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

3-7 June 2013

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Executive summary

The Working Group on *Crangon* Fisheries and Life History (WGCRAN) 2013 meeting was successfully held at the ICES headquarter in Copenhagen, Denmark June 2013. Members from Germany, the Netherlands and UK joined the meeting. Representatives from Denmark, Belgium, Portugal and France could not join the meeting but were represented via correspondence. Members of WGCRAN see the priority of this expert group in understanding the interactions between the brown shrimp population (structure and abundance) and human behavior (mainly fishing effort) and between the shrimps and the environment (temperature, currents) as well as the ecosystem (trophic interactions). Stock status indicators like biomass estimates, interannual and seasonal changes in landings per unit effort, total mortality and shares of large shrimp in the surveys were discussed. Strong emphasis during this years' meeting was set on possibilities on how to manage the population and how to give (if needed) advice (ToR h). Part of the time was therefore also used to discuss and prepare WKCCN (Workshop on the Necessity for *Crangon* (brown shrimp) and Cephalopod Management, ACOM).

In comparison to the year 2011 where a strike of the fishers and the strong 2010 year class altered the normally observed seasonal patterns, 2012 was, concerning effort and landings, again a more "normal" year. Total landings from all countries summed up to 32277 t (44% Netherlands, 39% Germany, 10% Denmark, UK 3%, Belgium 3%, and France 1%).Total mortality of shrimps >50 mm increased compared with 2011 and was about 5.7 a^{-1}. The share of shrimps > 60 mm in autumn decreased from 23 (2011) to 16% (2012). Both factors are influenced by natural variability and fishing pressure as well.Average annual biomass of shrimps > 50 mm and based on a preliminary swept-area estimate, was ~9200 t resulting in a total annual production of ~53000 t (using $P = B \cdot Z$ and $Z = 5.7\ a^{-1}$).

As a summary of the discussion on the necessity of a brown shrimp management it was concluded that, due to the high influence of the fisheries on the stock (high F/M of 3 to 5 during recent years, the visible influence of the 2011 strike on lpue, the decrease in mean length and large shrimps in the catch over time), the impact of the fisheries on the habitat and the benthos community and the indication for growth overfishing (shown by a *Crangon* specific Yield/Recruit model) an effort optimization should be recommended. Due to the short lifespan and the high seasonal dynamic of the stock a TAC rule is not applicable and therefore a harvest control rule (precautionary reference points following Fmax, F0.1 or constant egg production level) or technical measures (net selectivity) would be a suitable way for a shrimp management. The sensitivity of an lpue-based harvest control rule has been discussed during the meeting and is currently under evaluation.

1 Administrative details

Working Group name

WORKING GROUP ON CRANGON FISHERIES AND LIFE HISTORY (WGCRAN)

Year of Appointment

2011

Reporting year within current cycle (1, 2 or 3)

1

Chair(s)

Marc Hufnagl, Germany

Meeting venue

Copenhagen, Denmark

Meeting dates

3–5 June 2013

2 Terms of Reference a) – k)

a) Report and evaluate population status indicators like recent landings and effort trends in the brown shrimp fisheries or length based mortality estimates from Dutch and German scientific surveys. Generate a standardized lpue time-series of higher accuracy for all nations with horse power days calculated based on hours at sea for the future but also for the past where possible. (Lead persons: all group members)

b) Combine VMS, landings and effort data to gain a population distribution indicator and to monitor regional distribution and regional shifts in fishing effort. Evaluate the variability of the results by comparing different VMS data interpolation methods. (Lead persons: Katharina Schulte, Torsten Schulze)

c) Publish a common publication on brown shrimp biomass estimates and annual production rates. Besides the survey based swept-area estimates the publication shall also include correction factors based on new or existing information on gear selectivity, catchability and behavior aspects. (Lead persons: Ingrid Tulp, Volker Siegel)

d) Publish predation rates of cod and whiting on brown shrimp and discuss the role of fishing in relation to natural mortality. (Lead persons: Axel Temming, Marc Hufnagl)

e) Parameterize and use a *Crangon crangon* population model to investigate e.g. seasonal brown shrimp biomass dynamics, the implications of fishing effort alterations (including closures), mesh size and mesh selectivity on the population structure. The model shall be further developed to act as a decision aid for management rules and aspects. (Lead persons: Marc Hufnagl, Axel Temming,)

f) The ongoing introduction of the electric beam trawl will have strong implications on the relation of the nominal effort and the fishing mortality of brown shrimp. Existing literature and new results on the ecosystem and population impact of the introduction of the electric beam trawl into the fisheries shall therefore be reviewed and compiled. (Lead persons: Bart Verschueren, Axel Temming)

