important part of the distribution in our regular surveys.

Combining the biomass estimate of North Sea C. *Crangon* for all surveys

Only little progress has been made to combine the estimates for the different surveys. This will remain on the agenda for next year.

Other issues

We note that research on the *C. Crangon* fisheries is underway in several nations and describe some of that herein.

Colleagues in Germany continue to develop innovative biological models related to *Crangon* populations (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.

Colleagues in Denmark have started a young fish survey. However structural funding is lacking, so the follow up of this survey is highly uncertain.

In a related issue, since 2007 the European Data Collection Regulation (DCR) has become mandatory for the *C. Crangon* fishery. Germany and The Netherlands now have a discard programme, which also aims to provide more data for the MSC assessment.

Colleagues from Belgium are progressing with the development of innovative technologies to harvest brown shrimp by using an electric shrimp beam trawl. Having sufficiently developed the technology to testing, a series of intensive sea trials has been carried out, preliminary results are detailed herein. Now sea trials are also planned in the Netherlands in the Wadden Sea. Also in Belgium a study to assess the affect of persistent organic pollutants is continued on the North Sea *C. Crangon* stock. In the working group arrangements have been made to collect samples in the whole area frequented by research vessels to spatially describe pollutant levels in shrimps

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

1 Terms of Reference for the WGCRAN 2009 meeting

a) combine German and Dutch data into one biomass estimate and evaluate the utility of the estimate;

b) explore *Crangon* catch data from the Dutch BTS survey in geographical areas not covered by the D(Y)FS surveys with the aim of improving the *Crangon* biomass estimate;

c) make progress in updating the paper by Welleman and Daan;

d) explore available data on number of egg-bearing females and correlation with stock size;

e) provide annual VMS data (by quarter) from Member States to illustrate regions of fishing activity by *Crangon* vessels in the North Sea;

f) complete comprehensive sea trials of the electric shrimp beam trawl design, and investigate the effects of this fishing technology on the ecosystem;

g) review progress of MSC certification process;

h) collate and update landings and effort data, including numbers of active vessels;

i) review recent *Crangon* related Research and Development activity;

2 List of participants to the WGCRAN 2009 meeting

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

3 ToR a) combine German and Dutch data into one biomass estimate and evaluate the utility of the estimate

The update of the Dutch biomass estimate based on data from the Dutch Demersal Fish Survey (DFS) was presented to the working group (Figures 3.1 and 3.2). The total stock abundance was estimated by the sum of the stratified arithmetic means of the catch weights (by 5 m depth strata) multiplied by the surface of each depth stratum. The catchability of the gear is assumed to equal 1. Missing values were estimated using extrapolation. The estimates show strong year-to-year variations.

During the working group a first effort was made to combine the Dutch and German data. However as a result of illness of Volker Siegel the combination could not be made at the meeting. Next year we will present the combined estimate for the Belgian, Dutch and German survey area together.

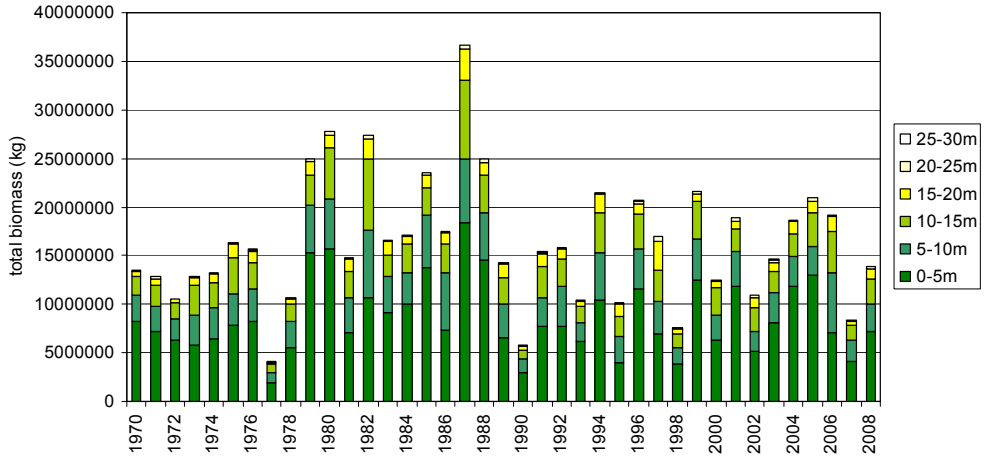


Figure 3.1. Total biomass swept-area estimate for the areas covered by the Dutch DFS survey.

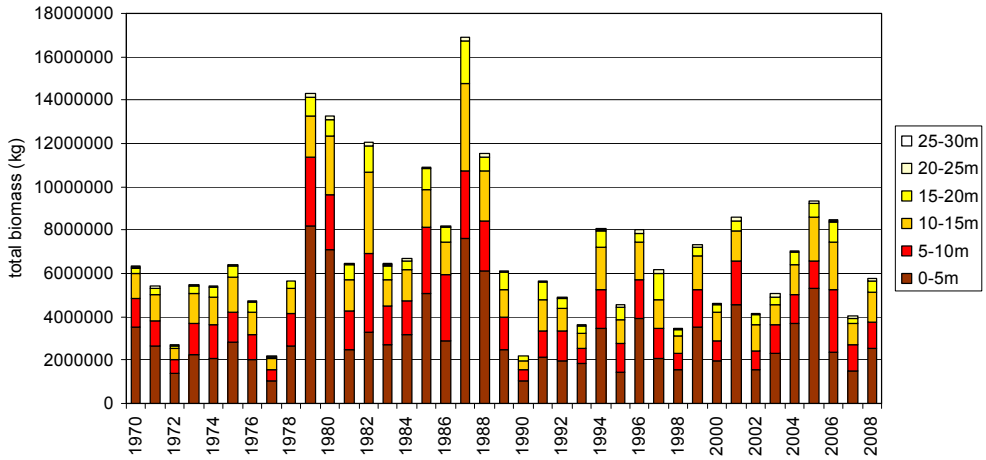


Figure 3.2. Biomass swept-area estimate for the commercial size class (>54mm) for the areas covered by the Dutch DFS survey.

4 ToR b) explore Crangon catch data from the Dutch BTS survey in geographical areas not covered by the D(Y)FS surveys with the aim of improving the Crangon biomass estimate

During the Dutch Beam Trawl Survey (conducted in autumn) hauls are carried out with a 2 metre beam trawl with 4 mm mesh and a chainmat (at a speed of 1 knot for 5 minutes) to sample epibenthos. This has been done annually since 1999 under the MAFCONS programme (Managing Fisheries to Conserve Groundfish and Invertebrate Species Diversity). This programme has been part of international programmes in 1999–2000 and 2003–2004. As it is thought that these data will provide more information on the catches of *Crangon* in water that is deeper than covered by the DYFS surveys and areas where commercial fishing for *Crangon* occurs, an extraction of the MAFCONS data has been made for the period 1999–2008.

The Dutch MAFCONS programme has been part of international programmes in 1999–2000 and 2003–2004. During these programmes different nations conducted epibenthos sampling with the 2 meter beam trawl and 4mm mesh. This resulted in a broad coverage of the North Sea. In 2000 in all 270 stations were sampled by five nations.

In the period 1999–2008 in all 372 hauls were made under the Dutch MAFCONS programme. *Crangon Crangon* was observed during 23 hauls. The spatial distribution of the Dutch data show that there is no evidence of *Crangon Crangon* densities in offshore waters (Figure 4.1). For *Crangon allmanni*, on the other hand, offshore densities were observed (Figure 4.2). These results are in correspondence with the results of the international MAFCONS programme in 2000 (Figure 4.3), but not with the data presented during the 2008 meeting by Marc Hufnagel. From the comparison we concluded that the data selection on which last year's presentation was based must have been wrong and that it cannot have been based on *Crangon Crangon*.

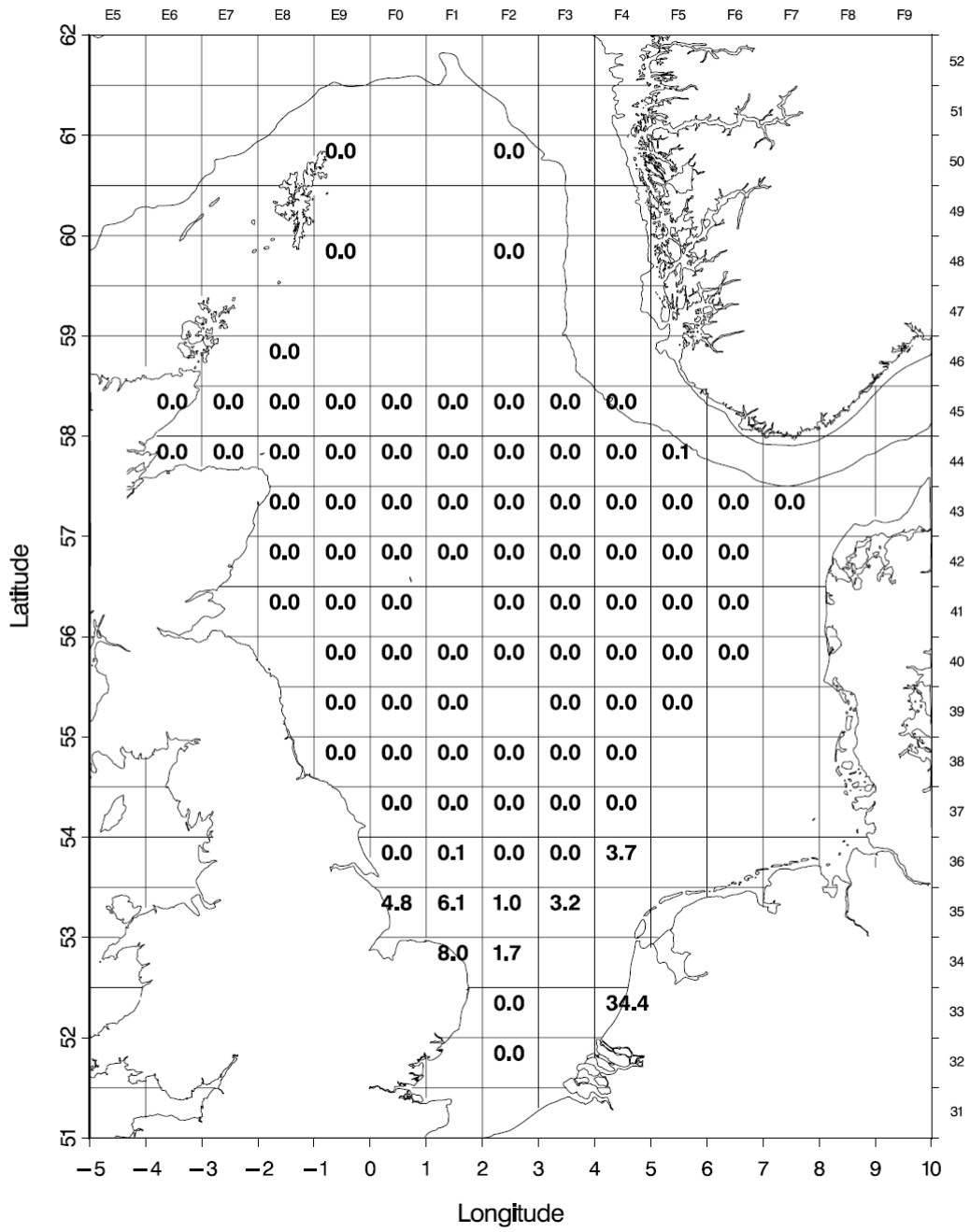


Figure 4.1. Average number of *Crangon Crangon* per 100 m2 for the sampled ICES rectangles in the period 1999–2008.

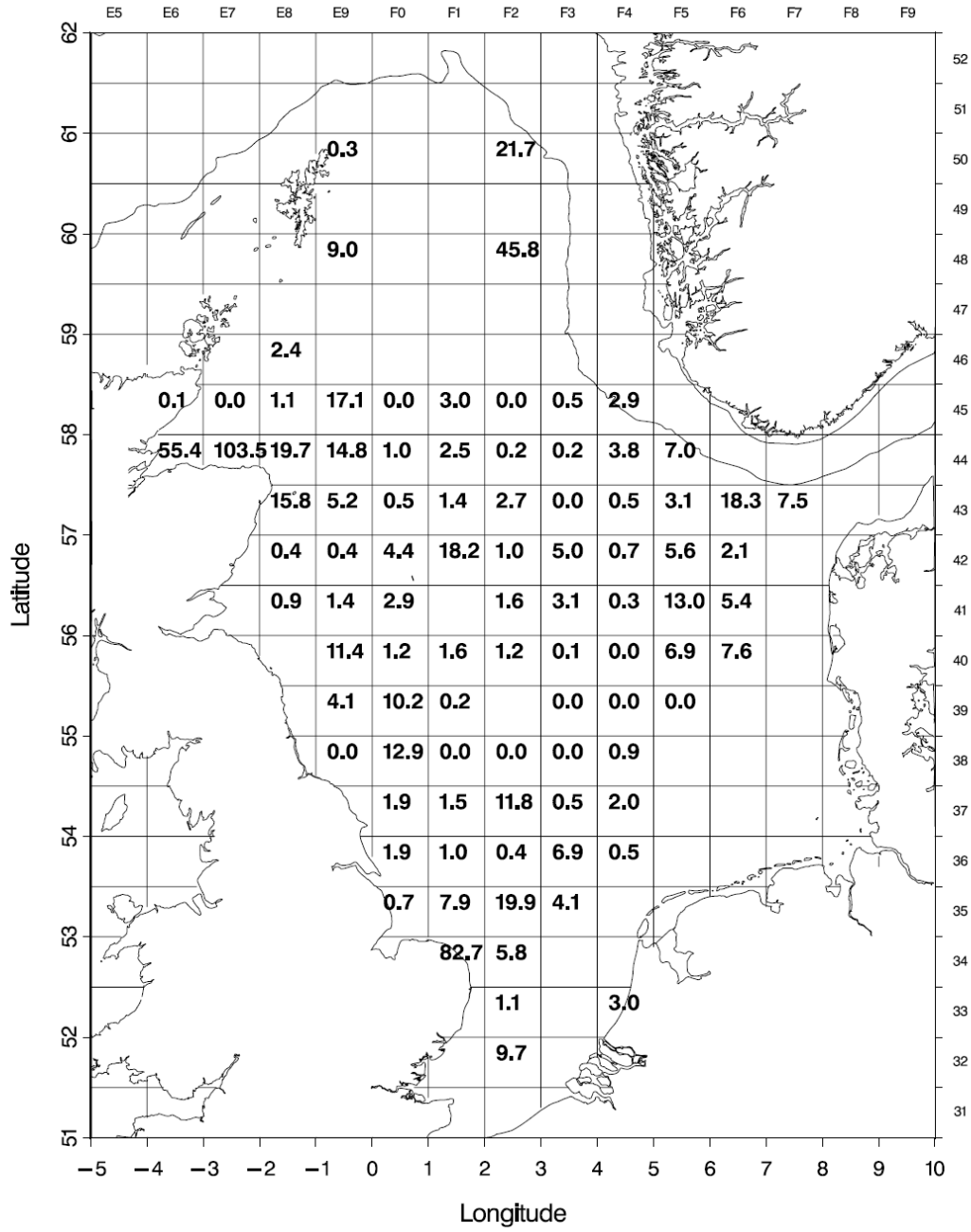


Figure 4.2. Average number of *Crangon allmanni* per 100 m² for the sampled ICES rectangles in the period 1999–2008 (MAFCONS Dutch Beam Trawl Survey).

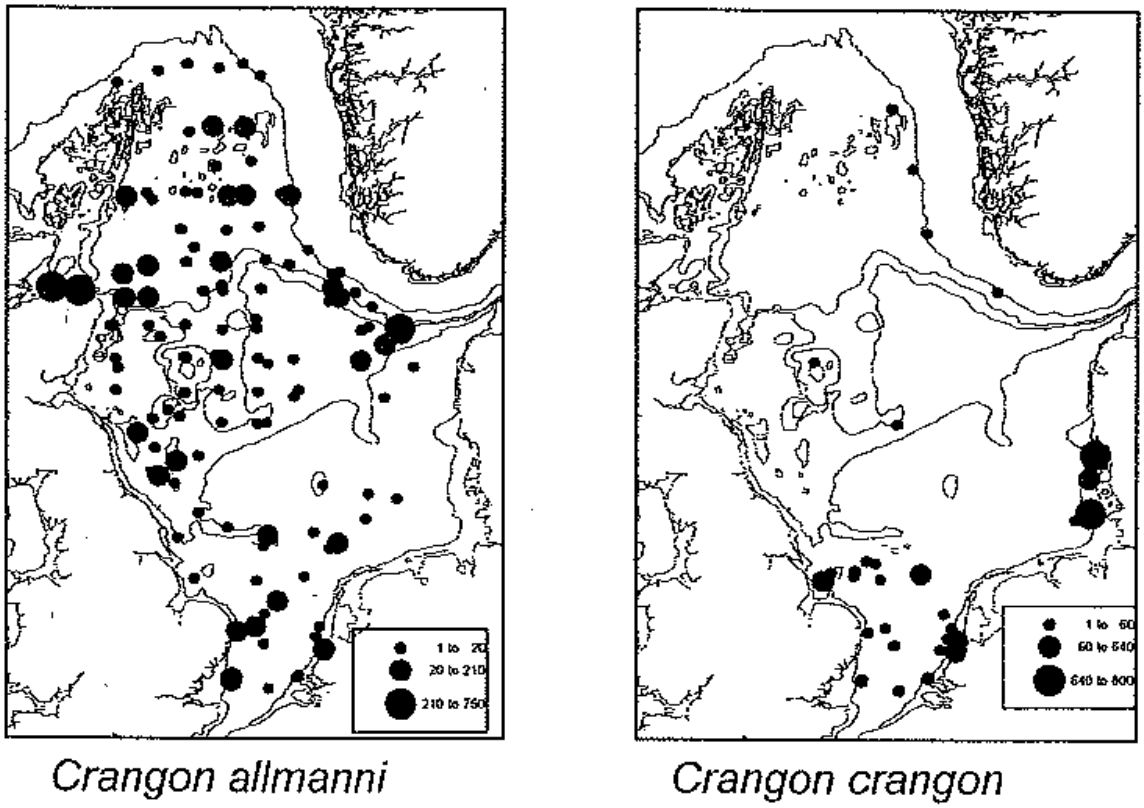


Figure 4.3. Distribution of *Crangon allmanni* and *Crangon Crangon* in the North Sea in 2000 on basis of the European project monitoring biodiversity of epibenthos and demersal fish in the North Sea and Skagerrak. The size of bubbles indicates abundance (EC project: 98/021, MAF-CONS Dutch Beam Trawl Survey).

5 ToR c) make progress in updating the paper by Welleman and Daan (2001)

No progress was made on this ToR. We concluded that this ToR is too ambitious for the group, given the limited amount of time. We agreed that Marc Hufnagel will try to incorporate this into the programme for a MSC student.

6 ToR d) explore available data on number of egg-bearing females and correlations with stock size

As a result of the illness of Volker Siegel no progress has been made on this subject.

7 ToR e) provide annual VMS data (by quarter) from Member States to illustrate regions of fishing activity by Crangon vessels in the North Sea

The Netherlands used VMS (Vessel Monitoring through Satellite) data to illustrate regions of fishing activity by *Crangon* vessels in the North Sea per quarter. There is a clear seasonal pattern with winter fishery concentrated off the Danish coast (Sylt area) and a more coastal oriented fisheries in the 3rd quarter. It appears that the fishing activity does not entirely overlap with the DFS areas. The working group therefore recommends that current surveys are extended to cover areas of deeper water that are currently not covered by the DFS surveys. These data only incorporate the Dutch vessels. Next year we will combine VMS data from all countries into one map for every quarter.

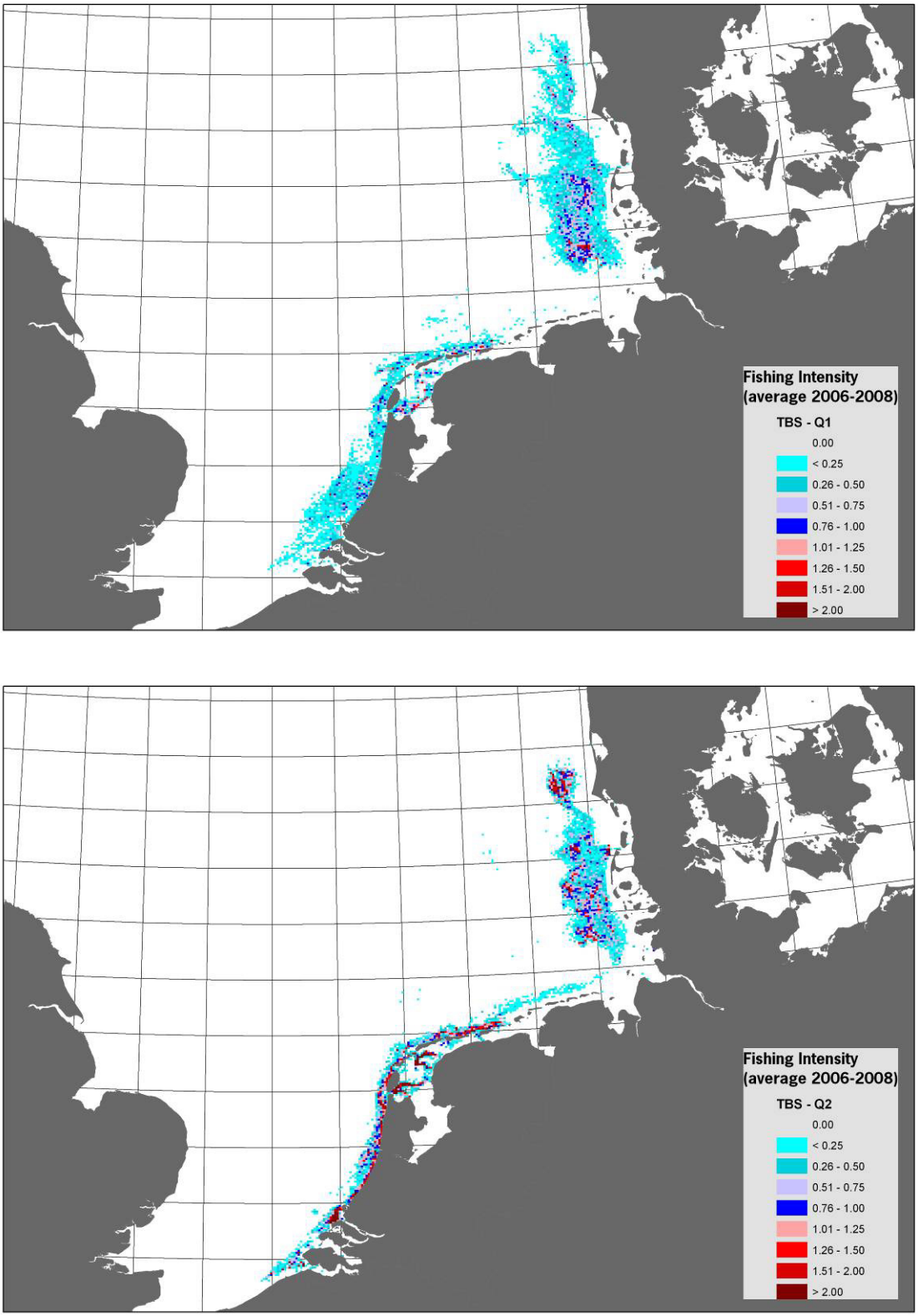
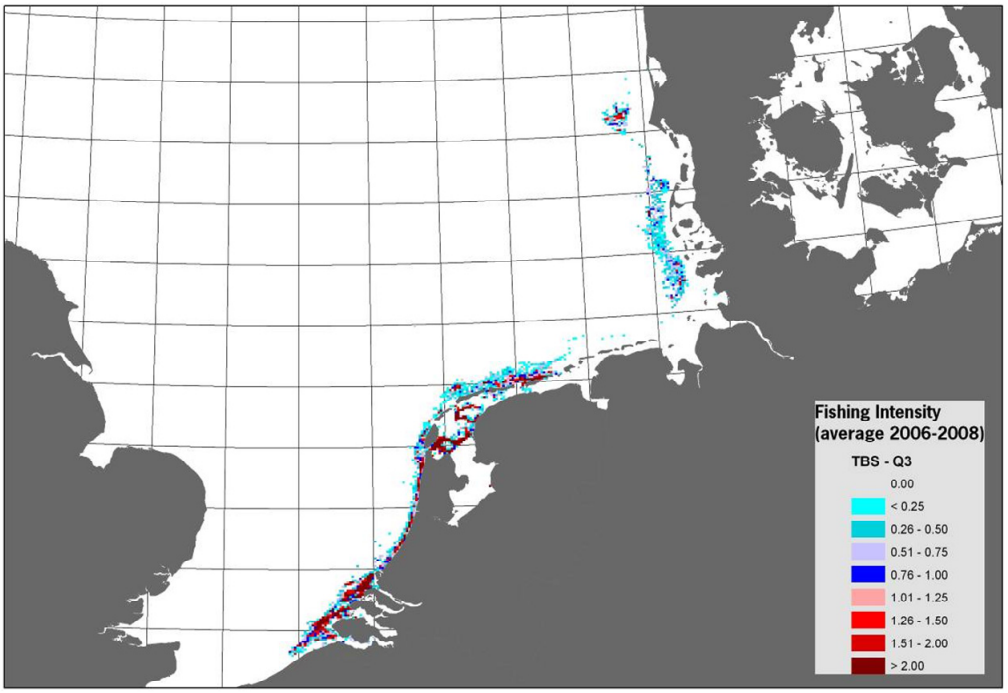


Figure 7.1. VMS data (number of visits per year) of the total Dutch fleet (data from 70% of the fleet were raised to the total fleet).



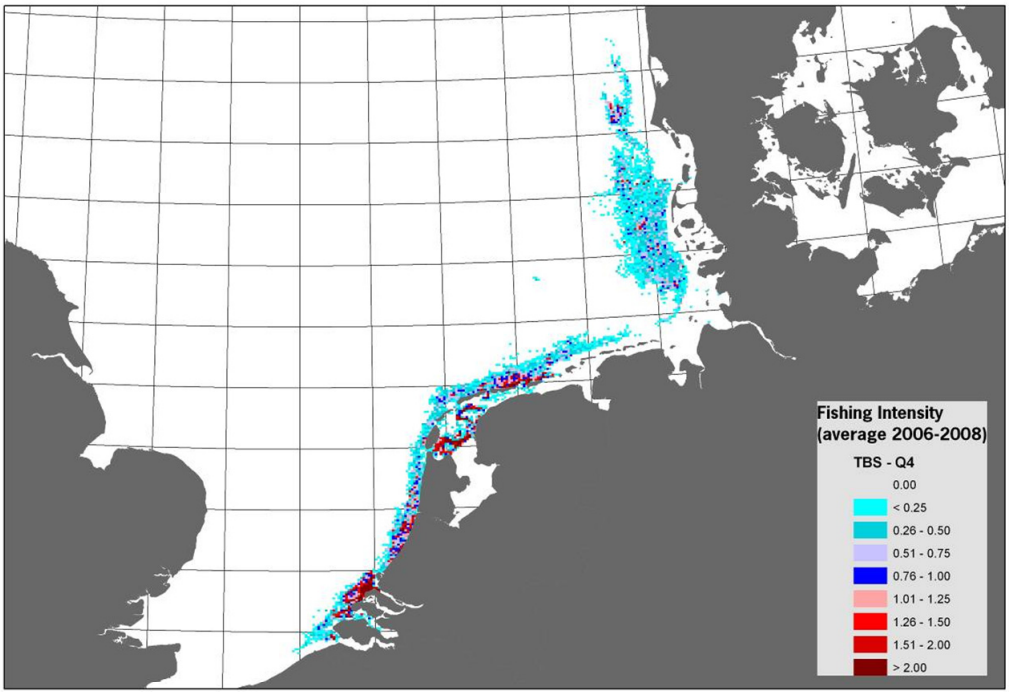


Figure 7.1 continued.

8 ToR f) complete comprehensive sea trials of the electric shrimp beam trawl design, and investigate the effects of this fishing technology on the ecosystem

8.1 Feasibility study on a species-selective electro trawl for the brown shrimp fishery with the focus on the reduction of discards and bottom contact finalized

Bart Verschueren

The discarding practises associated with the brown shrimp fishery have been regarded as a problem for many years. The poor selectivity of the small-meshed nets produces very high amounts of unwanted bycatch. The fact that the fishery itself is carried out in vulnerable areas like coastal-zones and estuaries, often important nurseries for a wide range of marine species, intensifies this problem. Especially the bycatch of young flatfish, like sole and plaice has a significant influence on the commercial fish stocks. An additional problem facing the fishery is the bottom contact caused by the heavy bobbin rope used to startle the shrimp.

Recently the brown shrimp fishery got confronted with certification of sustainability and environmental requirements (see elsewhere in this report). At the moment the issues mentioned above make it difficult to request for an ecological label. A label however could improve the competitive position and the image of this important fishery, and therefore could preserve the existence of several involved companies. Consequently the implementation of adequate selectivity enhancing and bottom affect reducing measures could result in both ecological and commercial improvements.

In this context a national project in Belgium, investigating the potential of electric pulses as a means to develop a species-selective electro-shrimp trawl, was finalized (Verschueren, 2009). 'Pulskor' was a multidisciplinary collaboration between ILVO Fisheries, the Flemish Fisheries Association, the University of Ghent and Marelec NV with the goal of developing and evaluating a new type of shrimp trawl.

This new fishing gear aims at stricter selectivity and reduced seabed contact. The fundamental idea is to replace the heavy bobbin rope with electrodes, in order to use electrical pulsation as a stimulation alternative. Prior research by ILVO Fisheries showed that the use of a specific electric field close to the seabed induces a jump response in shrimp and leaves other organisms untouched (Polet, 2004). Herein lays the selective fishing potential of this alternative technique. In addition, exposure and survival experiments, carried out in cooperation with an independent university, have shown that the use of these pulses, low in frequency and voltage, has no significant effects on fish and invertebrate species.

Generating the appropriate electric field in seawater requires custom equipment. The main element is the pulse generator which converts AC to low-frequency DC pulses and transmits them to the electrodes in the net. This generator is mounted on the gear and is fed through a cable from the ship. Lowering and hauling of this supply cable demands a specific winch. After a development phase, the equipment was installed on a shrimp trawler, on which testing took place.

Preservation of the commercial catches and the reduction of discards and seabed contact were the decisive criteria in the evaluation of the pulse beam trawl. Extensive testing of a prototype, by direct comparison with a standard catch shrimp trawl, revealed important and hopeful results (Verschueren, 2009). First and foremost could

be shown that at least as much shrimp can be caught with the new technique in comparison with the traditional gear, while the soil contact was reduced by 75%. On top of that, an average reduction of 35% in volume of discards is a major step forward in this issue

In the near future ILVO Fisheries would like to continue to examine how this unwanted bycatch can be further brought down. ILVO Fisheries is convinced that international cooperation between the North Sea bordering countries is needed to achieve this goal. The main brown shrimp fishery activity takes place in the Wadden Sea. At the same time the fishery in this area faces the highest quantities of discarded juvenile flatfish. Therefore further experiments and demonstration of this technique to the fishers on board of German, Dutch or Danish shrimp trawlers operating in this hotspot area is crucial. In future, implementation of this new technique could mean a revolutionary step in the evolution of the brown shrimp fishery.

8.2 References

Polet, H. 2004. Evaluation of bycatch in the Belgian brown shrimp (*Crangon Crangon* L.) fishery and of technical means to reduce discarding. PhD Thesis University of Gent, 212 pp.

Verschueren, B. 2009. Project 'Ontwikkeling en demonstratie van een selectieve pulskor voor de visserij op grijze garnaal met het oog op een reductie van de teruggooi en de milieuimpact (PULSKOR)': Eindrapportering, FIOV-project.

9 ToR g) review progress of MSC certification process

At the time of the meeting a full MSC assessment had not been carried out. The Dutch Producers Organisations have written a management plan. This plan was not known to WGCRAN until just before the meeting. The PO's had several questions that they would like to hear the group's opinion about. In addition Paul Medley and Bert Keus, on behalf of the assessment team joined the group on 13 May. We discussed especially the Principle 1 (A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations) of MSC and how and if the *Crangon* fishery could be evaluated under this principle.

Below are the questions and the answers by the group:

1. To assist the management of this Fishery, is 1990 (landings per unit effort) a suitable reference year to use for management purposes?

Crangon is a fast growing short-lived species with a lifespan of 2 years. The part of the stock that is important to the fisheries is consists of shrimps in their first year (0-group). Most of the recruitment important for fisheries is produced from the individuals that survive to spawn in winter and hatch larvae in the following spring. The variations in stock are poorly understood. Factors known to affect the stock include winter temperature and number of predators. There is no evidence to suggest a good stock/recruitment relationship from one year to the next in *Crangon*. Catch rates and landings often recover from low levels in a previous year or are poor following a good year but the relationship between spawning stock size and recruitment is not understood. The total mortality of *Crangon* depends on fishing mortality and natural mortality. In 1990 the stock of whiting and cod was high. However the three preceding years the numbers of egg-bearing females were exceptionally low for unknown reasons. If we would use 1990 as a reference year and at the same time the predator stock would increase, a problem could arise. Gadoid densities vary considerably but have a high affect on shrimp densities. It seems better to consider the fishing mortality in relation to the natural mortality. The problem here is that this estimate can only be made at the end of the year (based on the biomass estimate derived from the surveys) and that the biomass strongly depends on assumptions causing enormous variations in the estimate.

2. Can the Fishery managers improve on the use of the landed volume (max 15%) as the basis for a harvest control rule as referred to in the industry Management Plan?

Our interpretation of landed volume: including below commercial size shrimp

Clarification of question: the fishers are paid for the smaller shrimps, so it pays not to sieve properly, although the catch will be sieved in the harbour.

Reduction of the landed proportion undersized shrimp is only sensible if they are not caught and cooked. The sorting (or preferably not catching) should take place at sea before cooking. Published research (Revill and Holst, 2004) has shown that increasing the mesh size of the codend to 26 mm reduced the catch of small (below commercial size) shrimp by 13%. However using the sieve net is even more effective (reduction of 16–26%). Survival of small shrimp after sorting in the rotary sieve is 70% (Lancaster and Frid 2002). In conclusion a minimum of 15% in the landed volume does not make sense if the cooked shrimps are thrown overboard at sea.

3. Based on available information can you identify reference points that offer a high probability of, when used, improve the management of this fishery (target, precautionary and limit reference points)

Short answer: no.

These reference points are generally only used for stocks that are assessed. Because of its complicated life history this is not possible for brown shrimp. Any reference point related to spawning stock is not a good reference because of reasons mentioned above.

4. Would spatial (and temporal?) management (by National territory for example) offer improvement over generic management of the whole stock, e.g. using the same CPUE trigger point for all fishing areas.

The problem with the LPUE and/or CPUE is that the calculation method differs between the countries. Such a distinction would be justified when CPUE (and densities) differs between areas, which they probably do but currently we do not have the right figures to make the comparisons. That however would require additional analyses of the available data.

Note: there are some shifts in effort: recently more towards winter and more to the north (Danish waters)

5. How can the Fishery management Plan assist in the provision for data to the Working Group?

Any quantitative information provided by fishers' e.g. electronic logbooks, ratios of bycatch has potential scientific value, which may lead to better understanding of the fisheries and its environmental impacts. Although EU logbooks and VMS potentially supply this information it is difficult to combine them because of differences between the countries.

Possible exercises that may yield useful information with regard to reference points (this would require additional time from specific group members):

Look at possibility to use spring Balgzand juvenile *Crangon* as a prediction for stock in autumn

Use the Yield per recruit model developed by University of Hamburg. The problem that this is a mechanistic model. It gives directions as an outcome, no actual numbers. Also it is not predictive. Scenario-runs with reduced winter fisheries

Calculate natural and fishing mortality from total mortality (method Marc Hufnagel) per year and evaluate the possibility of using the ratio as a reference point.

Recommendations regarding the MSC process

Use the unfished areas in Danish waters as a reference to better understand the effect of Crangon fishing on the ecosystem.

Investigate the short-term ecological effects of fishing disturbance by Crangon vessels.

Quantify discard mortality of bycatch species caught in the Crangon fishery.

Exploring the utility of the correlation between autumn survey catches, spring survey and commercial catches as a management tool to assess the North Sea Crangon stock, including the implications of variable catchability during surveys.

10 ToR h) collate and update landings and effort data, including numbers of active vessels

10.1 Overview-Germany

German landings of consumption shrimp (*C. Crangon*) have slightly increased from 12173 tonnes in 2007 to 12956 in 2008. The seasonal distribution of the landings generally followed the standard pattern with very low landings in winter, increasing in spring, with a slight reduction in May/June (which occurred one month earlier in 2008) and the main autumn fishery. However, spring landings (January-June) fell back to 4000 t in 2008, two thirds of the highest landing in the time-series from 2005. The main season (July to December) was very good then and reached a high level of 8945 t with September having the most landings. The majority of brown shrimp landings originated from the Inner German Bight in the Elbe estuary and especially towards the peninsula of Eiderstedt in the north where the influence of the Elbe River is high. Further north within the North Frisian Islands and west in the East Frisian Islands, catches were lower. Therefore the fleet had concentrated its effort mainly in the southeast of the German Bight. However, in winter much of the fleet left the near coast areas and fished further offshore in the northern part of Germany as well as in the Danish waters as was shown in earlier reports.

The small increase in the annual landings has been achieved by an increase in effort by the 242 active vessels. This resulted in a further decrease in LPUE compared to the previous years and may suggest a further slight decrease of stocks compared to 2007 and the year before.

The known correlation between autumn and subsequent spring landings is a sign for comparatively good landings for the 2009 spring season. Based on this relationship the LPUE should be lower in spring 2009, which means that only increased effort will lead to average landings in the first part of the year.

The known climate effect (Winter NAO_{DJF} and SST_{DJF}) on the year classes of *C. Crangon* will probably also lead to an average stock and average landings for the period from July to December 2009 provided that predation by gadoids (presumably only whiting) is typical.

10.2 Overview-The Netherlands

Total effort in the Netherlands in 2008 was 4.8 million hp days. This value is in the same range since 1988. Dutch landings of *Crangon Crangon* have decreased to 14548 tonnes, which is a reduction of 10% in comparison with 2007. The seasonal distribution of the landings and effort show peaks in March to May and September to November and that pattern is consistent over the years. However, in 2008 the Dutch landings were considerably lower in January-May in comparison with previous years.

LPUE shows a consistent pattern in the last years. This pattern also appears in the German fisheries. The LPUE values are generally much higher in autumn than in spring. 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 tonne per year).

10.3 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 2008 and the Danish landings amounts to 3,389 tonnes and the landings by other EU-countries were 2,725 tones. These landings are included in the respective national figures. The Danish landings decreased in 2008 compared to 2007 by 14.4%.

Based on logbook information the reported catch, effort and LPUE for the Danish fleet is given. In 2008, 27 Danish vessels fished and landed *C. Crangon*. Total fleet effort increased from around average 918,083 (hp-days) in 2007 to 1,166,101 in 2008. The LPUE the previous 12 years was in average 3.23. The LPUE peaked in 2006 at a value of 6.51 Kg/hp-day. In 2008 the Danish LPUE decreased to 3.03. The highest landings took place in April, May, June and July. The lowest landings were in January and February. The Danish effort is high in spring and summer.

Similar to the previous years, a large number of German vessels (46) and Dutch vessels (76) fished shrimps too in Danish waters and landed the catches in Danish harbours. There has been smaller decrease in the number of vessels from other EU-countries fishing and landing *C. Crangon* in 2008 compared to 2007 of around 15%. The Belgians have in 2008 halved their activity in the Danish economical zone in North Sea and only 2 Belgian vessels have fished and landed *C. Crangon* in Danish waters. The effort and LPUE data for the other EU countries are based on logbook information from the respective EU-Countries.

10.4 Overview-United Kingdom

The Wash fishery in the North Sea is the source of around 90% of the recorded landings for the UK with ICES squares F034 and F035 the most important areas for the UK *Crangon*id fishery. Annual landings of *Crangon* have been variable over time with the highest recorded landings (1865 t) in 2001 and the lowest in 1984 (132 t). However improvements in reporting procedures since 1988 led to more comprehensive data collection, and data prior to this year are considered less reliable. 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. The low landings in 2006 were attributed partially to the success of The Wash cockle fishery (Cerastoderma edule), which provided a better economic alternative for much of the shrimp fleet. However, 2007 saw high landings of brown shrimps at 1389 tonnes, the fourth largest landings since (accurate) records began in 1988. Moreover, the landings-per-unit-of-effort was the highest for this period. The good recruitment that provided the high landings in autumn of 2007 also contributed to a good fishery in winter and early spring of 2008

Since 1989, effort information for 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 was 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. Effort in 2007 was higher than in 2006, although still low compared with previous years. However, in autumn of 2007 and winter of 2008 effort was very high and this corresponds to the period of good landings and high prices.

Since 1989 the number of vessels reported as fishing for brown shrimps has varied between 48 and 91, according to market forces and other fishing opportunities. Although this value is likely to be an underestimate of the true numbers of vessels operating in England and Wales it is considered a reasonable estimate of the size of the

fleet. The recent high prices and landings of the main UK fishery have led to moderately large numbers of vessels (82 in 2008) prosecuting the fishery.

10.5 Overview-Belgium

Total annual landings from Belgian shrimp trawlers into Belgian harbours increased in 2008 with 32% to 264 tons (50% in Oostende, 33% in Nieuwpoort and 17% in Zeebrügge) compared to 2007, this figure is still short of the average of 375 tons during the last decade, where landings seemed to stabilize after a 20-year drop. Landings of Belgian trawlers into foreign ports reached over 550 tons (90% in the Netherlands, 9% in Germany and 2% in Denmark). The Belgian shrimp trawling fleet consists of 33 vessels, of which 13 vessels exclusively landed in Dutch harbours, compared to 14 vessels in Belgian harbours. LPUEs (kg/hp-fishing hours) related to the landings in Belgian harbours and foreign harbours were 0,074 and 0,131 respectively. From now on we will further focus on the landings of Belgian shrimp trawlers into Belgian harbours: on average, the yearly Belgian effort during the last decade is characterized by a low effort of 180000 hp-fishing hours from January till March, gradually increasing and reaching a peak of 750000 hp-fishing hours in October. In contrast with other national shrimp fleets, an intensive winter fishery is thus missing. The annual effort was extremely low and comparable with the previous year: 3.9 million and 3.6 million hp-fishing hours in 2007 and 2008, respectively, compared with an average of 6.1 million during the previous decade. The extremely low effort in March, 41.000 hp-fishing hours, remains yet unexplained. Compared to previous years, LPUEs during January-March of 2008 were extremely low with an average of 0,016 kg/hp-fishing hours, compared to an average of 0,035 the previous decade. These extremely low winter LPUEs are surely related with the lowest LPUEs (and thus probably a small shrimp stock size) observed since 1991 during autumn (September-December) of 2007. It should be noted that LPUE peaked extremely early in July in 2007, which would normally occur only in September. This trend possibly explains the choice for a low shrimp fishing effort in March by the Belgian fleet. On the other hand summer LPUE's extremely peaked to 0,148 in August (compared to a monthly average of 0.92 during the previous decade), which is actually the highest monthly LPUE observed since September 1994. The apparently high shrimp abundance can possibly be attributed to the extremely low fishing efforts made during winter. Annual average LPUEs increased from 0.052 to 0.074, which is the highest LPUE value observed since 1999.