g) Gain a better understanding of the life cycle dynamics and history of brown shrimps in the different ICES regions with special focus on latitudinal gradients and the comparison of the North Sea core distribution area and the Portuguese Minho estuary at the most western distribution margin.This will include the application and further development of in situ growth methods, maturity and mortality estimates as well as the analysis of starvation and condition indices. Especially in the North Sea also the maturation and spawning process of brown shrimp shall be investigated to gain a better understanding of the recruitment process. (Lead persons: Joana Campos, Axel Temming, Volker Siegel)

h) Generate a common publication on existing data and possible methods to assess and manage the brown shrimp fisheries in the ICES region. This shall include i.) A compilation of existing brown shrimp information from commercial data and scientific surveys ii.) a review of suitable management methods gained from ICES recommendations on management of data poor and lower trophic level species and iii.) an identification and

evaluation (e.g overview table) of possible management strategies. (Lead persons: Josien Steenbergen, Axel Temming)

i) Gather, compile and evaluate information on the onboard and ashore sieving fractions and processes and new national bycatch/discards data from e.g. DCF (GER and NL) and the Dutch "Effects of shrimp fisheries on the Natura 2000 sites" - Project on i.) bycatch and discards of N2000 species and juvenile flatfish. (Lead persons: Ingrid Tulp, Josien Steenbergen).

j) Exchange of information on national legislation, laws (e.g concerning Natura 2000) and developments (MSC process) concerning the brown shrimp fisheries in the whole North Sea for an improved cooperation and coordination of research and advice efforts. Presentations on developments and ongoing brown shrimp research in the ICES area.

k) (new) Analysing the selectivity of different mesh openings and mesh types and the impacts they have on catch composition and stock dynamics (Lead persons: Thomas Neudecker, Sebastian Schultze)

3 Summary of Work plan

Workplan year 1 according to WGCRAN report 2012:

Data analysis shall be finished and a draft version shall exist for manuscripts planned under ToR b, c, d and i. All effort time-series of all countries required for ToR a shall be provided in a standardized and updated way.

ToR a.) Landings, effort, mortality, fraction of large shrimps and biomass estimates were updated until 2012. Effort data have been, with the exception of the Dutch data, standardized to horsepower – days at sea where days at sea have been calculated based on hours at sea / 24. French data are so far only available until 2009 but will be provided for a longer period next year.

ToR b.)Data analysis is finished and a first version of the manuscript is written.

ToR c.) Data analysis is finished and a first version of the manuscript is written.

ToR d.)Data analysis is finished and a first version of the manuscript is written.

ToR i.)Data acquisition is ongoing.

4 List of Outcomes and Achievements of the WG in this delivery period

a) Time-series of landings, effort, lpue, mortality and fraction of large shrimps have been updated and are added in the ANNEX.

Publication:

Hufnagl M., Huebert. K, Temming A. How does seasonal variability of growth, recruitment, and mortality affect the performance of length-based mortality estimates in fisheries science? ICES JMS (2012) DOI: 10.1093/icesjms/fss163,

b) Publication in progress

c) Publication in progress

d) Publication in progress

e) Parameterization ongoing model runs in progress. Part of the results will be presented at the ASC 2013 in Reykjavik.

Schulte et al.: Introduction of a cpue-based harvest control rule in the brown shrimp fishery. Applicability and sensitivity testing. ICES CM 2013/H:13

f) *Publication*:

Maarten Soetaert, Annemie Decostere, Hans Polet, Bart Verschueren, Koen Chiers (2013) Electrotrawling: a promising alternative fishing technique. Fish and Fisheries, DOI: 10.1111/faf.12047

Report (in Dutch):

Verschueren, B., Vanelslander, B., Polet, H., 2012. Verduurzaming vande Garnalenvisserijmet de Garnalenpuls:eindrapport. ILVO MEDEDELING nr 116

http://pure.ilvo.vlaanderen.be/portal/files/1000183/20121026_Eindrapport_Waddenfonds_Final.pdf

g) Data acquisition and analysis in progress

h) Workshop on the Necessity of *Crangon* and Cephalopod Management WKCCM will be held in October 2013

i) Combined Dutch German publication on the DCF data in progress.

Publication of 1st results of the N2000 project (in Dutch):

Steenbergen, J., van der Hammen, T., Rasenberg, M., Tulp, I., 2013. Tussenrapportage onderzoek "Effecten van garnalenvisserij" – onderdeel bijvangst. IMARES Rapport C047/13 (in Dutch), 39p. (http://edepot.wur.nl/258202)

j) WKCCM

k) Project started and data acquisition in progress

5 Progress report on ToRs and workplan

5.1 A) Population status indicators

Progress by ToR

Landing statistics

Landings and especially efforts have in the past been reported in different ways which made a comparison of the data and especially landings per unit effort (lpue) complicated. Additionally the general definition for "days at sea" will be misleading for the brown shrimps as the majority of the trips of the fleets are less than a day. The general definitions counts each calendar day as: any continuous period of 24 hours (or part thereof) during which a vessel is present within an area and absent from port. Several short trips especially overnight will therefore generate an artificially high effort which has not really been the case. WGCRAN therefore switched to a reporting of efforts in "real" days at sea based on hours at sea divided by 24. German data are available for the period 2002 to 2012, Dutch and UK data are not available in this format so far, Danish and Belgian data are available since 2001, French data are available for 2009 to 2012 but will be provided for the a longer period within the next reporting period.