10.6 Overview-France

In France, the brown shrimp fishing occurs in the Eastern English Channel and the Southern North Sea (Bay of Somme, Seine estuary), along the Atlantic coast (pertuis charentais) and also for a small part on the Mediterranean coast. Total landings in 2008 were estimated to 191 tonnes with 92 coming from the Northern part. For this same year, the total number of boats involved was respectively 125 and 38; these include a majority of boats having part-time activity on brown shrimp. The boats are small (8–14m) and they used otter bottom-trawl with selectivity device as Devismes or Asselin, the brown shrimp is landed alive and the main fishing seasons are spring and autumn. A general decreasing trend is observed for the landings and the current level is only 10% of which it was in the 70. This seems linked with a decrease of the local stocks.

10.7 Total EU landings of *C. Crangon*

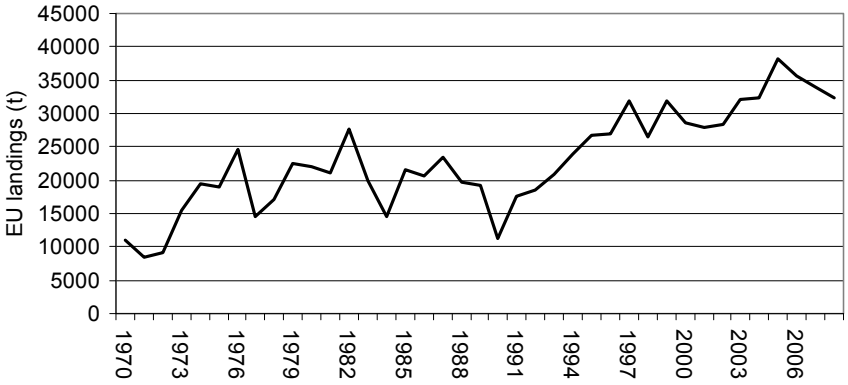


Figure 10.1. Total landings of *C. crangon* from the North Sea [t] by all countries

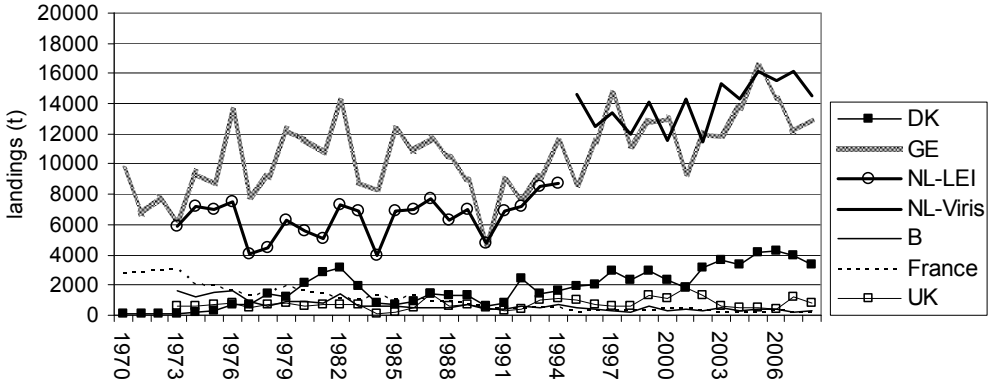


Figure 10.2. Total landings of *C. crangon* from the North Sea [t] by country. All data are in landed (cooked) weight

DK official statistics

DE official statistics

NL-VIS from Producer organizations (inclusion of foreign landings unclear)

NL-VIRIS source VIRIS logbook data (1995–2003) including landings in foreign harbours

BE official statistics

FR official statistics (France IV+VIId) UK official statistics, including Irish sea landings.

10.8 Seasonal EU landings of *C. Crangon*

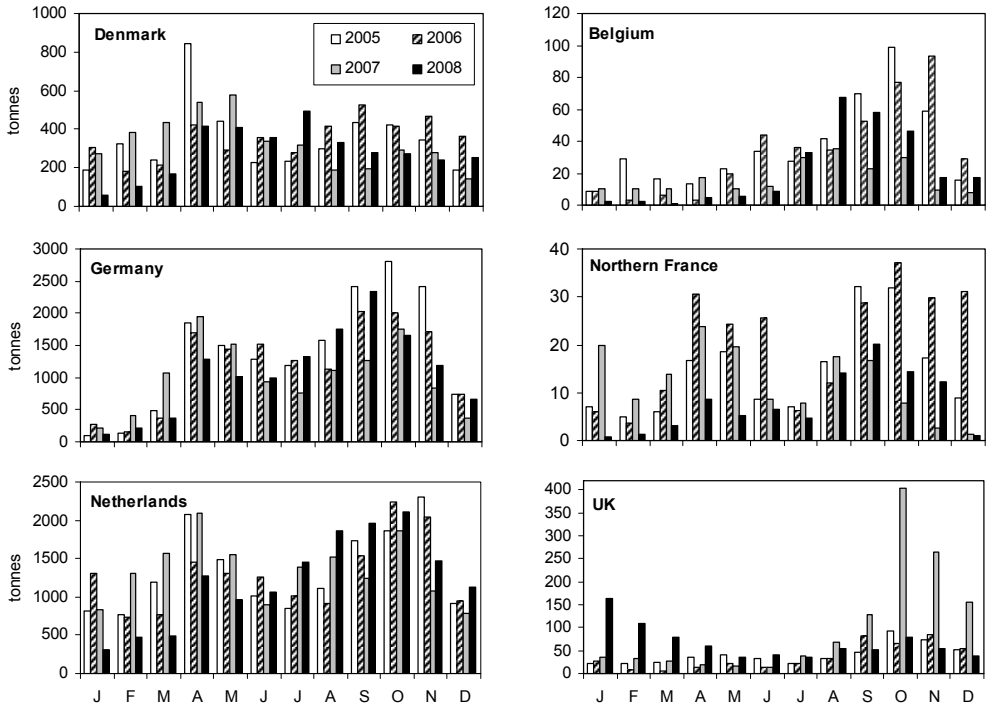


Figure 10.3. Landings of *C. crangon* from the North Sea [t] by country and month.

10.9 Total fleet effort in the EU *C. Crangon* fishing fleets

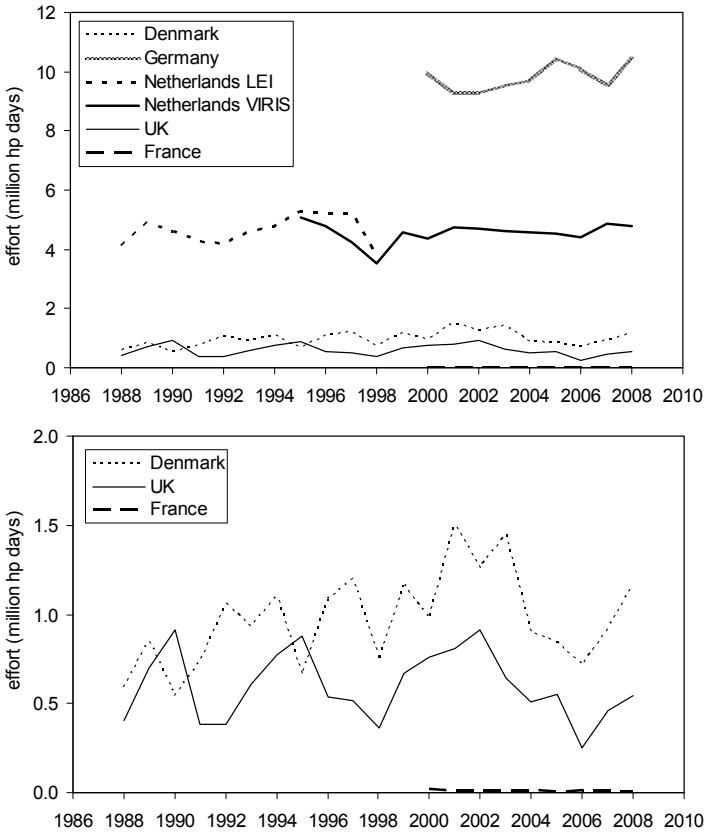


Figure 10.4. Netherlands LEI based on data collated by LEI institute; Netherlands VIRIS based on VIRIS data. The lower graph represents the data for Denmark UK and France again separate, but on a different y-axis, allowing to see the year to year fluctuations better.

10.10 Seasonal fleet effort in the EU *C. Crangon* fishing fleets

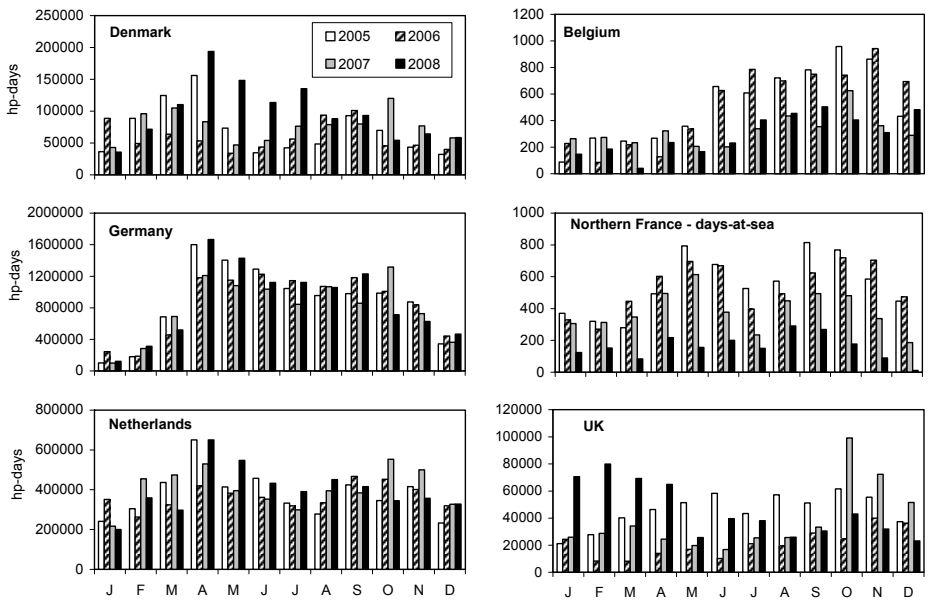


Figure 10.5. Effort by country and month.

10.11 Landings per unit effort in the EU *C. Crangon* fishing fleets

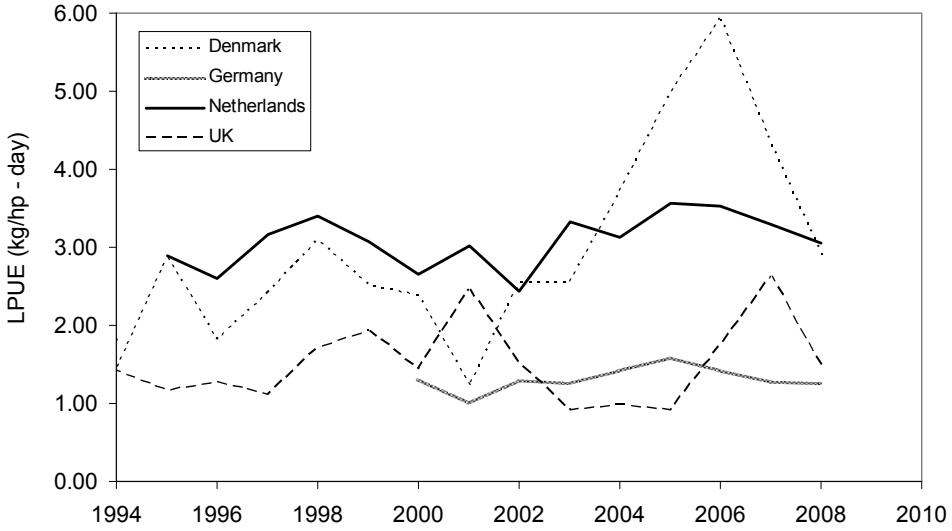


Figure 10.6. Units are different for the different countries: (DK) kg/hp-day; (NL) kg/hp-day;(DE) 1973–1994 effort LEI, catch PO, 1995 -2003 catch + effort VIRIS; (BE) kg/10 hp-fishing hours.

10.12 Numbers of vessels

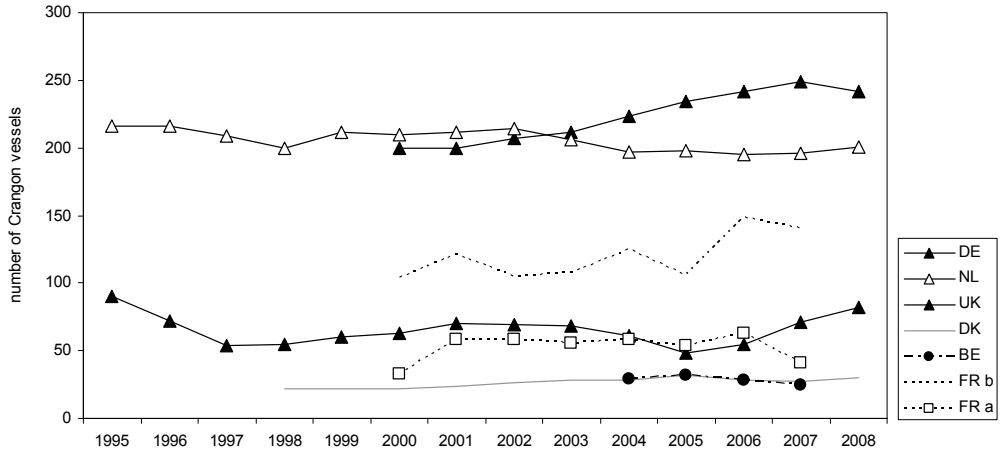


Figure 10.7. Number of active Crangon vessels per country.

11 ToR i) review recent Crangon related Research and Development activity

11.1 Feasibility study on a species-selective electro trawl for the brown shrimp fishery with the focus on the reduction of discards and bottom contact finalized

Bart Verschueren

The discarding practises associated with the brown shrimp fishery have been regarded as a problem for many years. The poor selectivity of the small-meshed nets produces very high amounts of unwanted bycatch. The fact that the fishery itself is carried out in vulnerable areas like coastal-zones and estuaries, often important nurseries for a wide range of marine species, intensifies this problem. Especially the bycatch of young flatfish, like sole and plaice has a significant influence on the commercial fish stocks. An additional problem facing the fishery is the bottom contact caused by the heavy bobbin rope used to startle the shrimp.

Recently the brown shrimp fishery got confronted with certification of sustainability and environmental requirements (see elsewhere in this report). At the moment the issues mentioned above make it difficult to request for an ecological label. A label however could improve the competitive position and the image of this important fishery, and therefore could preserve the existence of several involved companies. Consequently the implementation of adequate selectivity enhancing and bottom impact reducing measures could result in both ecological and commercial improvements.

In this context a national project in Belgium, investigating the potential of electric pulses as a means to develop a species-selective electro-shrimp trawl, was finalized (Verschueren, 2009). 'Pulskor' was a multidisciplinary collaboration between ILVO Fisheries, the Flemish Fisheries Association, the University of Ghent and Marelec NV with the goal of developing and evaluating a new type of shrimp trawl.

This new fishing gear aims at stricter selectivity and reduced seabed contact. The fundamental idea is to replace the heavy bobbin rope with electrodes, in order to use electrical pulsation as a stimulation alternative. Prior research by ILVO Fisheries showed that the use of a specific electric field close to the seabed induces a jump response in shrimp and leaves other organisms untouched (Polet, 2004). Herein lays the selective fishing potential of this alternative technique. In addition, exposure and survival experiments, carried out in cooperation with an independent university, have shown that the use of these pulses, low in frequency and voltage, has no significant effects on fish and invertebrate species.

Generating the appropriate electric field in seawater requires custom equipment. The main element is the pulse generator which converts AC to low-frequency DC pulses and transmits them to the electrodes in the net. This generator is mounted on the gear and is fed through a cable from the ship. Lowering and hauling of this supply cable demands a specific winch. After a development phase, the equipment was installed on a shrimp trawler, on which testing took place.

Preservation of the commercial catches and the reduction of discards and seabed contact were the decisive criteria in the evaluation of the pulse beam trawl. Extensive testing of a prototype, by direct comparison with a standard catch shrimp trawl, revealed important and hopeful results (Verschueren, 2009). First and foremost could

be shown that at least as much shrimp can be caught with the new technique in comparison with the traditional gear, while the soil contact was reduced by 75%. On top of that, an average reduction of 35% in volume of discards is a major step forward in this issue

In the near future ILVO Fisheries would like to continue to examine how this unwanted bycatch can be further brought down. ILVO Fisheries is convinced that international cooperation between the North Sea bordering countries is needed to achieve this goal. The main brown shrimp fishery activity takes place in the Wadden Sea. At the same time the fishery in this area faces the highest quantities of discarded juvenile flatfish. Therefore further experiments and demonstration of this technique to the fishers on board of German, Dutch or Danish shrimp trawlers operating in this hotspot area is crucial. In future, implementation of this new technique could mean a revolutionary step in the evolution of the brown shrimp fishery.

11.1.1 References

Polet, H. 2004. Evaluation of bycatch in the Belgian brown shrimp (*Crangon Crangon* L.) fishery and of technical means to reduce discarding. PhD Thesis University of Gent, 212 pp.

Verschueren, B. 2009. Project 'Ontwikkeling en demonstratie van een selectieve pulskor voor de visserij op grijze garnaal met het oog op een reductie van de teruggooi en de milieuimpact (PULSKOR)': Eindrapportering, FIOV-project.

11.2 Crangon genetics in ecotoxicology

Yves Verhaegen

As discussed during the WGCRAN meeting last year, the aim of this PhD research is to document the effects of pollution on North Sea brown shrimp. Within the framework of the OSPAR Coordinated Environmental Monitoring Program (CEMP), the Flemish Institute for Agricultural and Fisheries Research measures the concentrations of heavy metals and organic pollutants in *C. crangon* originating in the Belgian Continental Shelf (BCF) on a seasonal basis since 1975 and 1989, respectively. These and other data show that pollution in shrimp reaches comparable concentrations as in benthic fish. However, such data currently vastly short comes their potential scientific value as long as no deductions can be made concerning the biological effects of the pollutant concentrations measured. Moreover, wild shrimp are naturally subjected to a complex composition of environmental conditions, further impeding the detection of pollutant effects. Acute and chronic laboratory exposure experiments will therefore relate exposure to single pollutant concentrations with classical biological effects (e.g. survival, molting, reproduction, behaviour…) on the one hand, and effects on gene expression through the use of a C. crangon microarray, which is currently under development, on the other hand. Gene expression analysis will thus allow us to investigate pollution effects at the most basic biological level, leading to a better understanding of the complex effects at higher biological levels (e.g. individual physiology and population dynamics) and under various conditions. Moreover, this microarray will represent a powerful tool (e.g. a practically unlimited set of biomarkers on one glass slide) for field monitoring of biological effects of contaminants. During the PhD research program the laboratory experiments will focus on three ubiquitous pollutants: (a) PBDE 47, a flame retardant which has been used in large quantities in household and industrial products (b) TBT, a biocide mostly used in antifouling paints, and (c) PFOS, a surfactant used in many household and industrial products, mostly as a water repellent. Besides acute (lethal) and chronic (sublethal) exposure

experiments, the effects on molting hormone (ecdysteroid) functioning, which is known to be sensitive to disruption, of these pollutants will be quantified by an in-vitro method. The research progress will be discussed during this meeting. Concerning the in-vitro analysis, the ecdysteroid receptor (EcR) and retinoid-X-receptor (RXR), the obligate heterodimeric partner of EcR, were fully cloned and expressed in an insect cell line (as no crustacean cell line currently is available). Subsequently, the effects of these three pollutants on the hormone-receptor interaction were measured through a luciferase reporter assay, a molecular approach we will not discuss in detail. This technique proved that TBT and PFOS interfered partially, while BDE47 completely blocked the hormone-receptor interaction, even at nanomolar concentrations, confirming current scientific concerns over these environmental contaminants. Concerning the shrimp microarray, 85 unique gene fragments have now been isolated. It should be noted that, except partial coding sequences from cytochrome oxidase subunit 1, no genetic information for C. crangon was actually known. During the next weeks a microarray encompassing a thousand unique gene fragments will thus be constructed, which will allow us to quickly screen the altered expression of a broad range of genes between two shrimp samples. For the experimental study, the laboratory facility is currently being upgraded to accommodate large-scale exposure experiments, while the first acute (lethal) toxicity experiments are planned for this summer. Finally, field samples have been collected during the past two years on the Belgian continental flat and into the Western Scheldt estuary towards Antwerp harbour. Of each sampling station subsamples were taken for contaminant analysis and gene expression analysis. Analyses of these samples should also start during this summer as the microarray shall be completed. During the following years this sampling strategy shall be continued and expanded to encompass the international shrimp grounds of the North Sea, in cooperation with the partner institutes supporting the ICES WGCRAN workgroup. Following this multidisciplinary approach, an extensive image of pollutant concentrations and effects on the North Sea brown shrimp stock should be documented within three years, while the shrimp microarray should have proven itself to be a powerful research and monitoring tool.

11.3 Preliminary assessment of brown shrimp *Crangon crangon* biomass from the FFS "Solea" and FK "Poseidon" Winter Surveys, German Bight, January 2009

Thomas Neudecker, Maren Odefey, and Uli Damm

The German national Winter *Crangon* Survey (WCS) targeting on brown shrimp (*C. Crangon*) was again conducted by FFS "Solea" in January to February 2009 with in all 107 stations along the Dutch, German and Danish coasts including for the first time one transect towards the Dogger Bank (Figure 11.3.1). The beam trawl hauls (7-m-shrimp trawl, 20 mm stretched mesh in codend, half hour each) covered depths from 10 to 64 metres (Figure 11.3.2).

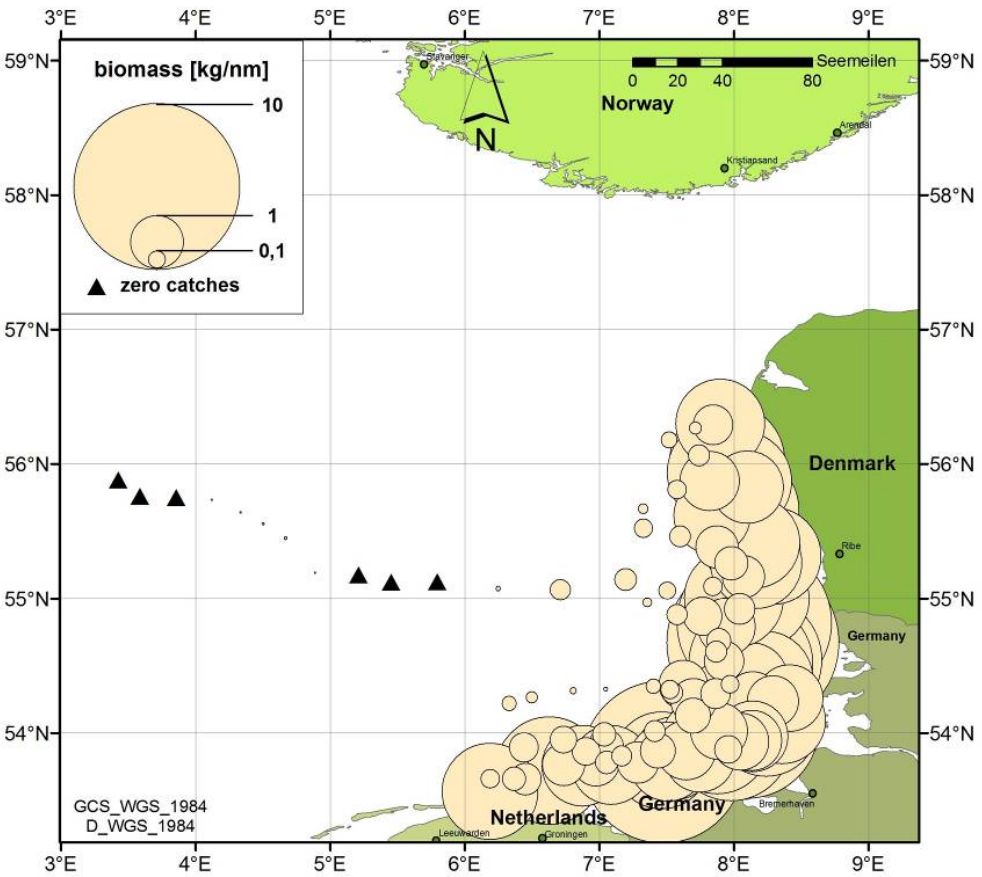


Figure 11.3.1. Distribution of trawl stations during German national Winter Crangon Survey of FFS "Solea" in January 2009 with total crangonid biomass [kg/nm] per station.

Additionally 31 hauls were done by a chartered shrimping vessel (FK "Poseidon") in the East Frisian region near the islands of Baltrum and Langeoog using a 3-m- beam trawl (20 mm stretched mesh in codend, 15 min. each). These hauls covered the depth range of 2 to 14 m (Figure 11.3.2) and were partly overlapping in area with the Solea survey. All catch data were calculated to a standard of kg / 1000 m². Catch data from both datasets are plotted in Figure 2.

Area data on depth strata were obtained from the Bundesamt für Seeschifffahrt und Hydrographie (BSH), Hamburg, and are listed in Table 11.3.1.

Figure 11.3.1 shows that *Crangon*id shrimps are distributed along the coastline of the German Bight with highest concentrations in the inner part. Obviously the distribution area exceeds the survey area towards the north as well as towards the southwest, as high catch rates occurred at the northern most as well as southwestern most stations. On the other hand catch rates decrease with the distance from the shore, and zero catches occurred northwest of 55°N and 6°E at depths below 40 m of water. Only single specimens were caught in the five hauls at the northeast part of the Dogger. This result – "only single specimens" - was confirmed by RV "Senckenberg" fishing on Dogger Tail End as well at the same time (M. Sonnewald, pers. comm. 2009).

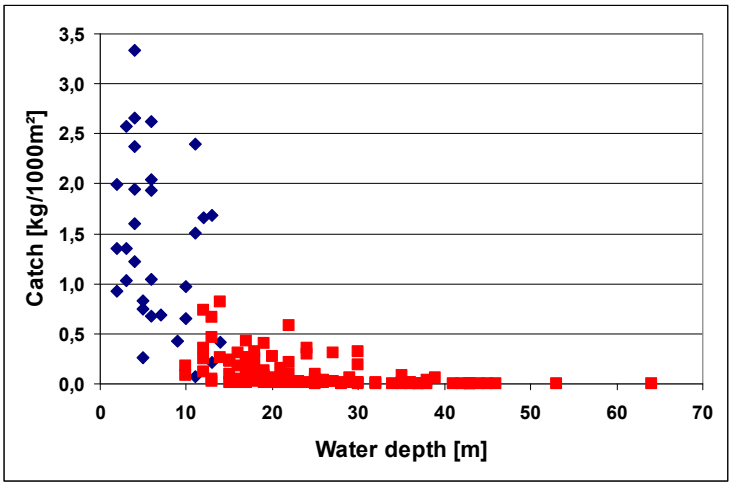


Figure 11.3.2. Catch rates for crangonid shrimp [kg/1000 m²] during German national Winter Crangon Survey of FFS "Solea" (red squares) and shrimping vessel FK Poseidon (blue rhombus) in January 2009.

As FFS "Solea" had fished depths down to 45 m before in 2000 (cruise report 453. Solea, 05. to 18.01.2000) and 1999 (cruise report 436. Solea, 04. to 19.01.1999) with very similar results for abundance of brown shrimp in the deeper parts of the Eastern North Sea it can be assumed, that the distribution and abundance pattern may be generally valid for the species in the North Sea. Therefore areas of the 0-m-depth strata were multiplied with the mean catch rates [kg/1000m²] of the same depth ranges giving biomass data per stratum and vessel (Table 11.3.1). Adding up the highest results per stratum (because catch efficiency is below 1.0) a first and preliminary total biomass for brown shrimp in winter is obtained for the North Sea for January 2009: 65664 tonnes.

That result needs to be checked against catch efficiency rates for brown shrimp in winter and by length classes of shrimp leading to probably much higher biomasses. On the other hand the catch rates from the East Frisian Wadden Sea area may not be valid for the entire Wadden Sea or depth stratum from 0 to 10 metres all along the North Sea coasts.

Considerable differences between channel systems have been found based on DYFS data from autumn period (compare ICES WGCRAN Report 2007, 9.5) and could lead into either direction as there is a lack of information on abundance data from the rest of the coastline.

However, the order of magnitude seems to be acceptable as other studies have shown 25000 and 35000 tonnes of brown shrimp above 54mm total length for autumn (DFS data) only for the Wadden Sea area (compare ICES WGCRAN Report 2007, 6.1.2. and 6.1.3.) missing other parts of the *C. Crangon* North Sea distribution.

Another but minor factor is the combining of *C. Crangon* and *C. allmanni* catches as *Crangon*ids valid here before species separation. *C. allmanni* was present only in very small numbers if at all in most of the catches. A more detailed investigation, however, will leave them out, while available length measurements will give accurate information on commercial as well as non commercial sizes.

Generally it should be possible to achieve time-series for brown shrimp biomasses for a number of years for winter, spring and autumn periods based on data collected during WCS (1991 to present), DFS and DYFS (spring: 1974 to 2004, autumn: 1974 to

present) respectively. In combination with commercial catches and predation rates they could well serve for the validation of stock size models.

Table 11.3.1. Depth strata for the North Sea, corresponding catch rates for brown shrimp and resulting biomass data for depth strata and total North Sea in January 2009.

Depth strata [m]	Areas in North Sea [km²]	Mean catch FK "Poseidon" [kg/1000m²]	Mean catch FFS "SOLEA" [kg/1000m²]	Biomass "Poseidon" [t]	Biomass FFS "SOLEA" [t]	Combined Biomass [t]
10	21000	1,527		32.072		32.072
20	24000	1,064	0,2016	25.539	4.838	25.539
30	61000		0,0893		5.447	5.447
40	65000		0,0399		2.596	2.596
50	58000		0,0002		9	9
60					0	0
70					0	0
North Sea	229000	Total biomass of brown shrimp		57.611	12.890	65.664

11.4 Preliminary abundance and distribution of brown shrimp *Crangon crangon* in the German Wadden Sea region from DYFS data 2008

Thomas Neudecker

The Demersal Young Fish and Brown Shrimp Survey (DYFS) targeting on plaice, sole, cod, whiting and brown shrimp (*C. Crangon*) was again conducted in September to October 2008 with in all 159 stations along the German coasts including for the first time one transect towards Helgoland (Figure 11.4.1). The beam trawl hauls (3-m-shrimp trawl, 20 mm stretched mesh in codend, 15 minutes each) normally cover depths from 2 to 15 metres. In 2008 - due to the transect to Helgoland - depths down to 32 metres have been fished as well to investigate, whether and to what extent the deeper off shore parts along the coast are inhabited by brown shrimp as well. That was a recommendation of the 2007 WGCRAN meeting.

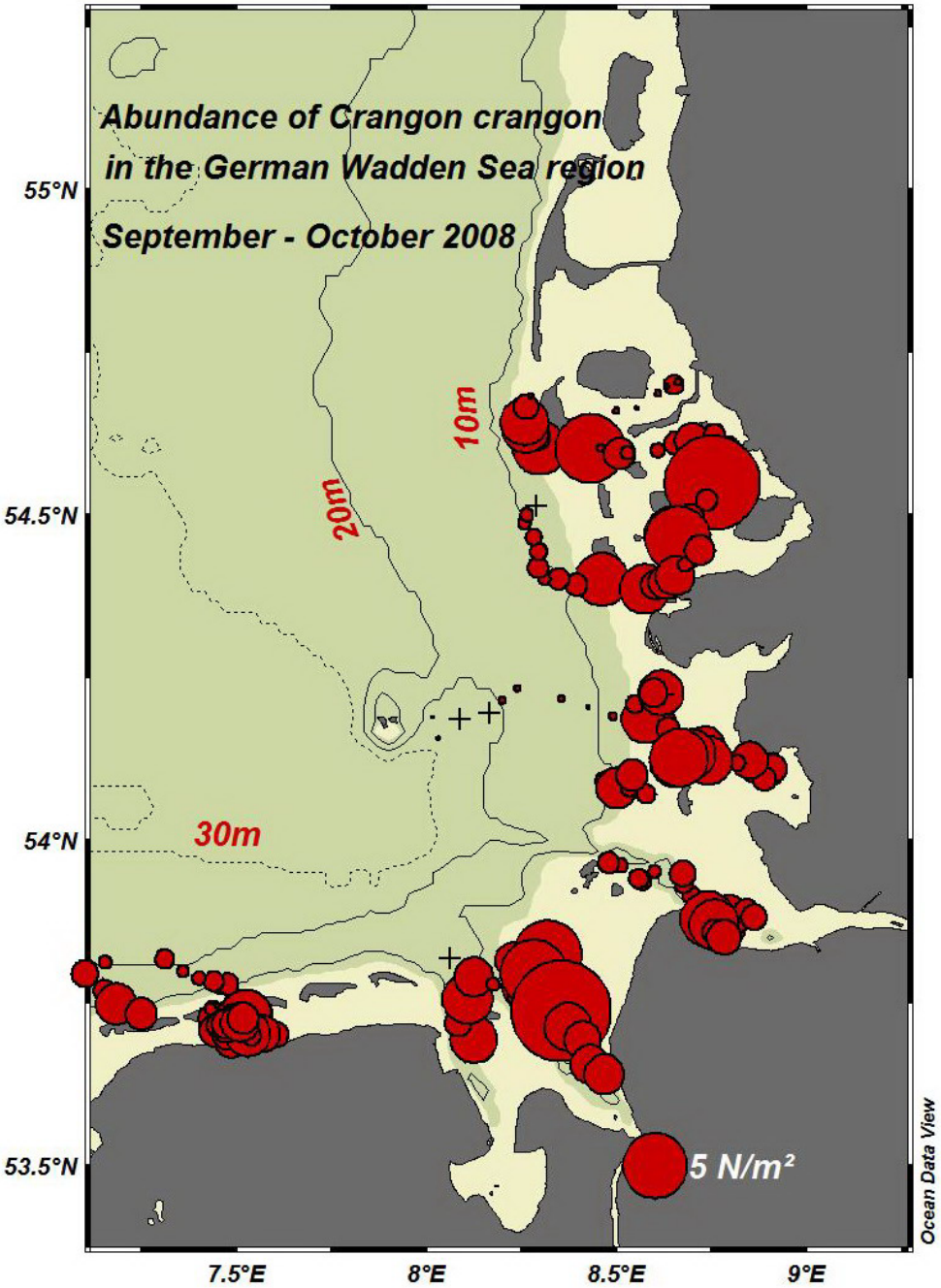


Figure 11.4.1. Distribution of trawl stations during German DYFS in autumn 2008 with abundance data for brown shrimp (*C. crangon*).

Figure 11.4.1 shows that all stations between Helgoland and the 10m-line gave only marginal numbers of shrimp and at depths of more than 20 metres two hauls held no *C. Crangon* at all (Figure 11.4.2). As length based data are available it will be interesting to see how the size dependant distribution will look like which is known from former comparisons to give trends between northern and southern stations as well as from inshore to offshore parts of the Wadden Sea.

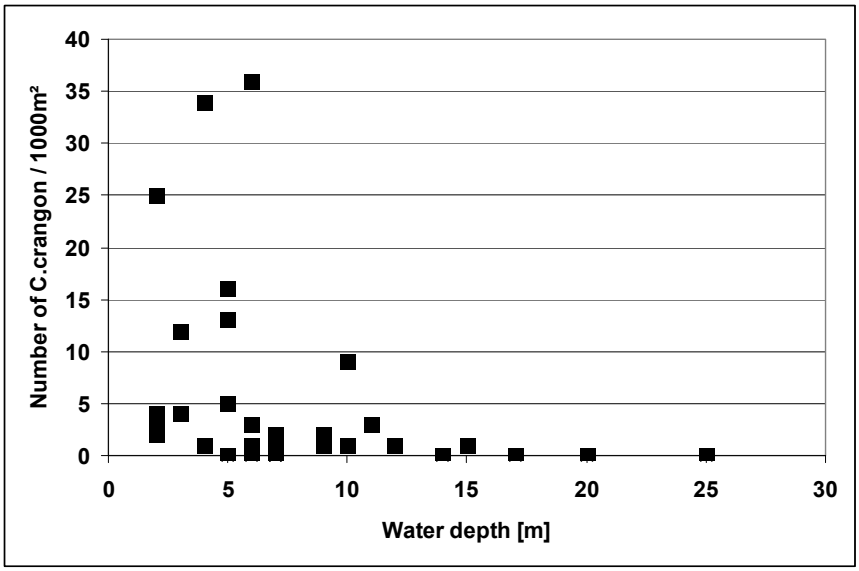


Figure 11.4.2. Depth dependant abundance data of brown shrimp *C. crangon* from the DYFS in the Büsum-Helgoland region, September 2008.

11.5 No evidence of brown shrimp *Crangon crangon* in the deep waters between Scotland and Norway in 2009

Thomas Neudecker, Gerd Wegner, and Gitta Hemken

At the 2008 WGCRAN meeting information arose, that brown shrimp (*C. Crangon*) is also occurring in great numbers in deep waters between Scotland and Norway besides *C. allmanni*. Evidence for that was given on basis of results from IBTS surveys conducted with RV "Walther Herwig III" in 1999 as well as in 2000 (compare Figures 11.5.1 and 11.5.2). On the IBTS compare Callaway *et al.* (2002).

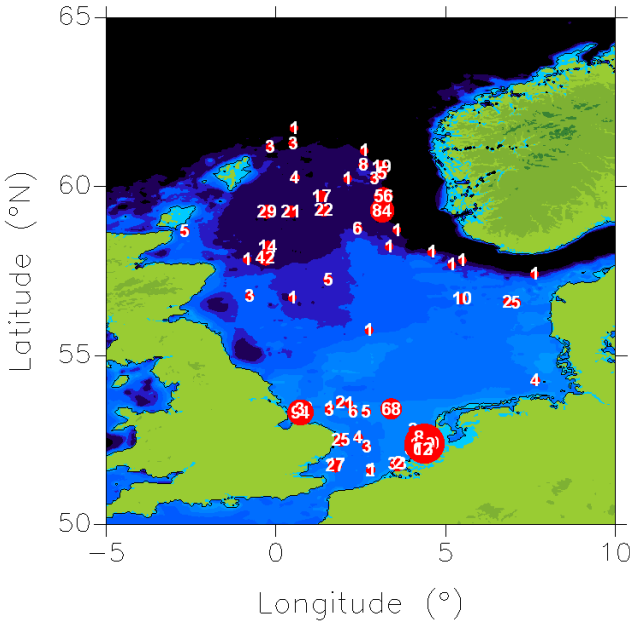


Figure 11.5.1. Distribution of trawl stations of IBTS in January 1999/2000 and abundance data [N/100m²] for brown shrimp (*C. Crangon*).

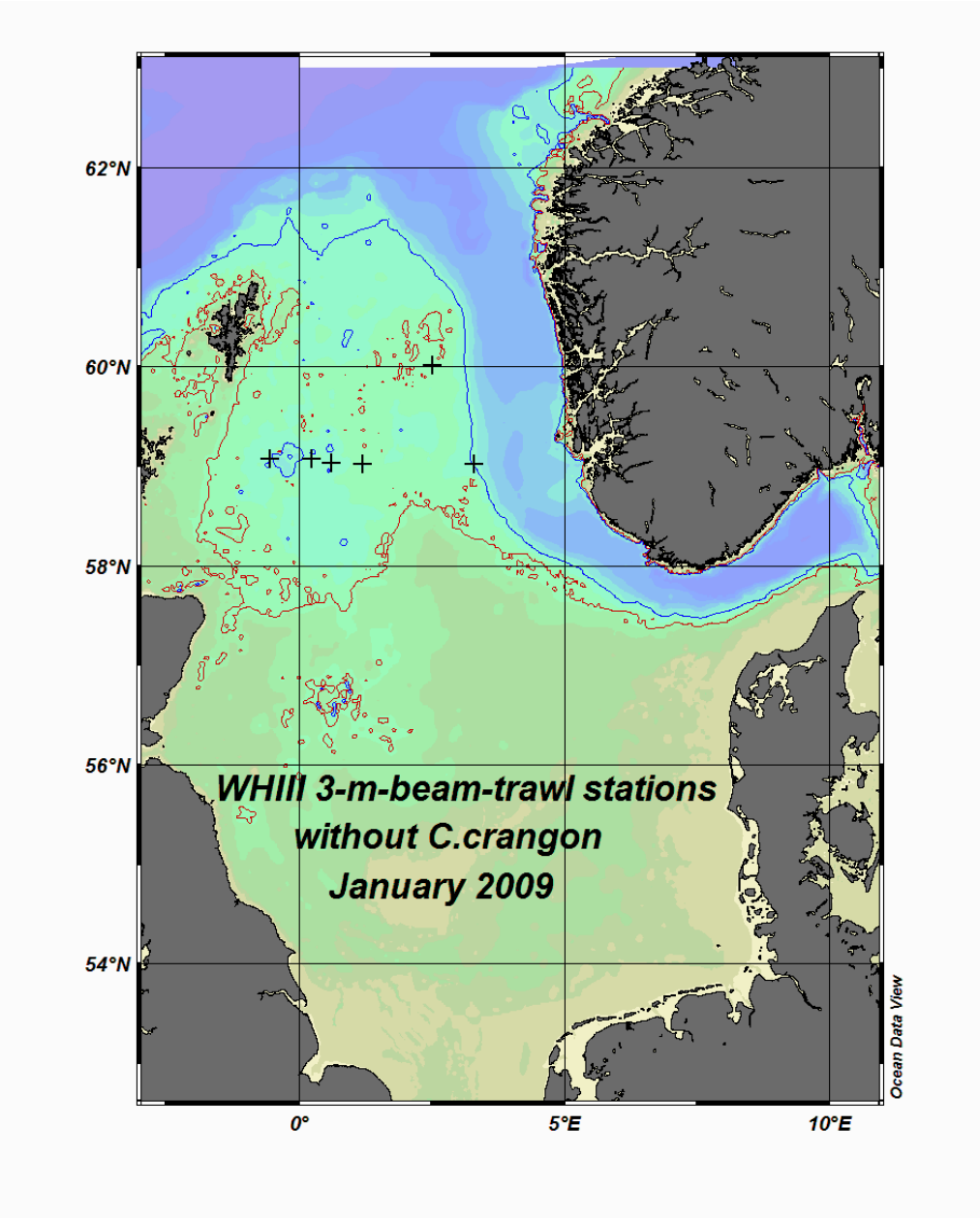


Figure 11.5.2 Distribution of trawl stations of IBTS in January 2009 were no brown shrimp (*C. Crangon*) could be found in contrast to the records from 1999 and 2000 in Figure 11.5.1.

The data files for the surveys were checked and contain indeed catch reports on both *Crangon* species indicating coexistence in deep water. However, as standard knowledge is, that *C. allmanni* is a species preferring deeper waters while *C. Crangon* lives not deeper than approx. 50 metres (compare WD 1), the information was doubted a lot.

The written material was the only information left as no further details could be obtained and the samples had been discarded after control according to the participants of the IBTS.