Total North Sea wide landings, as well as landings and shares by nation in 2012 were comparable to 2011 (Figure 1-7). Total landings from all nations were 32277 t with 44% landed by the Netherlands, 39% by Germany, 10% by Denmark, 3% by UK, 3% by Belgium 3% and 1% by France.

Dutch and German landings were generally comparable to the long term mean but slightly higher in February (Figure 8). Danish shrimpers mainly landed in autumn which is different from previous years. UK landings also peaked in autumn and were lower than the average in spring but still within the standard deviation of the variability of previous years. French shrimpers landed most shrimps in spring.Decadal averages are similar to those reported last year (Figure 9).

Effort in days at sea (Figure 10) and horsepower days at sea (hp-das, Figure 11) showed - where available - comparable patterns and focus will therefore be set here on hp-das. German effort between March and November ranged from 470 000 to 640 000 hp-das. In winter effort was lower and ranged from 60 000 to 150 000 hp-das. Dutch fleet effort in summer was lower than the German effort and ranged from 350 000 to 470 000 hp-das. Dutch data are not calculated based on hours at sea but on whole days on sea. Danish effort was lowest in February and March (<22 000 hp-das) and peaked in October (134 000 hp-das). UK effort also peaked in October with 75 000 hp-das. French effort ranged from 900 to 7 500 hp-das with the exception of September and October where 21 000 and 14 000 hp-das where reported.

In France, UK and Denmark lpue in January were higher than the average of previous years (Figure 12, 13). Dutch lpue were slightly higher during the first half of 2012 but generally comparable to previous years.

Total landings of all nations peaked in October and were about 5 700 t (Figure 14). Lowest landings were reported for February. Seasonal effort summed by all nations was comparably high between March and November and lower in Dec, Jan and Feb. (Figure 14-15). In comparison to 2011 total effort increased by a factor of 1.5 and was 11 161 452 hp-das (Figure 17). Average annual lpue of French and UK vessels were lowest 1.8 kg·hp-das^{-1} those of the Netherlands highest (3.5 kg·hp-das^{-1}) followed by

Denmark (3.2 kg·hp-das^{-1}) and Belgium and Germany (2.3 kg·hp-das^{-1}).There was no trend in lpue over time recognizable for any nation and also there are no really consistent patterns for several nations.

Mortality

Mortality increased compared with 2011 and was 5.7 a^{-1} in 2012 (Figure 19). The share of large shrimps in the catches of the scientific surveys decreased to 16-17% (>60 mm) and 1.3% (>70 mm), respectively.

Biomass/Production

See ToR c.)

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

Cooperation with WGMIXFISH and WGNSSK on including brown shrimp landings data in the common data call and in the ICES-database Intercatch.

Cooperation with Advisory structures

None

Science Highlights

The strong 2010/2011 cohort in combination with the strike in spring 2011 led to higher than average lpue observed in 2011. This high level was not carried over to 2012 and lpue-levels were again comparable to the long-term average in 2012. Additionally mortality rates increased and the fraction of large shrimps decreased. Total landings in 2012 were comparable to 2011 although the effort was 40% lower. This indicates a growth overfishing of the population as a reduced effort results in comparable landings.

5.2 B) Effort distribution based on VMS data

Progress by ToR

VMS data contain two-hourly pings, transmitting speed, direction and coordinates of the vessel. This resolution is insufficient for several tasks, and different methods are available to estimate the spatial extension of fishing areas and the spatial distribution of effort, catch and revenue. Five different methods (raw pings, straight line and spline interpolation, the amplification method and ellipses) were applied on a VMS dataset of the German brown shrimp fleet, to check, if and on which resolution the considered methods differed in their results. The analysis is finished and the publication in progress.

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

None

Cooperation with Advisory structures

No cooperation

Science Highlights

Will be presented as soon as the publication is available (likely interims report year 2)

5.3 C) Swept-area biomass and production estimates

Progress by ToR

The necessity and the general procedure and methodology to estimate biomass and production of brown shrimp in the North Sea have been described in detail in the WGCRAN report 2012. Correction factors have now been included and verified and the latest data from the 2012 surveys were added. The publication of the results is in progress

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

Cooperation with WGBEAM on identifying catchability differences between the German and the Dutch demersal fish surveys.