To give a possible proof for the reported observation, WHIII was equipped for her 319th cruise from 23 January to 18 February 2009 also with the standard 3-m-beam trawl normally used for the DYFS to catch small fish and brown shrimp (shrimp net

with 20mm stretched mesh in codend). On four days (9., 10., 11. and 15.2.09) WHIII was able to fish with that gear six times at depths between 107 and 158 metres at stations where C. *Crangon* had been found before. Trawl duration was 15 minutes at 2.5 knots equivalent to the DYFS procedures.

The catches contained only 1 to 5 specimen of *C. allmanni* and no *C. Crangon*. We assume therefore that the results from 1999 and 2000 have been misidentifications of a number of *C. allmanni*, where the carina on top of the pleonite 6 had been overlooked besides other less clear identification features separating both species. The respective data should be marked doubtful therefore in the official ICES database.

11.6 Comparison of Geographical distribution of landings, fishing effort (Days at sea), LPUE (Days at Sea) and LPUE (Horse power days) in German brown shrimp (*Crangon crangon*) fisheries in 2008

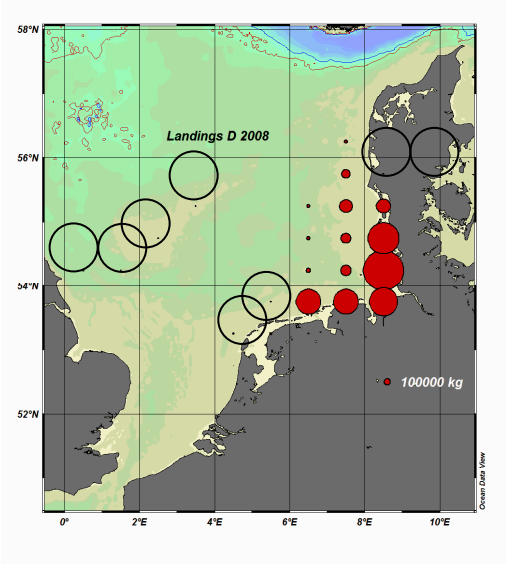
As it was not possible to process VMS data from the German shrimping fleet according to TOR e for the 2009 WGCRAN meeting, logbook data had been used for the visualization of 2008 landings. The ICES rectangle information and landings data were used for that purpose, grouped per rectangle and month using EXCEL and OceanDataView programmes.

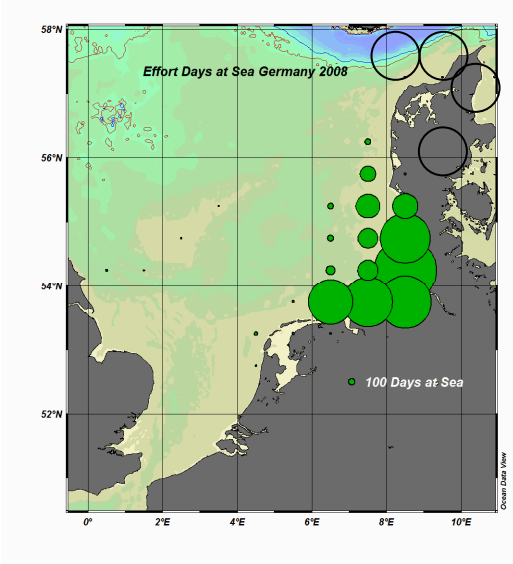
The graphs show annual landings left, fishing effort (Days at sea) second from left, LPUE (Days at Sea) third from left and LPUE (Horse power days) to the right in German brown shrimp (*Crangon Crangon*) fisheries for 2008 in the first line, while the following lines shown the same results by month.

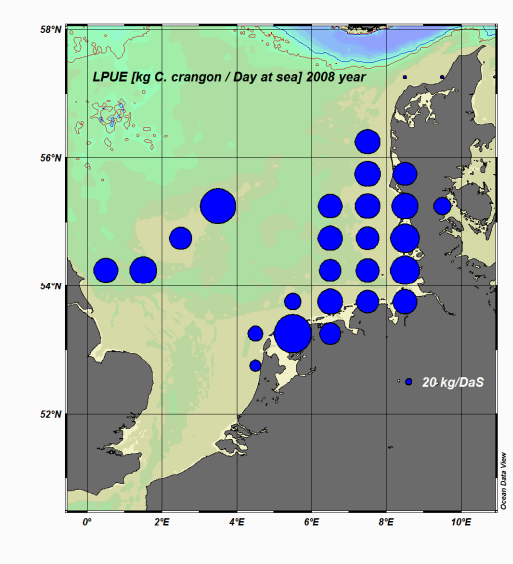
The filled circles are proportional to reference circles within the maps. Open circles mark either test hauls or possibly mistakes within the databases caused by typing errors. However, they confirm anecdotal information about some fishing on the Dogger as well as at the north tip of Jutland. The amount fished there is - at least for the German fleet – negligible.

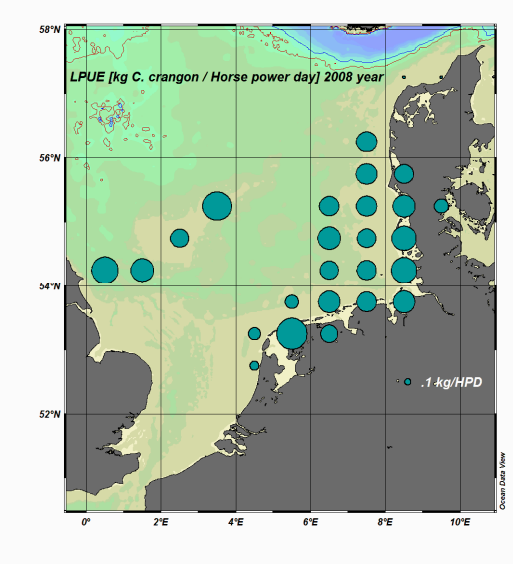
The increase and decrease of landings by month as well as the shifts from fishing grounds partly in the northern, Danish sector in winter towards the German coast can clearly be seen in landings and effort plots. Also the offshore movement in winter vs. a close to shore fishery in late summer and autumn is obvious and confirms earlier working documents. The patterns of the LPUE-plots show no difference between both units (kg/das and Kg/ hpday) but confirm the seasonality in regional fishing grounds as well as changes in stock size with the recruiting young shrimp in autumn.

MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

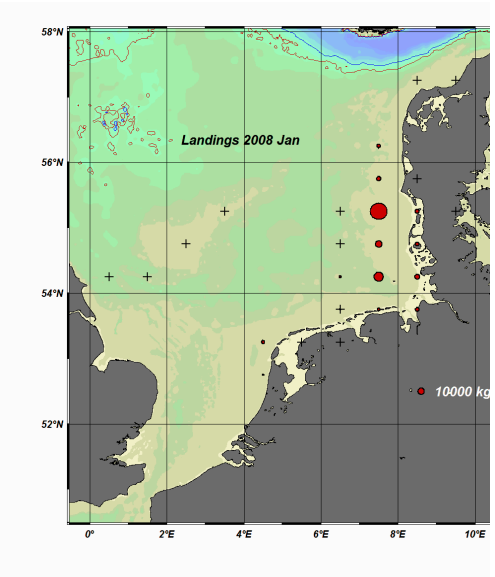


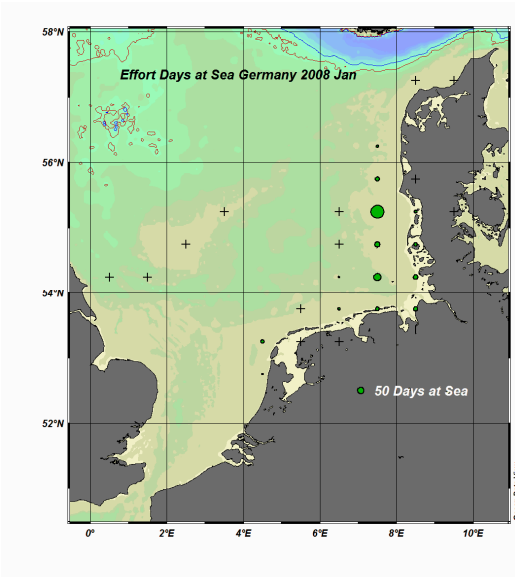


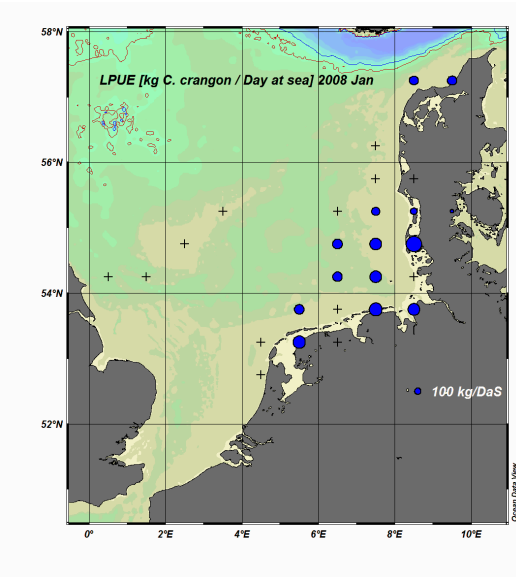


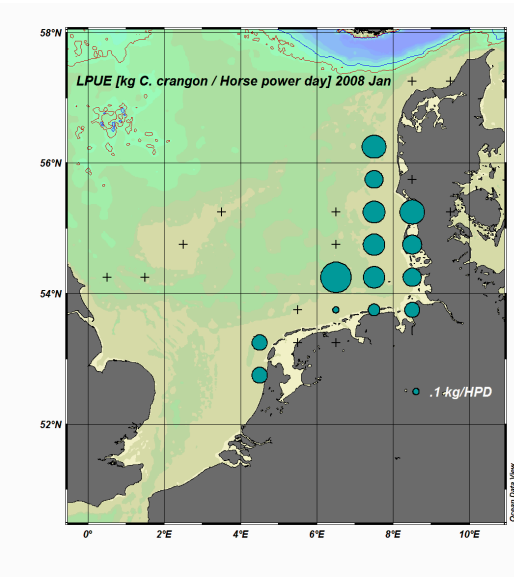


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

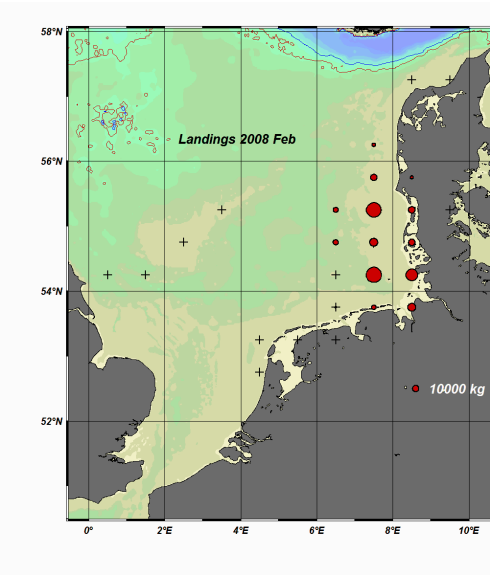


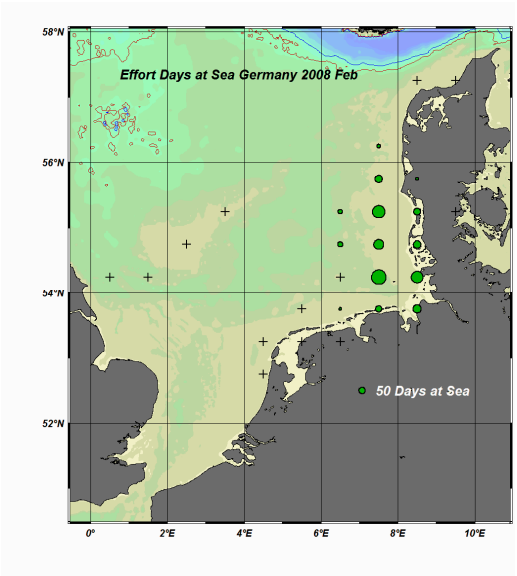


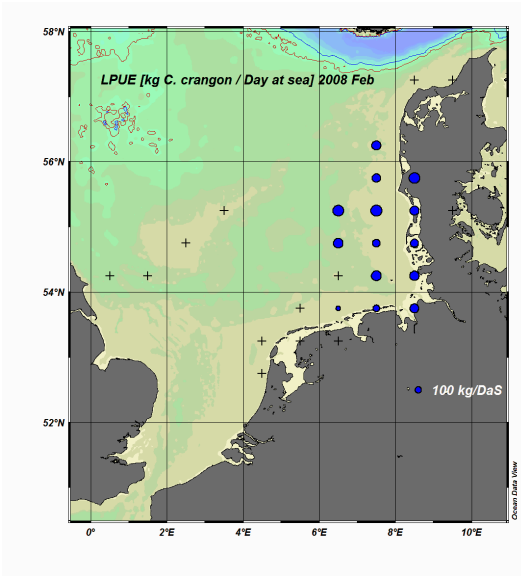


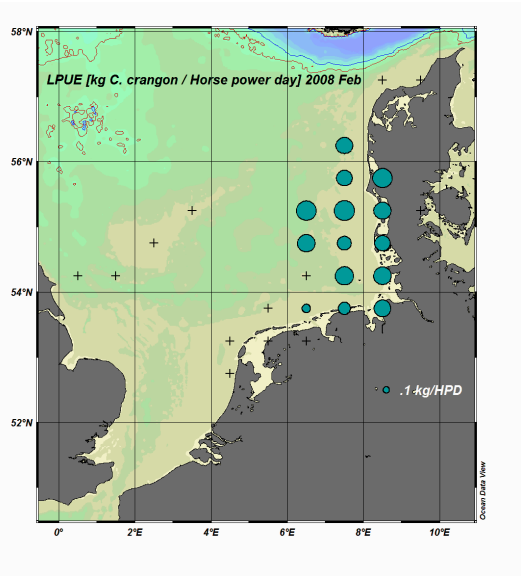


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

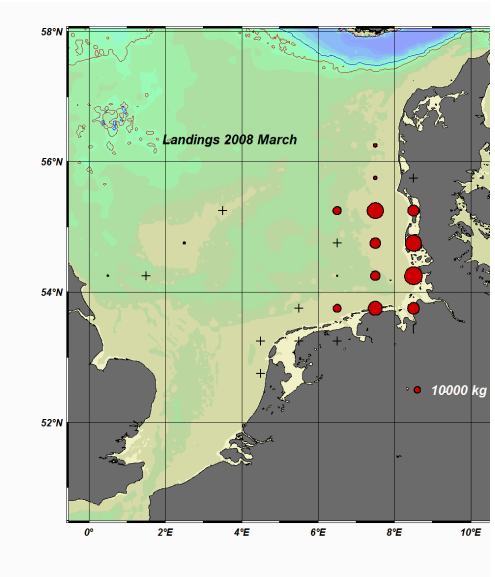


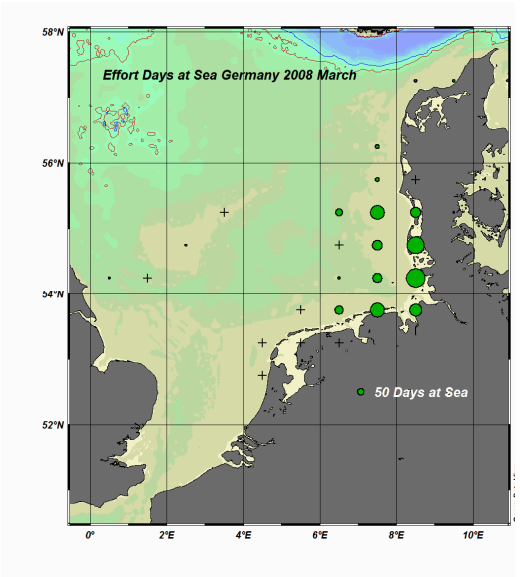


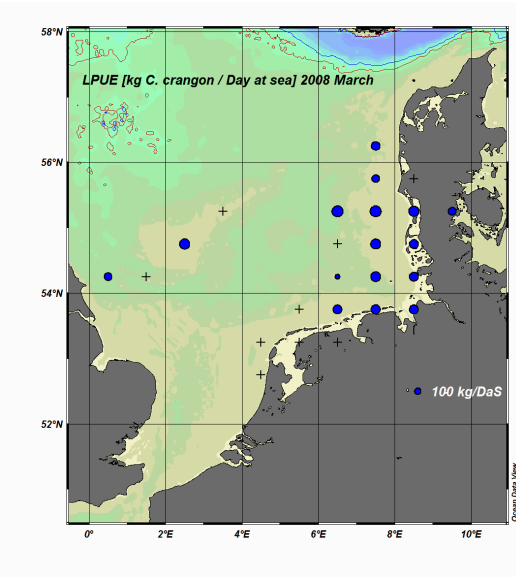


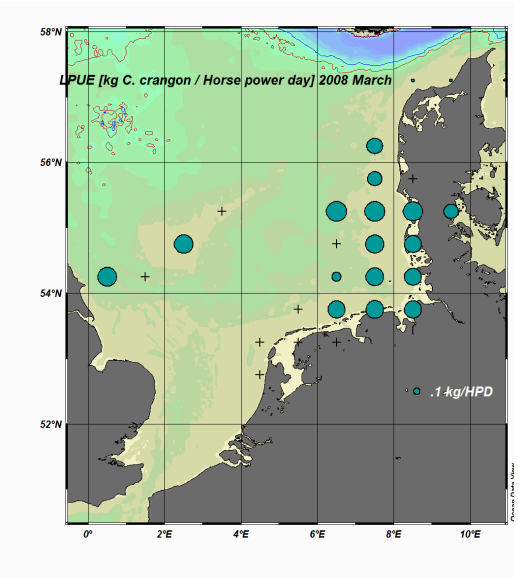


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

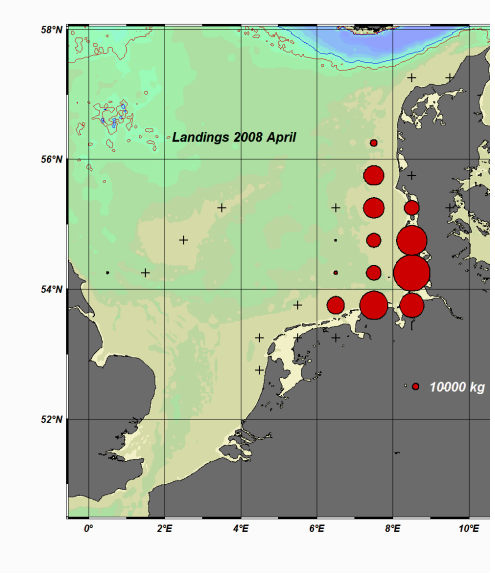


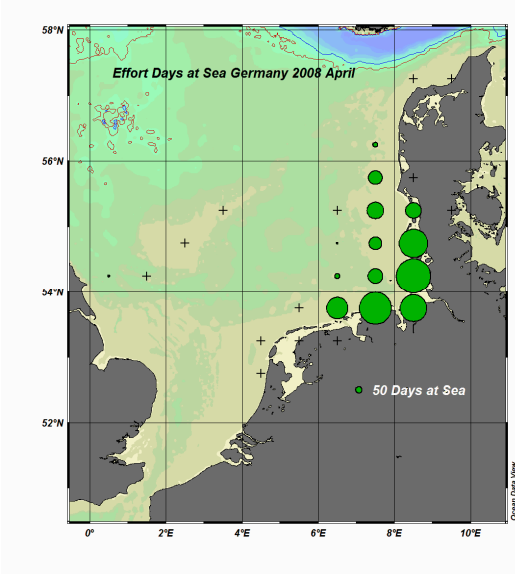


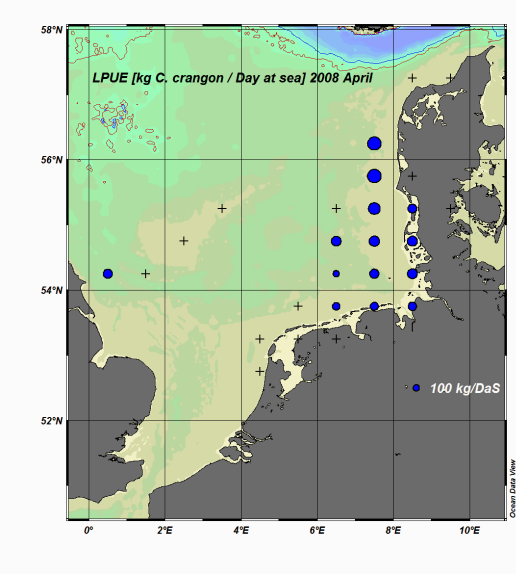


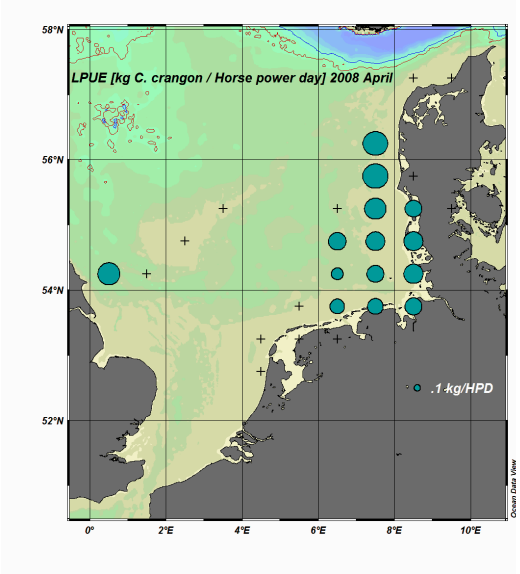


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*









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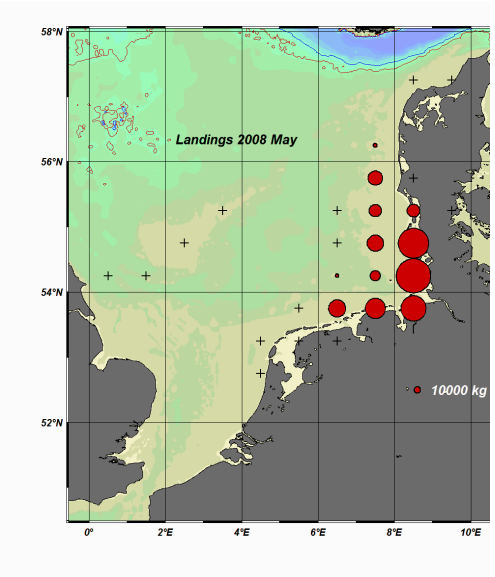
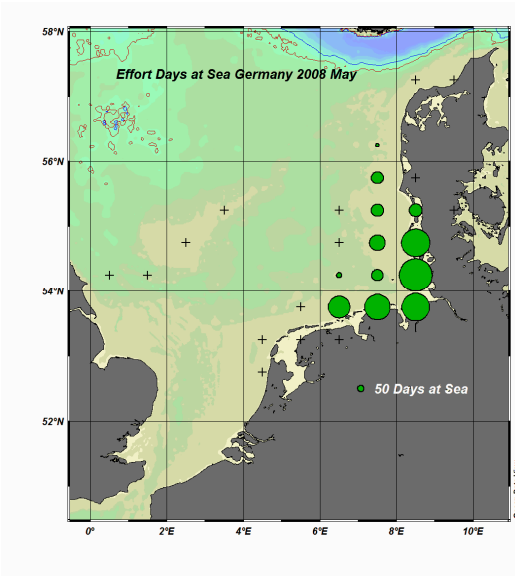
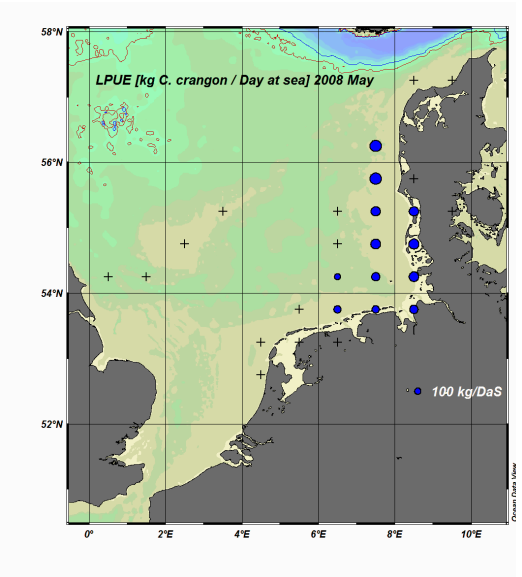
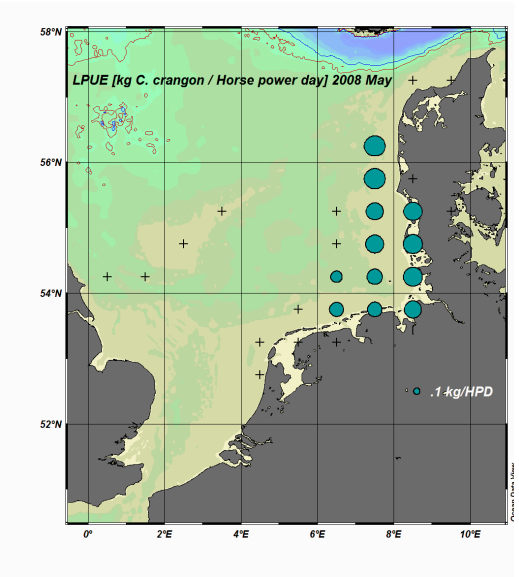
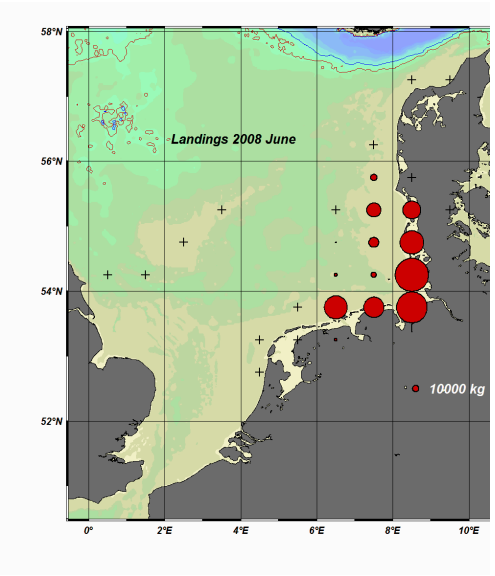