Cooperation with Advisory structures

No cooperation

Science Highlights

The autumn swept-area biomass estimate based on the Demersal Fish and the Demersal Young Fish Survey (method see WGCRAN report 2012) has been updated and was about 40% lower than 2011. Average annual biomass of shrimps > 50 mm was ~9200 t resulting in a total annual production of ~53000 t (using $P = B \cdot Z$ and $Z = 5.7\ a^{-1}$).The final production estimate and the average annual standing stock biomass of shrimps > 50 mm will be provided next year along with the time-series reaching back to 1970.

5.4 D) Natural mortality rates vs. fishing mortality

Progress by ToR

We extend the analysis made by Welleman and Daan (2001) for the years 1996 – 2011 using updated stock assessment and predator distribution data. Stock numbers for the predators were derived from age based assessment data (IBTS, SMS) for the total North Sea and were multiplied with the quarterly consumption rates per individual by age class and the average share of brown shrimp in the diet of the predators. Total mortality estimated using length based methods were then split into M (natural mortality) and F (fishing mortality) using the total consumption of the predators and the North Sea wide landings.

Reference

Welleman HC, Daan N (2001) the dutch shrimp fisheries sustainable? Senckenbergia maritima 31(2): 321-328

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

Assessment data were obtained from WGSAM

Cooperation with Advisory structures

None

Science Highlights

Will be presented as soon as the publication is available (likely interims report year 2)

5.5 E) Yield-per-recruit model

Progress by ToR

Yield-per-recruit (Y/R) models (Beverton and Holt 1957) can be used to evaluate growth overfishing and the impact of increased fishing mortality on harvestable biomass. These curves typically increase with F from zero onwards with steadily decreasing slopes and either reach a defined maximum, or depending on growth parameters and M, appear as flat top curves. If a maximum is clearly developed, F should not be increased beyond Fmax to avoid growth overfishing. For stocks with a flat top Y/R-curve an alternative F-level has been proposed as a reference level, namely the F at which the initial slope of the Y/R curve has decreased to 10% of the initial value (F0.1). F0.1 indicates a level of exploitation, where any further increase would only result in minimal further increase of the Y/R, while at higher F levels the mean spawning stock per recruit (SSB/R) would decrease dramatically.

Based on the Y/R model presented in the WGCRAN report 2003 a new version has been developed including males and females, different mortality schemes for larvae, juveniles and adults, updated growth and mortality rates in combinations with updated fishing effort and F/M ratios and a new recruitment index. This new model is described and published in the thesis of Chris Rückert (2011). A slightly modified version (mainly concerning the coding) of this model was used to calculate landings using different F and M values based on the analysis of ToR d.).

References

Beverton RJH, Holt SJ (1957). On the Dynamics of Exploited Fish Populations, Fishery Investigations Series II Volume XIX, Ministry of Agriculture, Fisheries and Food.

Rückert C (2011). Die Entwicklung, Parametrisierung und Anwendung eines Simulationsmodells für die Nordseegarnele (*Crangon crangon*, L.) zur Beurteilung des Befischungszustandes, PhD Thesis, Univ. of Hamburg, Germany

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

None

Cooperation with Advisory structures

None

Science Highlights

Work in progress, part of the results will be presented on the ASC 2012 in Reykjavik.

5.6 F) Pulse-gear

Progress by ToR

Results published (section 3)

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

SGELECTRA

Cooperation with Advisory structures

None

Science Highlights

The future of the flatfish fishery, in particular by beam trawls, is endangered as fuel costs and obligations to reduce bycatch will further increase. Pulse fishery with electrotrawls may pose a promising alternative, offering multiple improvements. Unfortunately, not all possible negative side effects can be excluded yet. Although various studies elucidating the effects of electrical fields on fish have been performed, various major gaps of knowledge still remain and need to be investigated. – With Shrimp electric fishing we are talking about another, lower stimulus and thus this should be regarded separately.

With regard to electric fisheries on shrimp, the used gears are getting more efficient especially as it can catch shrimp during daytime and clear water. Considerations on stock effect and management consequences with such a new gear should be done as was also concluded in 2011:

Given the increase of efficiency this gear (hoovercran in combination with the bobbin rope) should only be used under strict regulation of catches. Increased efficiency could be an advantage (in terms of less bycatch and bottom contact per kg of shrimp caught), but only when there is a limit in total catches per year (e.g. quota). Otherwise the catch is likely to increase.

The fishing industry has proposed an lpue-based management approach (see also ToR e. and ToR h.). This management would be based on lpue reference points determined using values of previous years. Changes in catchability of the used gears will alter these patterns and will complicate or even make it impossible to determine these reference points.

5.7 G) Life cycle dynamics comparison among ICES regions

Progress by ToR

Data acquisition ongoing.