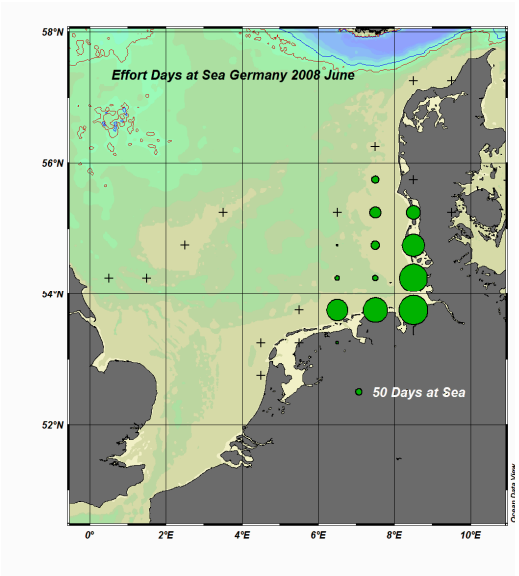


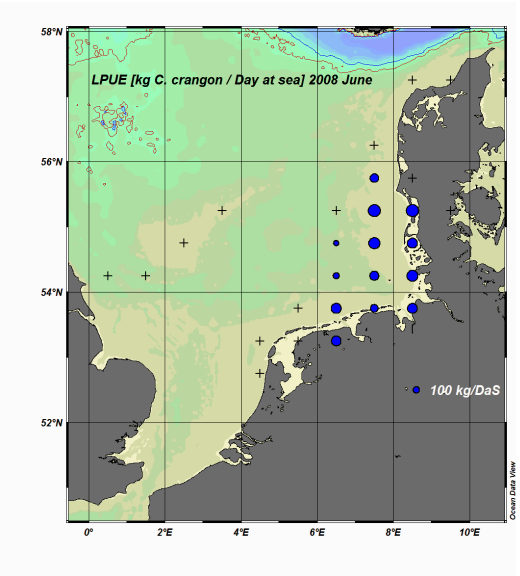


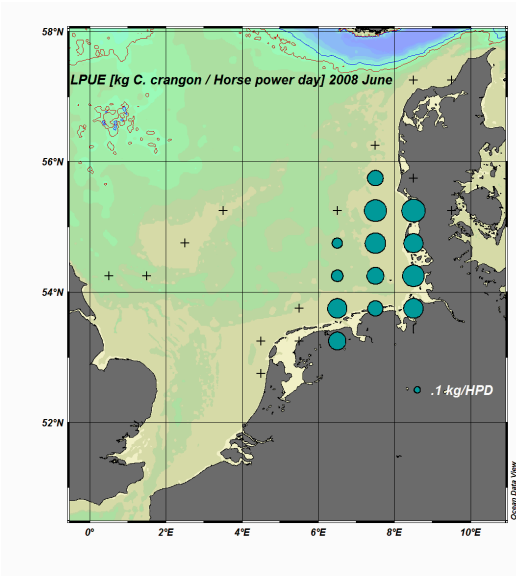


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

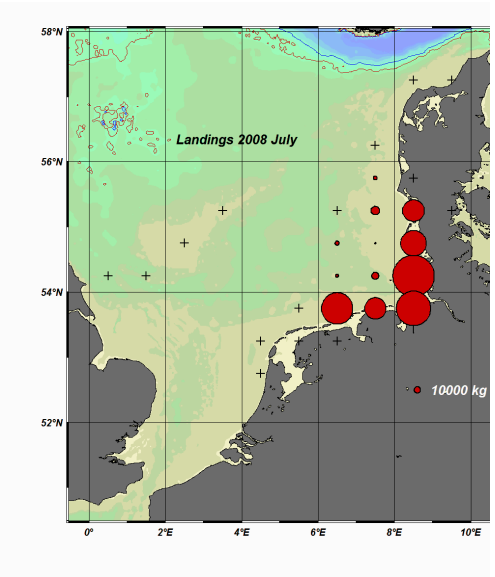


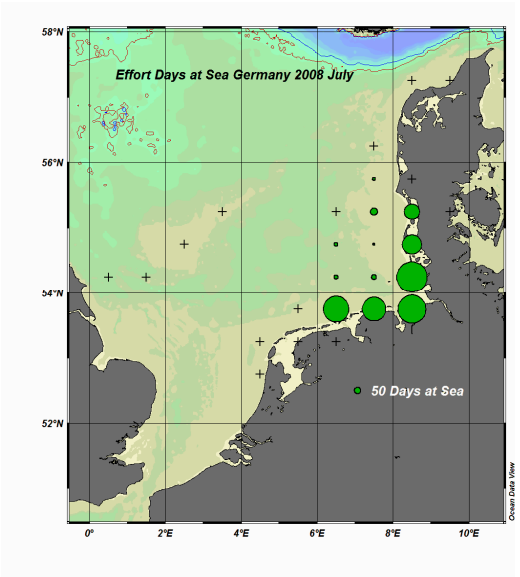


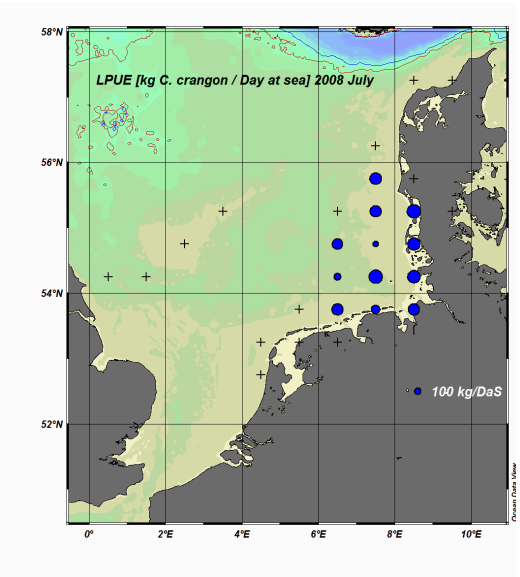


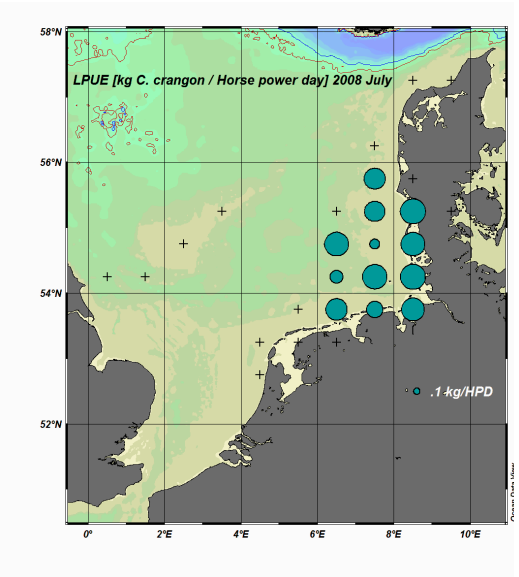


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

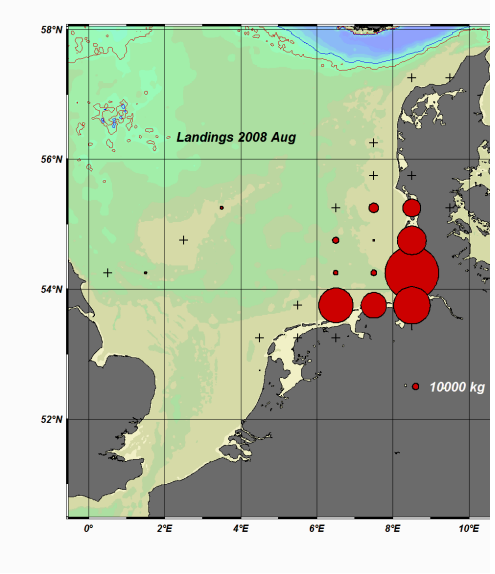


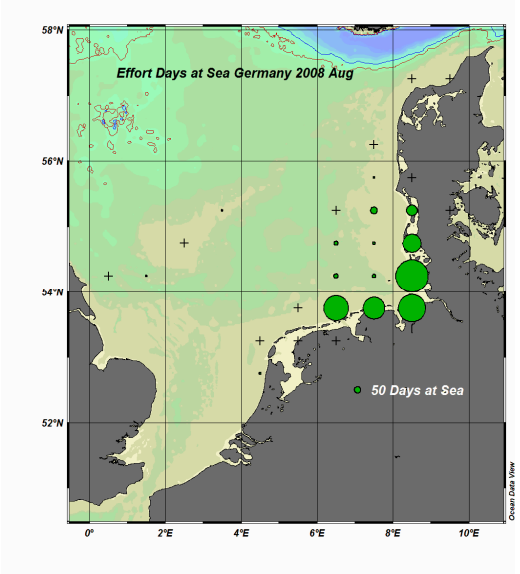


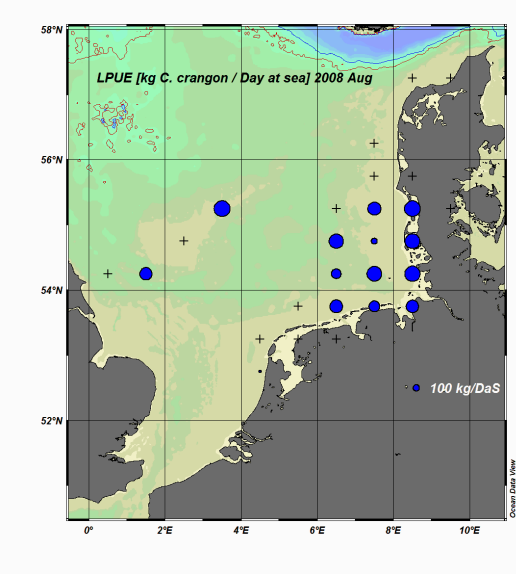


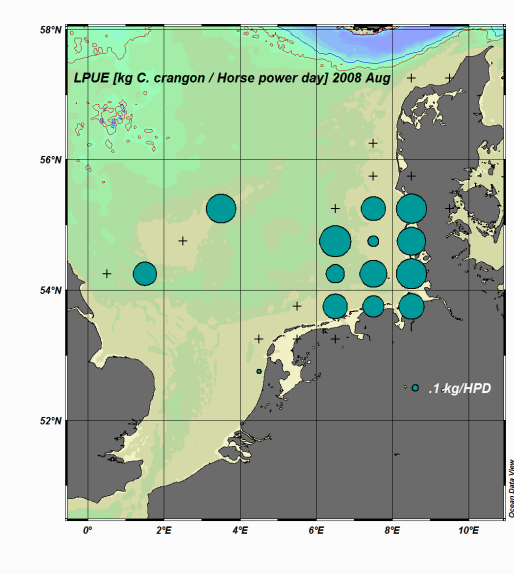


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

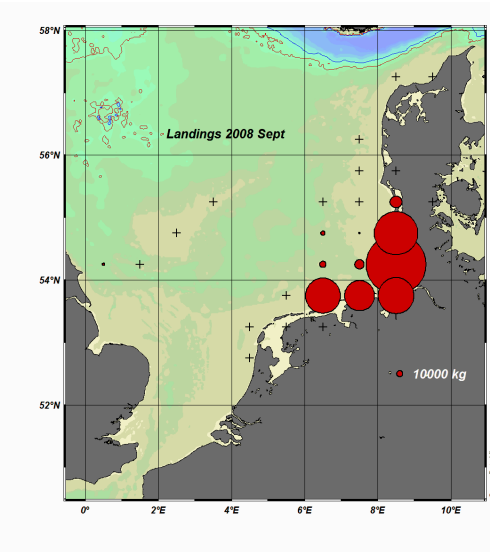


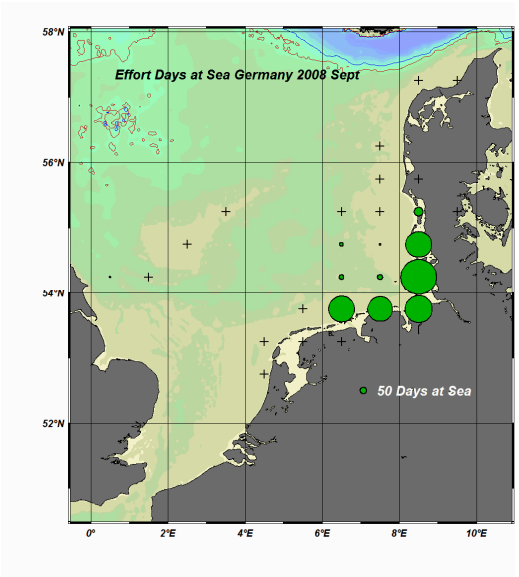


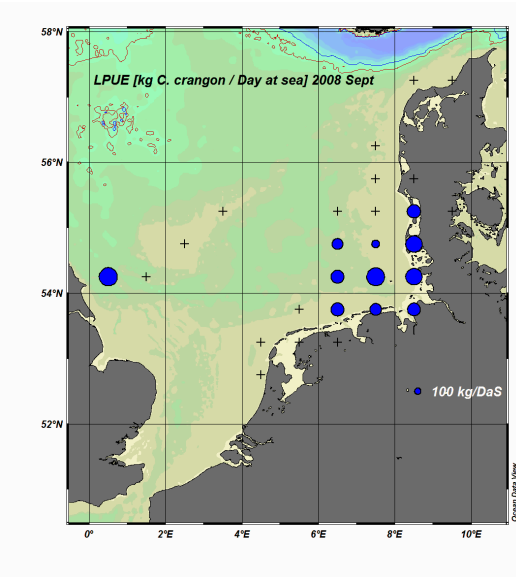


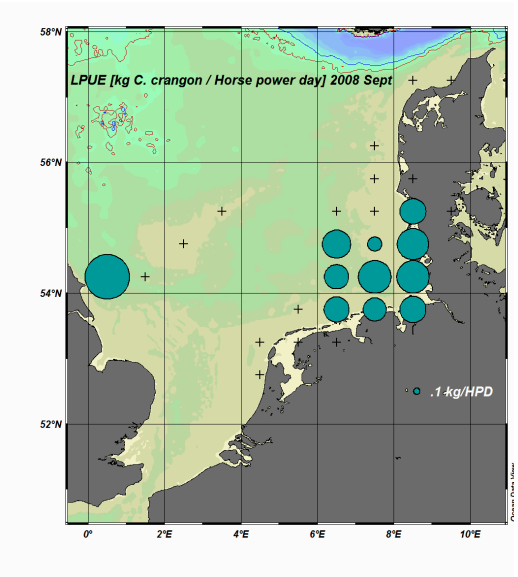


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*

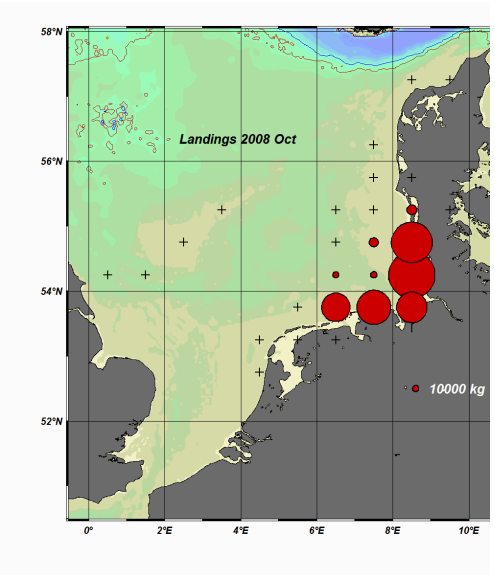


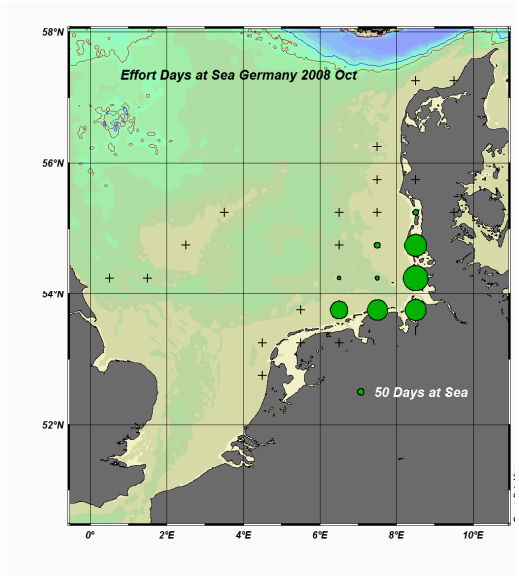


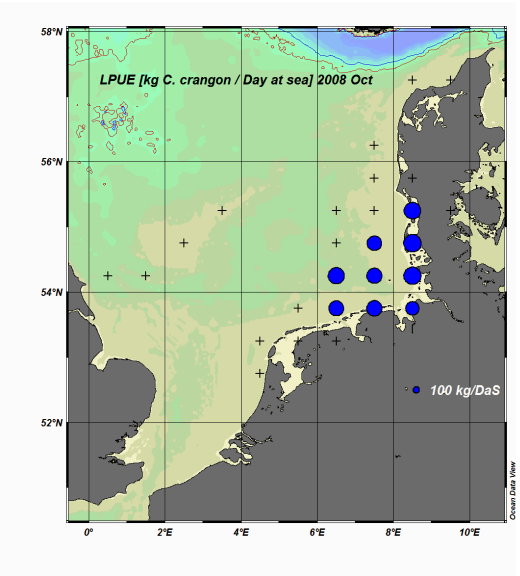


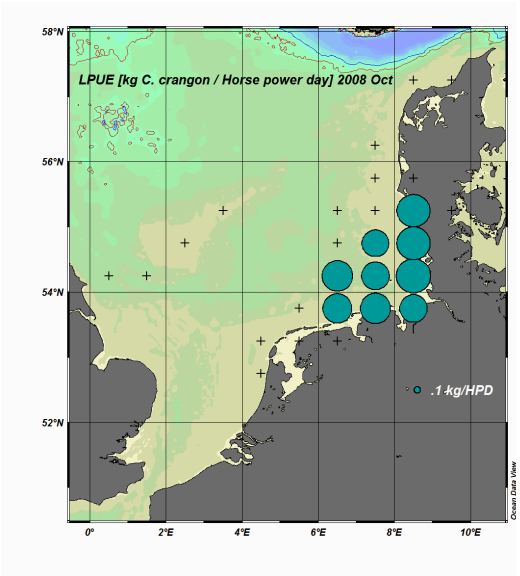


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*









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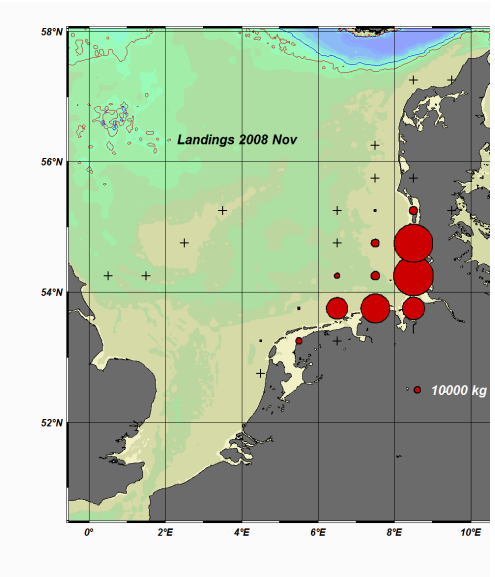
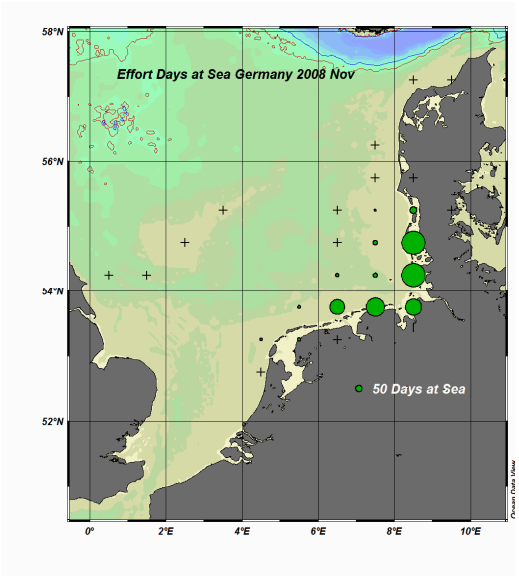
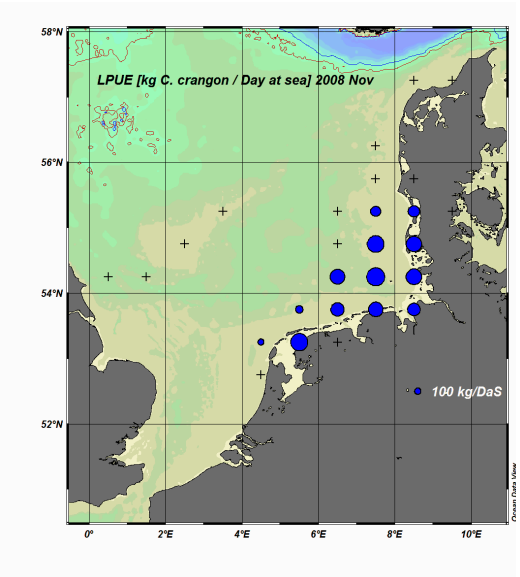
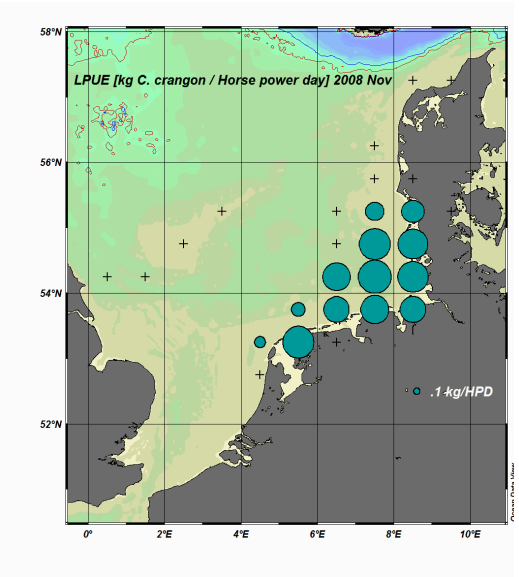
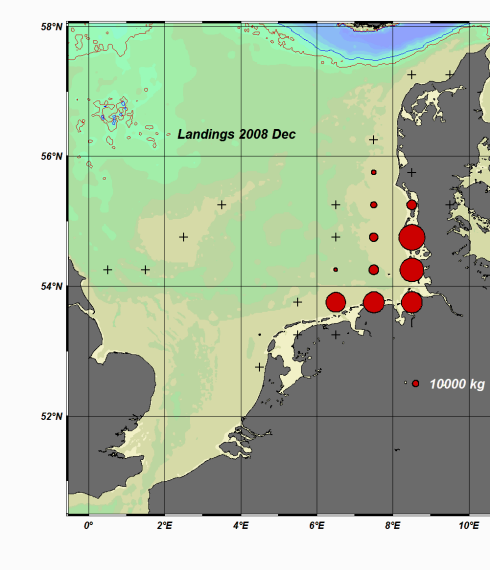


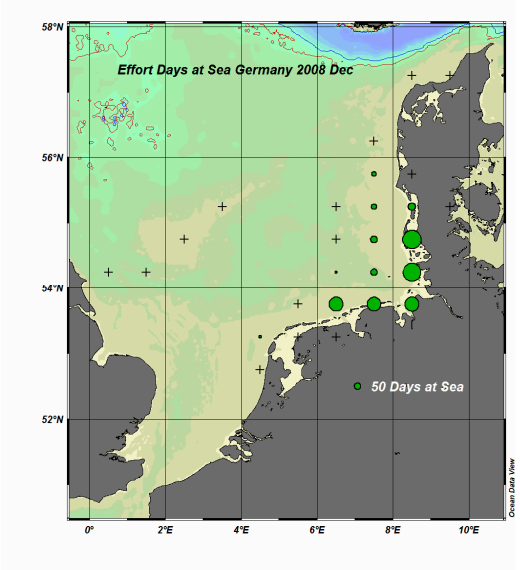


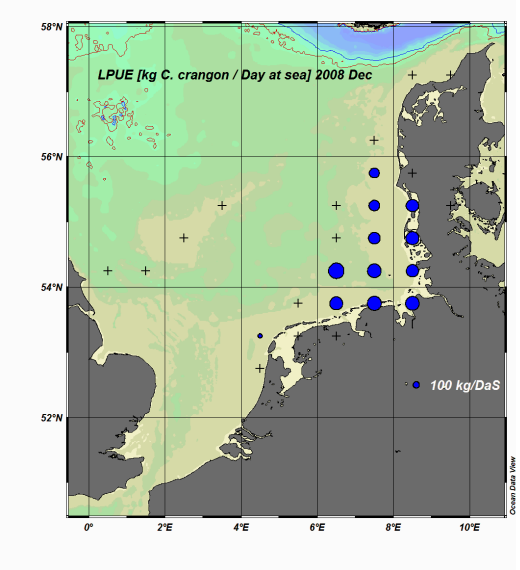


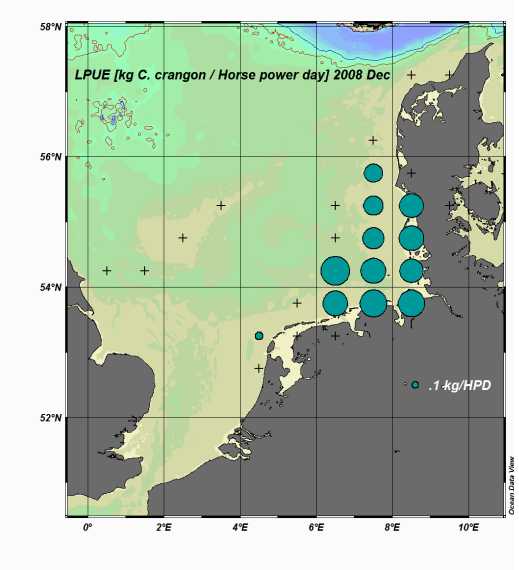


MONTHLY LANDINGS, FISHING EFFORT, LPUE (DAYS AT SEA) AND LPUE (HORSE POWER DAYS) IN GERMAN BROWN SHRIMP (*CRANGON CRANGON*) *FISHERIES IN 2008*









11.7 Preliminary assessment of potential bycatch in *Crangon Crangon* winter fishery in January 2009

The German national Winter *Crangon* Survey (WCS), targeting on brown shrimp (*C. Crangon*), was again conducted by FFS "Solea" in January to February 2009 with in all 107 stations along the Dutch, German and Danish coasts, including one transect towards the Dogger Bank. The beam trawl hauls (7-m-shrimp trawl, 20 mm stretched mesh in codend, half hour each) covered depths from 10 to 64 metres.

The survey area was separated into three areas. The first area A included stations close to the East- and West-Frisian Islands, while area B was west to the North-Frisian Islands and the coast of Denmark. Area C mainly contained stations in deeper offshore water; including the Dogger Bank transect (Figure 11.7.1).

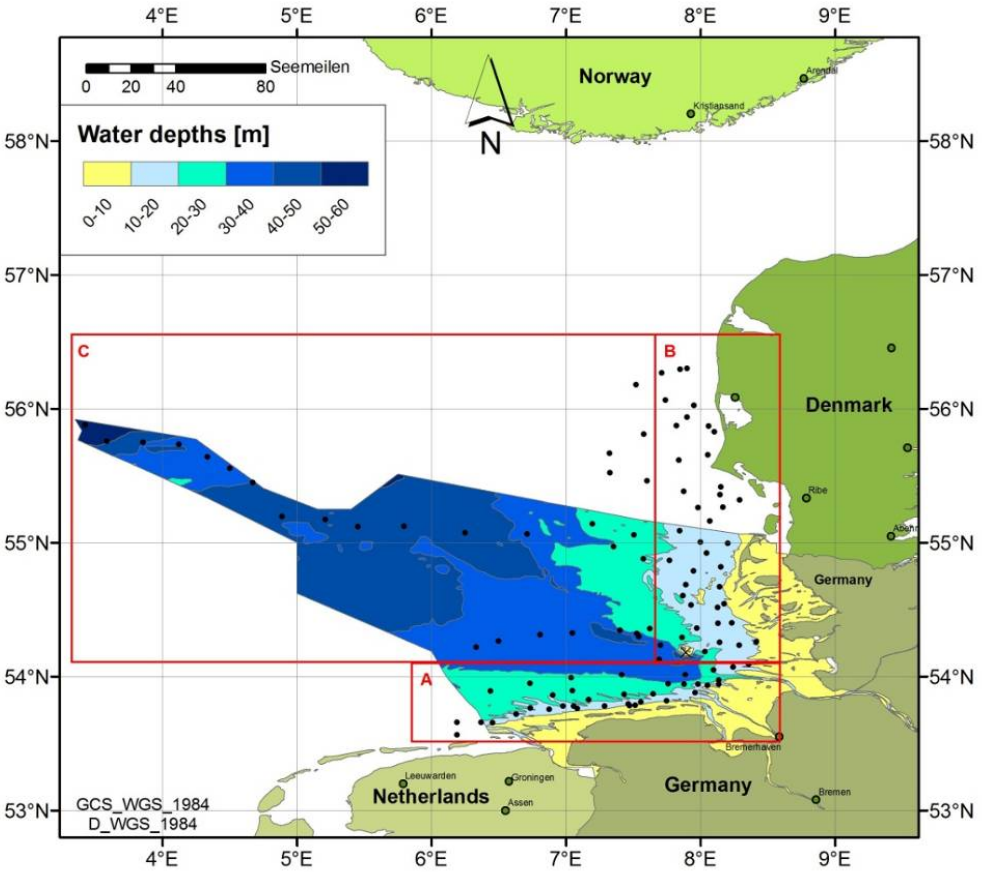


Figure 11.7.1. Survey area separated in areas A to C, Crangon-Survey 2009.

Figure 11.7.2 shows that the highest biomass was caught in area A. Fish dominated the catches, closely followed by "ISH-invertebrates" ("ISH-invertebrates" means all taxa determined along the German Seafisheries Institute standard procedures). The "ISH-bycatch" was slightly higher than the catch of *Crangon*id shrimps, which had the lowest biomass within all hauls in that area ("ISH-bycatch" means all undetermined debris, sediment, plants and invertebrates not to be listed according to the German Seafisheries Institute standard procedures).

In area B total catch was less compared to area A. However, contrasting to area A, the highest biomass of *Crangon*id shrimps was found here, which corresponds well to the distribution of the commercial shrimping fleet. The biomass of fish, ISH-invertebrates

and ISH-bycatch were noticeable lower than in area A. In area C the lowest biomass was detected and the catches were dominated by fish.

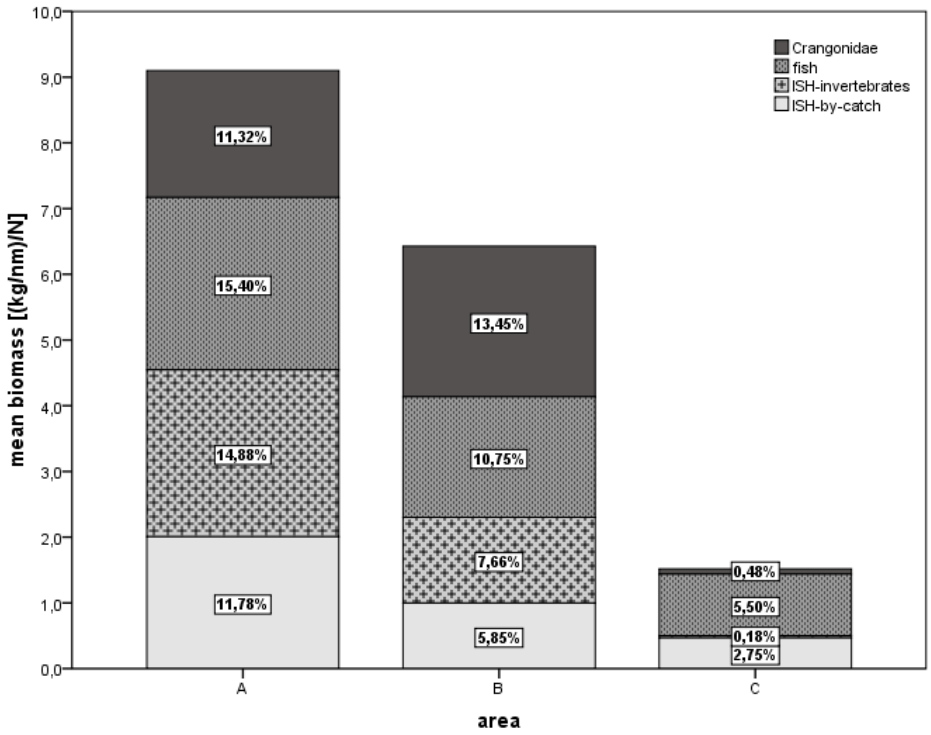


Figure 11.7. 2. Total catch (%) of Crangonidae, fish, ISH-invertebrates and ISH-bycatch in Area A, B and C.

Overall 40 fish species were caught (Table 11.7.1). The highest biomass was determined for sprat, herring, dab and plaice. Sprat and herring dominated the catches in East-Frisia (area A). The biomass of dab and plaice was higher in area B, the dominant fishing grounds of winter fishery on shrimp, while the biomass of sprat bycatch was approximately equivalent in both areas (A and B). The biomass of herring was noticeable lower in area B compared to area A. In area C dab and plaice showed the highest biomass.

Future research should also focus on abundance data as numbers of individuals give a different perspective due to the variable body weight of the species caught. For example the goby *Pomatoschistus minutus* was caught by large numbers, but because of its small body length and a maximum weight of approximately 4 grams, their biomass does not reflect the rate of bycatch. Also just a few cod were caught, but they had higher weights, giving a comparatively high biomass.

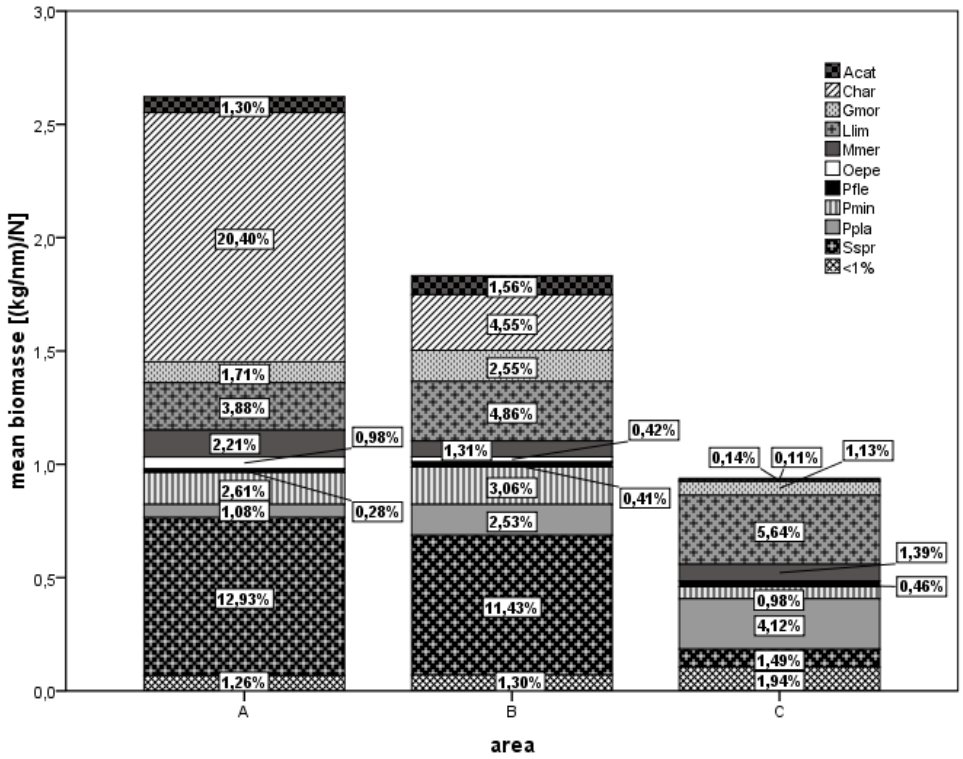


Figure 11.7.3. Percentages of fish species bycatch in Areas A, B and C.

13 species of ISH-invertebrates were recorded (Table 11.7.1). The highest biomasses were reached by common starfish (*Asterias rubens*), brittlestar (*Ophiurida*) and common swimming crab (*Liocarcinus holsatus*).

While in area A the biomass of common starfish and brittlestar had the highest rate, in area B swimming crabs had the highest biomass in bycatch (Figure 11.7.3). In area C the observed biomass of ISH-invertebrates was low.

These results give a first indication of the general bycatch situation in the German Bight by region and for a standard shrimp trawl. It does not at all reflect the real bycatch situation in the fleets active there as the shrimpers use veil-nets separating many organisms already during trawling. To obtain real bycatch data for winter fishery on shrimp, it is inevitable to sample the fleets operating along the coast as it is done by the EU Data Collection Regime.

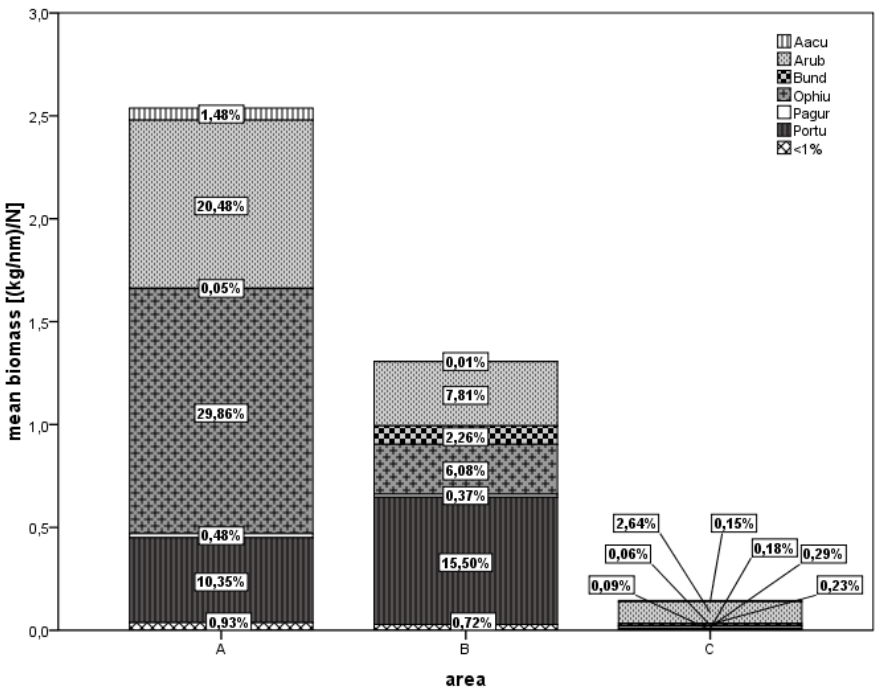


Figure 11.7.4. Percentages (%) of ISH-invertebrates species bycatch in Areas A, B and C.

Table 11.7.1. Total, mean and percentage biomass of bycatch species for area A to C caught in January 2009.