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

None

Cooperation with Advisory structures

None

Science Highlights

None yet

5.8 H) Brown shrimp management

Progress by ToR

A large fraction of this years WGCRAN meeting was used to discuss suitable management strategies applicable to the brown shrimp fishery, to analyse which datasets are reliable and which datasets can be used for management issues. Further the Workshop on the necessity of a Crangon and Cephalopod management (WKCCM) was planned and discussed. The reasons why the shrimp fisheries should be managed are multiple and were discussed in detail in the 2011 WGCRAN report, therefore only a brief summary shall be given here.

- The fishery takes place in ecologically important nursery areas.
- The fishery takes place in UNESCO heritage and NATURA2000 areas.
- The bottom trawl has a high impact on the benthos community and the habitat structure.
- Small mesh sizes are used and bycatch and discards are therefore high.

The fishing pressure on the population is high with F/M ratios of 3 and higher during recent years. The influence of the fishery on the stock became visible in the strong lpue increase in 2011 after the strike period where fishing was stopped.

Since the WGCRAN 2011 report the group worked on developing strategies and possibilities for giving an advice and on how to manage the stock. Different indicators and techniques became available since then: 1.) the standardization and calculation of more accurate lpue is in progress, 2.) total mortality estimates are available, 3.) an estimate of the F/M ratio can be given on a yearly basis, 4.) a biomass and production estimate is available, 5.) the yield-per-recruit model is now in a state that it can be easily used to address questions concerning the management 6.) shares of large shrimps from independent scientific surveys are available. Furthermore there is a high motivation of the fisher to participate in a management plan. The evaluation of a harvest control rule based management proposed by the fishing industry is in progress at the moment.

The whole European fleet that targets brown shrimp has about the size of 600 vessels. After May 2011 where the majority of the fleet was not operating lpue increased significantly (WGCRAN report 2012). I combination with the results of the yield-per-recruit model WGCRAN concluded that the brown shrimp stock in the North Sea is growth overfished. This means that effort can be reduced while landings remain on a comparable level or even increase. Reducing the effort would therefore lead to an economically and ecologically better used resource and to less bycatch, less discard, less bottom impact at comparable landing levels.

The currently discussed harvest control rule (HCR) would include an effort reduction if lpue fall underneath a certain predefined threshold. An analysis of the appropri-

ateness of these reference points as well as the level of effort reduction is ongoing and will also be part of the WKCCM.

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

WKCCM in cooperation with WGCEPH (delegates invited from WKLIFE2, ACOM, WGMG, WGMIXFISH)

Cooperation with Advisory structures

None yet

Science Highlights

As a summary of the discussion on the necessity of a brown shrimp management it was concluded that, due to the high influence of the fisheries on the stock (high F/M of 3 to 5, the visible influence of the 2011 strike on lpue, the decrease in mean length and large shrimps in the catch over time), the impact of the fisheries on the habitat and the benthos community and the indication for growth overfishing (shown by a *Crangon* specific Yield/Recruit model) an effort optimization should be recommended. Due to the short lifespan and the high seasonal dynamic of the stock a TAC rule is not applicable and therefore a harvest control rule (precautionary reference points following Fmax, F0.1, constant egg production level) or technical measures (net selectivity) would be a suitable way for a shrimp management. The sensitivity of an lpue-based harvest control rule has been evaluated prior to and during the meeting.

5.9 l) Bycatch and discard fractions

Progress by ToR

In 2012 a 2 year project has started in the Netherlands to monitor discards in *Crangon* fisheries in cooperation with the fishers.A reference fleet of 24 vessels along the whole Dutch coastline once per month take a sample from their (fish and benthic) discards. These samples are picked up at the harbour and analysed at the lab. In this way we hope to get > 400 samples / year of the (composition of) discards in *Crangon* fisheries.

Germany and the Netherlands are running an observer-program to monitor the catch and discards in shrimp fisheries. Both countries use the same protocol on board. About 8 trips are monitored per year. During a bilateral meeting between the institutes IMARES and TI it has been agreed on summarizing the discards in the shrimp fisheries in the Netherlands and Germany. Data of 5 years of DCF-sampling will be used in this publication. The main outcomes will be included in the final WGCRAN report (2015).

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

None

Cooperation with Advisory structures

None

Science Highlights

None yet

5.10 J) Ongoing research

Progress by ToR

1) Statistical data on brown shrimp landings and effort have always been provided by the German agency „BLE“. They were formerly compiled by the “fishery police” and the first buyers by harbour and then passed on to the relevant agencies.Meanwhile logbooks and sales records are established statistical bases for many years and recently these became compulsory in an electronic version easing administrative effort and speeding up processing data. However, changes were inevitable in definitions due to the harmonization of the logbook data system on European basis. New codes have are now used to define the different classes:

“csh” (crangonid shrimp)

“WHL” meaning: “whole” (unprocessed animal)

“OTH” meaning: “other”

“BOI” meaning: Boiled

“FRE” meaning: Fresh

“HCN” meaning: Human Consumption

“IND” meaning: industrial use

“UKN” meaning: Unknown

“WDR” meaning: Withdrawn

“ANF” meaning: Animal Feed

On top of that size classes were recorded which were unclear to us ranging from: “0”, “1”, “2” and “3” plus quality grades “0”, “1”, “2” and “3”.

Checking with the authority “BLE” gave the initial explanation, that they refer to the legal sizes of “>6.5mm“-sieving – for size class “2” (according to the EU market regulation for human consumption shrimp) and “1” for the little larger ones sieved on riddles with bar distances of 6.8mm (according to the new market agreements within the fishery and processing companies). Sizes “0” were for “no information” and “3” for “large ones”.

This system can so far and in this way not be used to gain size information as size classes are not specifically defined and are variable.

WGCRAN therefore suggests the following size definition:

“0”: “no information on size composition”

“1”: very large shrimp retained by a 9.0 mm sieve (distance between bars)

“2”: large shrimps retained by an 8.0 mm sieve

“3”:“standard” shrimp retained by a 6.8 mm sieve

Shrimp of 6.5 mm< 6.8 mm carapace width are still acceptable human consumption shrimp according to EU law but are mostly rejected and sieved out for industrial purposes (animal feeds) combined with the fraction <6.5 mm. That information should be verified by shrimp buyers and sieving stations.

The formerly applied three types of shrimp landings (human consumption, industrial shrimp and "crushed shrimp" (equivalent to "undersized shrimp" or shrimp too small for human consumption)) can, nevertheless, be retrieved by aggregating coded shrimp in various ways:

"ANF" meaning: Animal Feed - was listed only for months in the second part of the year representing the old "Industrial shrimp" formerly coded in Germany by "26". Some minor cases of shrimp coded "FRE" were included – the original indication for the formerly "Industrial shrimp" (the only type of shrimp that was not boiled at sea).

"HCN" meaning: Human Consumption – was listed in various sizes and categories. We combined them all to the formerly used code "23" (human consumption), while all other classifications besides "ANF" and "HCN" where taken as former German code "25" ("crushed shrimp"), i.e. "IND"= industrial use, "UKN" = Unknown and "WDR" = Withdrawn. "IND" was found in all months clearly indicating that these shrimp belonged to those sizes too small for human consumption. "UKN" and "WDR" were not very frequent and therefore included to that use - industrial or animal feeds (based on boiled shrimps).

2) An image analysis tool was presented that allows for the size determination of several shrimps simultaneously. This has been developed and will be tested within the German CRANNET project where large sample volumes need to be analysed with respect to the size distribution of shrimps. The system has been validated against hand measurements and allows an accurate determination of the shrimp total length within a limit of ±1 mm.

Changes/ Edits/ Additions to ToR

No changes

Cooperation with other WG

None

Cooperation with Advisory structures

None

Science Highlights

WGCRAN suggests the following size definition to be used in the landings statistics:

"0": "no information on size composition"

"1": very large shrimp retained by a 9.5 mm sieve (distance between bars)

"2": large shrimps retained by a 9.0 mm sieve (distance between bars)

"3":"standard" shrimp retained by a 6.8 mm sieve

5.11 K) Net selectivity and the influence of using different mesh width on the shrimp population

Progress by ToR

Started in 2013

Changes/ Edits/ Additions to ToR

Added as a new ToR

Cooperation with other WG

None

Cooperation with Advisory structures

None

Science Highlights

None yet

6 Revisions to the work plan and justification

Work on all ToRs have progressed following the work plan.

One new ToR has been added:

ToR k.) Analysing the selectivity of different mesh openings and mesh types and the impacts they have on catch composition and stock dynamics (Lead persons: Thomas Neudecker, Bente Limmer)

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
k	Analysis of mesh openings and types on catch composition.	The brown shrimp fishery uses small mesh sizes that retain juvenile shrimps that are discarded after the first sieving process (part of the shrimps alive) and the second sieving process after the cooking (all dead). As the sum of both fractions can be substantial the selectivity of the mesh might have an effect on the population. Gathering data on the selectivity is therefore an essential and valuable information to identify the impact on the stock.	134, 131, 133, 311, 141,143, 212, 311, 334	year 2 and 3	Publication on selecltivity of different mesh types and openings. Lead persons: Thomas Neudecker and Bente Limmer

Year 2: Sampling and field surveys

Year 3: Publication/Report on the catch composition.

7 Next meeting

The next meeting will be held 6.5.2014 to 9.5.2015 at the Thünen Institut Hamburg, Germany.