Sspecies name	code	area A-C	area A-C	area A-C
		∑ B	∑ $\bar{x}$ (B)	∑ $\bar{x}$ (B)%
Agonus cataphractus	**Acat**	**6,151**	**0,160**	**1,25**
Alosa fallax	Afal	0,069	0,002	0,01
Ammodytes spec.	Atob	0,368	0,010	0,08
Arnoglossus laterna	Alat	0,300	0,009	0,07
Atherina presbyter	Apre	0,005	0,000	0,00
Buglossidium luteum	Blut	1,565	0,047	0,37
Callionymus lyra	Clyr	0,290	0,009	0,07
Callionymus reticulatus	Cret	0,145	0,004	0,03
Ciliata mustela	Cmus	1,080	0,029	0,23
Clupea harengus	**Char**	**49,909**	**1,354**	**10,53**
Echiichtys vipera	Evip	0,028	0,001	0,01
Engraulis encrasicolus	Eenc	0,003	0,000	0,00
Entelurus aequoreus	Eaeq	0,003	0,000	0,00
Eutrigla gurnardus	Egur	0,251	0,008	0,07
Gadus morhua	**Gmor**	**10,778**	**0,290**	**2,26**
Gasterosteus aculeatus	Gacu	0,018	0,000	0,00
Hippoglossoides platessoides	Hpla	0,948	0,032	0,25
Hyperoplus lanceolatus	Hlan	0,273	0,008	0,06
Limanda limanda	**Llim**	**27,393**	**0,775**	**6,03**
Liparis liparis	Llip	0,184	0,005	0,04
Melanogrammus aeglefinus	Maeg	0,062	0,002	0,02
Merlangius merlangus	**Mmer**	**9,425**	**0,264**	**2,06**
Microstomus kitt	Mkit	0,452	0,013	0,10
Myoxocephalus scorpius	Msco	0,717	0,019	0,15
Osmerus eperlanus	Oepe	2,842	0,076	0,59
Pholis gunellus	Pgun	0,105	0,003	0,02
Phrynorhombus norvegicus	Pnor	0,006	0,000	0,00
Platichthys flesus	Pfle	2,199	0,062	0,48
Pleuronectes platessa	**Ppla**	**14,338**	**0,416**	**3,24**
Pomatoschistus microps	Pmic	1,115	0,028	0,22
Pomatoschistus minutus	**Pmin**	**13,429**	**0,359**	**2,79**
Pomatoschistus pictus	Ppic	0,005	0,000	0,00
Rhinonemus cimbrius	Rcim	0,359	0,010	0,08
Scophthalmus rhombus	Srho	0,041	0,001	0,01
Solea vulgaris	Svul	0,020	0,001	0,00
Sprattus sprattus	**Sspr**	**52,757**	**1,393**	**10,84**
Syngnathus rostellatus	Sros	0,020	0,001	0,00
Trachurus trachurus	Ttra	0,013	0,000	0,00
Trisopterus luscus	Tlus	0,002	0,000	0,00
Zoarces viviparus	Zviv	0,092	0,002	0,02
Aphrodita aculeata	Aacu	2,321	0,065	0,51

Sspecies name	code	area A-C ∑ B	area A-C ∑ $\bar{x}$ (B)	area A-C ∑ $\bar{x}$ (B)%
Astropecten irregularis	Airr	0,306	0,008	0,07
Asterias rubens	**Arub**	**45,334**	**1,234**	**9,59**
Buccinum undatum	Bund	4,032	0,101	0,79
Corystes cassivelaunas	Ccas	0,080	0,002	0,02
Carcinus maenas	Cmae	0,036	0,001	0,01
Cancer pagurus	Cpag	1,200	0,031	0,24
Echinidae	Echin	0,009	0,000	0,00
Micrasterina	Micras	0,673	0,019	0,15
Ophiurida	**Ophiu**	**52,894**	**1,436**	**11,17**
Paguridae	Pagur	1,625	0,045	0,35
Pandalidae	Panda	0,300	0,007	0,06
Portunidae	**Portu**	**40,412**	**1,038**	**8,07**
bycatch	**bycatch**	**127,235**	**3,474**	**27,02**
sum	**∑**	**474,220**	**12,857**	**100,00**

11.8 Monitoring the *Crangon crangon* fishery in the Danish Economical zone in the North Sea 2008

Per Sand Kristensen

11.8.1 Introduction

Danish fishers have only fished brown shrimps since 1963. The first years the fishery only took place on an experimental level. After 1968 the landings and number of vessels gradually increased. Already from the beginning The Danish Institute of Fisheries and Sea Research (now AQUA DTU) was taking part in the fishery investigating the discard and the by catches in this for Denmark new coastal fishery (Albrechtsen, 1977). After some years new investigations was conducted in the catches and by catches and discards in the European brown shrimp fisheries (see Marlen, *et al.*, 1998 (RESCUE); Revill, *et al.*, 1999 (EURODISC); Kristensen and Hedegaard, 2001 and 2002)

The early Danish investigations in the by catches and discards in the Danish brown shrimp fishery resulted in bans of fishery within the islands in the Wadden Sea (enforced since 1977), where fishery East of this line (shrimp line) was prohibited. And applying trawls with veil nets was mandatory from 1977 too. The intention with those restrictions was to protect the 0-group and one year old commercial species of fish like plaice, cod, and sole.

The most modern sorting equipment are today applied in the Danish brown shrimp fishing fleet to sort the catches and to optimizing the discards of all the unwanted commercial and non commercial fish species as well as invertebrates. The Danish fleet therefore follows all recommendations to prevent all unwanted by catches.

Besides the Danish fleet of 28 licensed vessels around 75–100 German and Dutch vessels also fish brown shrimps in the Danish economical zone in the North Sea. The landings from those fleets have the last couple of years been of the same magnitude

as the annual Danish landings amounting to a total landing of more than 8,000 tons annually in the Danish economical zone in the North Sea.

11.8.2 Material and methods

DTU Aqua purchased two 3 m beam trawl constructed after technical advice from our colleagues from Hamburg (VTI; Johann Heinrich von Thünen-Institut; Neudecker, personal comm.). The survey was conducted on-board a chartered vessel from Havneby. The trawls were with no sorting and veil net system. Each haul varied between 20 and 30 minutes.

The catches in each haul were estimated and a sub sample was selected to estimate the single species caught. The catches was not sorted in the rotary riddle on-board the vessel. The sub sample was sorted in the different species of fish and invertebrates, which were either weight (fish species) and measured or counted (invertebrates).

11.8.3 Results

The catches varied between 30–100 kg and the sub samples between 3.3 and 7.2 kg. A minor by catch of the most important fish species were plaice (*Pleuronectes platessa*), cod (*Gadus morhura*), sole (*Solea solea*) and dab (*Limanda limanda*). There were also by catches of less important fish species as whiting (*Merlangus merlangus*), bullhead (*Agonus cataphractus*), sand goby (*Pomatoschistus minutus*), broad-nosed pipefish and greater pipefish (*Syngnathus rostellatus* and *S. acus*) and common sea snail (*Liparis* sp.). A few specimens of dragonets, sail-flukes and sprats were in the catches too.

The bycatches of invertebrates consist of sea stars (*Asterias rubens*), common whelk (*Buccinum undatum*), red whelk (*Neptunia antiqua*), shore crab (*Carcinus maenas*), and swimming crab (*Portunus depurator*). Among the by catch also bivalves species were recorded such as cockles (*Cerastoderma edule*) and razor knife clams (*Ensis americanus*). The catch of brown shrimps varied between 7 and 90 kg pr. Haul (see Figure 11.8.1).

Compared to the catches with the 3 m beam trawls, the catches applying the 9 commercial equipped with veilnet. After sorting on-board in the rotary riddle practically no fish and invertebrates were transferred to the cooking facilities. Few boiled gobies and fragments of swimming crabs were observed among the boiled and cooled brown shrimp before packed and stored in the holder. Gobies and the fractions of crabs are of similar sizes and dimensions as the boiled brown shrimps and passes through the riddle along side with the shrimps.

The outlet of the discarded fish species below sea surface attracts gulls. However they presumably only predate on the floating whiting that are unable to dive after been through the rotary riddle system on-board the vessel. The flatfish are obviously more capable to dive after the sorting process because no gull was observed with dabs and plaices in their beaks.

The catch of shrimps in the 3 m beam trawl were between 9 and 55 present of the total catch depending of the conditions on the fishing grounds. The relative amount of shrimps in the total catch in 9 m beam trawl was considerable higher compared to what was seen in the 3 m beam trawl.

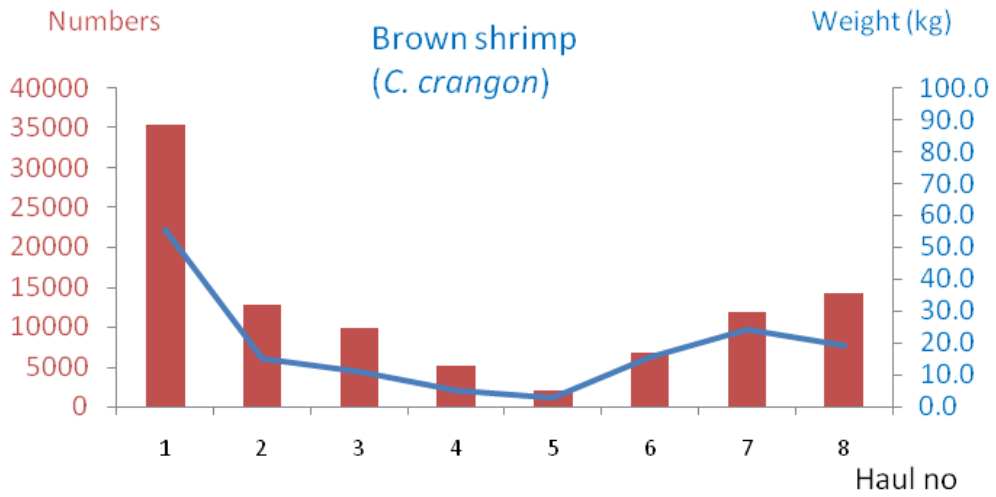


Figure 11.8.1. The catches of brown shrimps (C. crangon) on level-zero in each 20 or 30 minutes haul in numbers and weight.

11.8.4 Discussion and conclusions

The development in the Danish brown shrimp fishery the last 45 years have been a long positive expansion, where the catches and number of licenses steady have increased. Today the gross earnings in the fleet amount to around 85 million. Dkr. (about 11 million EUROs). The fleets from other EU-countries fish and land an amount of brown shrimps of equal size as the Danish caught in the Danish economic zone in the North Sea. The total value of the landings caught in the Danish zone amounts to around 22 million EUROs annually.

Carrying out the planed program for the monitoring of the whole fishing area along the Danish west coast was not possible due the unfavorable wetter conditions. Wind force > 10 m/s and waves > 3 m, which makes the light 3 m beam trawl jump and not fishing as efficient with less wind force and smaller waves.

However if the monitoring continues the following years it will be possible to fulfill the total plan and cover the whole Danish Eastern part of the North Sea close to the coast where the fishery takes place between Rømø in the South up to around Thyborøn and the inlet to Limfjorden.

The limited investigations in October 2008 however showed that the new monitoring beam trawls were fishing efficiently and that the trail catches operating the 3 m beam trawl was successful and reflected what may be caught in the shrimp fishery along the Danish coast.

The catches with the 9 m beam trawl with a veilnet however, were quite different from the catch taken with the 3 m beam trawl and the main by catches taken with this gear did not show up in the 9 m beam trawl. Very few fish both of commercial as well as non commercial species are efficiently sorted and released through the veilnet before the catches are taken on-board. The few fish ending in the hopper are afterwards efficiently sorted and released (discarded) before the consumption shrimps are cooked in the boiler.

So, the by catches of fish and invertebrates in the 3 m beam trawl reflects what are present of these species on the fishing grounds where the commercial shrimp fishery takes place and reflects what the commercial beam trawl without a veilnet presumably would catch.

Many of the released whiting will presumably end as food for gulls as was observed during the whole fishing performance with the 9 m beam trawl on the second day on the cruise in October 2008. No flatfish were seen eaten by the accompanying gulls.

Although the experimental fishery with the 3 m beam trawl was limited and did not cover the whole area a number of information and experiences was achievement, which may help in the planning surveys in the following years that can be used in evaluating the Danish brown shrimp stock and the fishery.

11.8.5 References

Albrechtsen, K. 1977. Rapport over de fortsatte undersøgelser af fiskeriet på hesterejer (*C. Crangon*). Fiskeristatistikken for året 1976. Intern DFH-rapport nr. 7. Pp 11. (Report over the continuing investigations of the fishery of brown shrimps (*C. Crangon*).Fishery Statistic 1976. Internal DFH-Report no. 7 pp. 11.

Bodekke, R. 1966. Sexual cycle and growth of brown shrimp (*Crangon Crangon*). ICES, C.M. Shellfish Committee, M: 7.

Bodekke, R., Bosschieter, J.R., Goudswaard, P.C. 1991. Sex change, mating, and sperm transfer in *Crangon Crangon* (L.). *In*: Bauer RT, Martin JW, editors. Crustacean sexual biology. Columbia University Press, New York. pp. 164–182.

Havinga, B. 1930. Der Granat (*Crangon* vulgaris Fabr.) in den Holländischen Gewässern. J. Cons. Perm. Int. Explor. Mar. 5. p 57–87.

Kristensen, P.S., og A. Hedegaard. 2001. Hesterejer (*Crangon Crangon*) - køns - og størrelsesfordelinger - i danske fangster og landinger fra Nordsøen, 2000. DFU-rapport 90–01. Pp 41. (Brown shrimps (*Crangon Crangon*) – sex – and size distribution – in the Danish catches and landings from the North Sea 2000. DFU-Report no 90–01. Pp 41.)

Kristensen, P.S., og A. Hedegaard. 2002. Hesterejer (*Crangon Crangon*) - køns - og størrelsesfordelinger - i danske fangster og landinger fra Nordsøen, 2001. DFU-rapport 102–02. Pp 39. (Brown shrimps (*Crangon Crangon*) – sex – and size distribution – in the Danish catches and landings from the North Sea 2001. DFU-Report no 102–02. Pp 39.)

Kühl, H., og H. Mann. 1963a. On the distribution of shrimp larvae (*Crangon Crangon*) in the estuary of the Elbe. Veröff. Inst. Küst.- u. Binnenfisch. (27). P 50–52.

Kühl, H. og H. Mann. 1963b. Das Vorkommen von Garnalen larven (*Crangon Crangon*) in der Elbemündung. Arch. Fisch. Wiss. 14(1/2). P 1–7.

Marlen, B. van, F. Redant, H. Polet, C. Radcliffe, A.Revill, P.S. Kristensen, K.E. Hansen, H.J.Kuhlmann, S. Reimann, Th. Neudecker and J.C. Brabant. 1998. Research into *Crangon* Fisheries Unerring Effect (RESCUE) – EU Study 94/044. p. 151.

Rees, C.B., 1952. Continuous plankton records. The decapod larvae in the North Sea. 1947–1949. Hull Bull. Mar. Ecol. 3(22). pp 157–184.

Revill, A., S. Pascoe, C. Radcliffe, S. Reimann, F. Redant, H. Polet, U. Damm, T. Neudecker, P.S. Kristensen and D. Jensen. 1999. The economic & biological consequences of discarding in the European *Crangon* fisheries (The Ecodisc Project). EU (DG XIV A: 3) financially assisted project No 97/SE/025. p. 117.

Thorson, G. 1946. Reproduction and larval development of Danish marine bottom invertebrates, with special reference to planktonic larvae in the Sound (Øresund). Meddr. Fisk.- og Havunders. 4(1), pp 523.

Tiews, K. 1954. Die biologischen Grundlagen der Büsener Garnalenfischerei. Ber. Dt. Komm. Meeresforsch. 13(3). P 235–269.

Tiews, K. 1965. Lichtung des Nordsee Garnalenbestandes (*Crangon Crangon* L.) durch Wegfraß. Arch. Fisch. Wiss. 16(2). P 169–181.

Annex 1: List of participants

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Annex 2: Agenda

Monday 11th May start at 9:30

Open meeting/welcome – Ingrid Tulp/Bart Verschueren

'*Crangon* genetics in ecotoxicology' (Yves Verhaegen)

Beam trawl survey in the near coast areas along the Danish Wadden Sea (Per Sand Kristensen)

Various presentations by Tom

Summary of landings and effort data and number of fishing vessels (Ingrid Tulp)

Dutch VMS data by quarter (Ingrid Tulp/Floor Quirijns)

Crangon data from Dutch BTS survey (Harriet van Overzee)

Update swept-area biomass estimate including German data (Harriet van Overzee/Marc Hufnagel/Ingrid Tulp)

Tuesday 12th May start at 09:30

Update on pulskor-electric beam trawl (Bart Verschueren)

Film Tom

Discussion on questions raised by steering committee MSC process

Wednesday 13th May start at 09:30 (joined by MSC representatives: Paddy Walker from the Wadden Sea Society, Dr Paul Medley who is the Principle 1 expert on the MSC assessment team and Bert Keus from MSC steering group)

Update on the process of the MSC accreditation and identification of scientific bottlenecks (MSC representative)

Discussion on MSC accreditation process

ToRs for 2010

Annex 3: WGCRAN terms of reference for the next meeting

The **Working Group on Crangon fisheries and life history** [WGCRAN] (Chair: I. Tulp, The Netherlands) will meet in AWI, Sylt, Germany from 18–20 May 2010 to:

a) collate and update landings and effort data, including numbers of active vessels;

b) give an update on bycatch data collected under the DCR in German and Dutch shrimp fisheries;

c) make progress in updating the paper by Welleman and Daan;

d) explore available data on number of egg-bearing females and the correlation with stock size;

e) collate annual VMS data (by quarter) from Member States into one map to illustrate regions of fishing activity by *Crangon* vessels in the North Sea;

f) review the report on electric beam trawl research by Bart Verschueren;

g) give an update on the spatial distribution in pollution loads of *Crangon* (work by Yves Verhaegen);

h) review progress of MSC certification process and evaluate use of data collected within MSC for use by WGCRAN;

i) review recent *Crangon* related Research and Development activity.

WGCRAN will report by 1 August 2010 to the attention of the Steering Group Ecosystems Function.

Supporting information

Priority	C. crangon fisheries are economically important with landings value that rank this species in the top three species caught from te North Sea.
Scientific justification	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, 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 soundeffective management advice in relation to these fisheries, if we use such information in isolation. For the production of more robust and flexible managerial advice, we need to combine our current knowledge of fisheries landings, effort and fishing activity with a good supportive biological understanding of the Crangon stocks and their ecological interacions. 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 goals to arrive at a combined estimate for all surveys this year was not met and will be dealt with next year. Following a pre-assessment by the Marine Stewardship Council on the sustainability of the *C. crangon* fishery, attention has been drawn to its discarding practises, the sustainability of *C. crangon* stocks, and impacts

	upon benthic communities. Following a full assessment of the technical measures introduced to reduce discards in *C. crangon* fishery (see WGCRAN07), it was recognized that although discards had been significantly reduced the problem had not been completely resolved. Further modifications to the trawl design and catching process may offer one way to reduce discarding, in particular through the development of the electric shrimp beam trawl design. A comprehensive series of sea trials using this method has determined its usefulness in reducing discards. By next year the report of this new technique will be published. Fishing mortality in turbid areas may increase because fishing operations are no longer restricted to night-time. To investigate these side effects the group will need to evaluate this report. The biology and behaviour of *C. crangon* does not lend itself to conventional stock assessment techniques therefore other methods are required. Further to a biomass estimate, data are available to investigate the ability to assess the stock size within each year through its correlation with the numbe of egg bearing females. A thorough analysis of these data are required before its usefulness in assessing the stock can be established. Further research has commenced as a response the MSC process. It is therefore considered important to keep fully informed on the MSC certification process. It was also agreed that in addition to the landings, effort and number of active vessels, each Member State would provide VMS data from *C. crangon* vessels in order to identify areas affected by the fishery and spatial patterns in fishing activity. The combined map of all memebr states will give the needed seasonal overview picture of fishing effort.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are 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 some 12 members and guests. Next year we will invite students of Crangon bIology that have recently finished their PhD and might contribute valuable insight to the group
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 WGBEAM and WGECO
Linkages to other organizations	CWSS = Common Wadden Sea Secretariat, TMAP= Trilateral Monitoring and Assessment Programme.

Annex 4: Recommendations

Recommendation	For follow up by:
1.WGCRAN recommends that the Danish young fish survey be continued because of the different catch composition as compared to the German DYFS	WGNSSK, WGBEAM, WGICZM
2. WGCRAN recommends that current surveys are extended to cover areas of deeper water that are currently not covered by the DFS surveys but that are frequented by the shrimp fishers especially in the colder seasons	Survey coordinators at Institut für Seefischerei Hamburg
3. with regard to the MSC accrediditation process WGCRAN recommends that studies be conducted to address specific information deficits on:	Wadden Sea Society (Paddy Walker)walker@waddenvereniging.nl
Use the unfished areas in Danish waters as a reference to better understand the effect of *Crangon* fishing on the ecosystem	North Sea Foundation
The short-term ecological effects of fishing disturbance by *Crangon* vessels Discard mortality of bycatch species caught in the *Crangon* fishery	Netherlands Ministry of Agriculture, Nature Management and Fisheries (Min. LNV)
Exploring the utility of the correlation between autumn survey catches and spring survey and commercial catches as a managementtool to assess the North Sea *Crangon* stock, including the implications of variable catchability during surveys	Ministry LNV POBox 20401 2500 EK Den Haag The Netherlands
4. WGCRAN recommends for all the different countries to supply *Crangon* samples to Yves Verhaegen for pollutant analyses and possibly genetic analyses. For pollutant analysis a sample of 100 g *Crangon* (frozen) is needed, for the genetic analysis *Crangon* needs to be preserved in ethanol or liquid nitrogen	To the whole working group
5.WGCRAN recommends that the electric beam trawl is tested in other shrimp fishing areas under as many different conditions as possible	Sector/national PO's Gear technology experts wthin ICES