Annex 1: List of participants

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Annex 2: Recommendations

Recommendation	Adressed to
1. Send a delegate of ACOM to join the "Workshop on the necessity of Crangon and Cephalopod Management" WKCCM in October in the ICES headquarter.	ACOM

Annex 3: Figures

Total landings time series and percentages landed per country

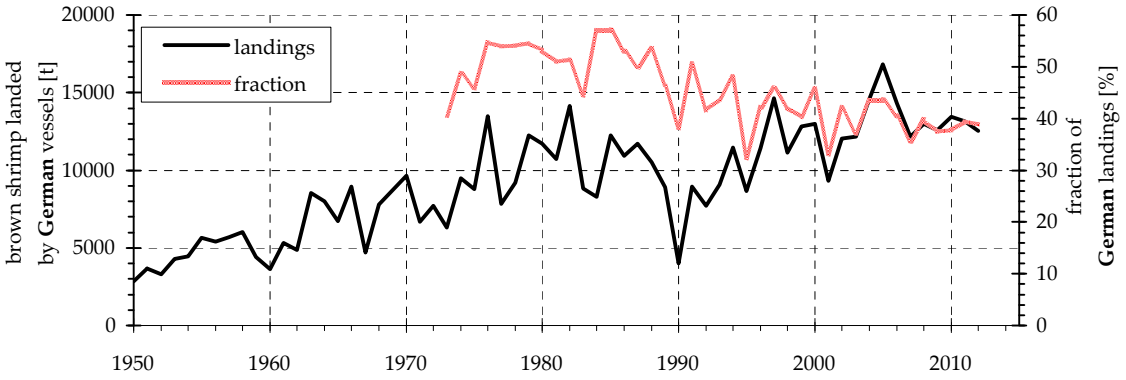

Figure 1 Consumption shrimps (in t) landed by German vessels between 1950 to 2012 in European harbours (primary y-axis). Red line and secondary y-axis: Percentage of German landings in relation to total landings (whole North Sea, all nations).

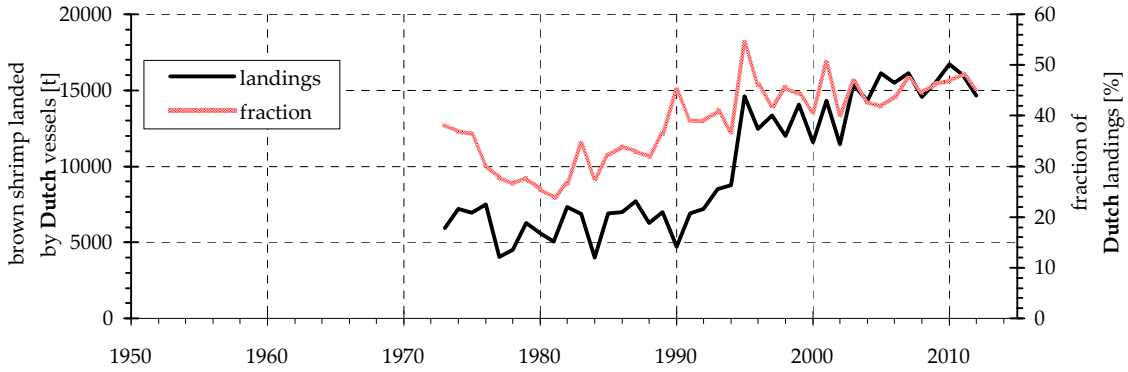

Figure 2 Consumption shrimps (in t) landed by Dutch vessels between 1973 to 2012 in European harbours (primary y-axis). Red line and secondary y-axis: Percentage of Dutch landings in relation to total landings (whole North Sea, all nations).

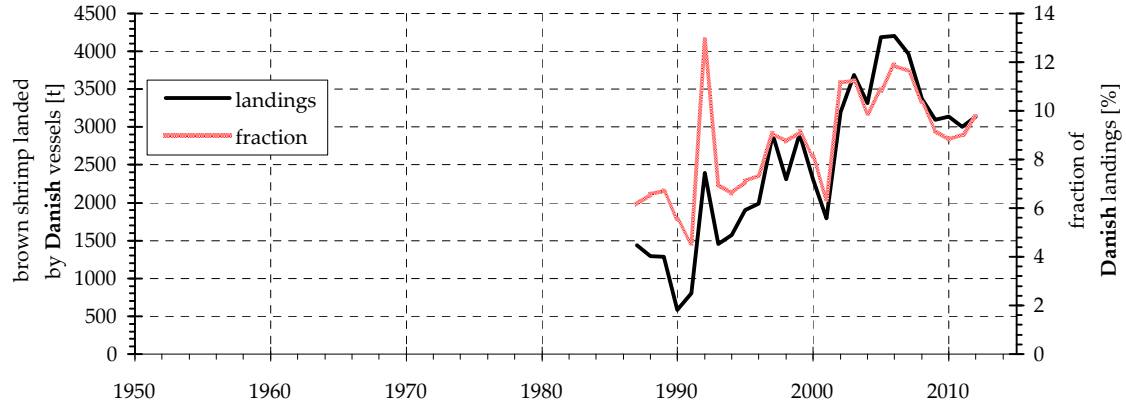

Figure 3 Consumption shrimps (in t) landed by Danish vessels between 1987 to 2012 in European harbours (primary y-axis). Red line and secondary y-axis: Percentage of Danish landings in relation to total landings (whole North Sea, all nations).

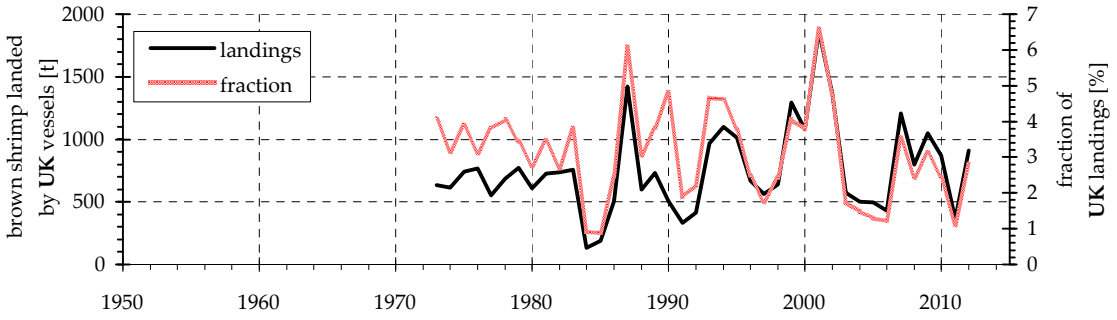

Figure 4 Consumption shrimps (in t) landed by UK vessels between 1973 to 2012 in European harbors (primary y-axis). Red line and secondary y-axis: Percentage of UK landings in relation to total landings (whole North Sea, all nations).

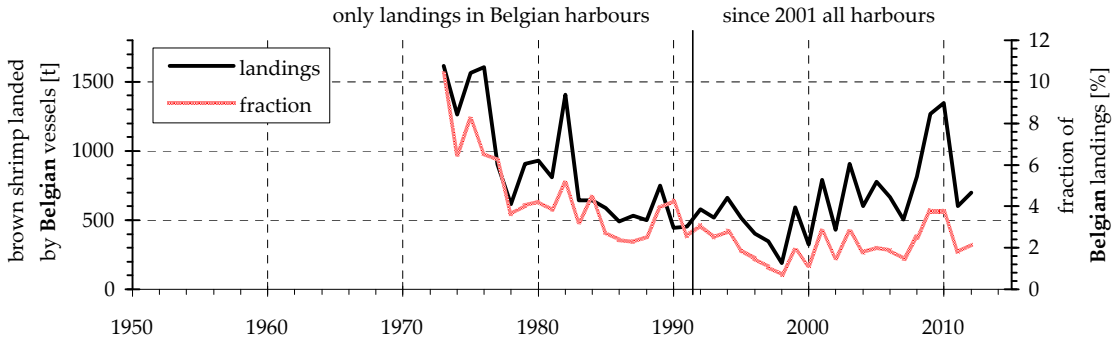

Figure 5 Consumption shrimps landed by Belgian vessels over the period 1973 to 2012 in t (primary y-axis). Since 2001 all landings of all Belgian ships landed in all European harbours. Before only landings by Belgian ships in Belgian harbours are presented. Red line: percentage of Belgian landings in relation to total landings (whole North Sea, all nations).

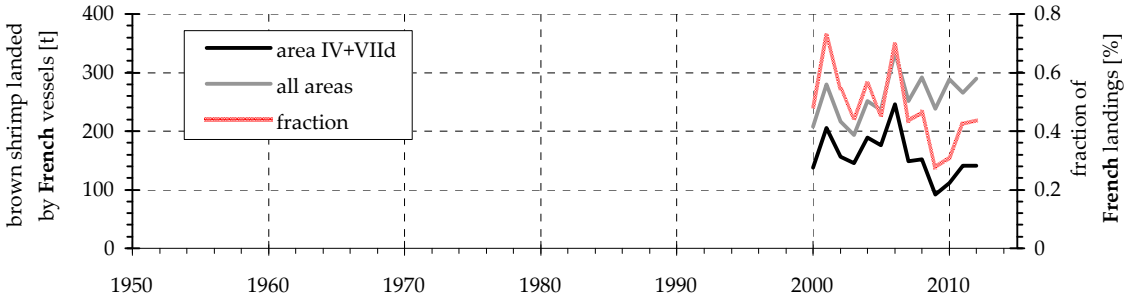

Figure 6 Consumption shrimps (in t) landed by French vessels between 2000 and 2011 (primary y-axis). Solid black line indicates shrimps landed in ICES area IV and VIId and the grey line total amount of shrimps landed by the whole French fleet (from North Sea and Atlantic). Red line indicates the percentage of French landings (area IV+VIId) in relation to total (whole North Sea all nations) landings.

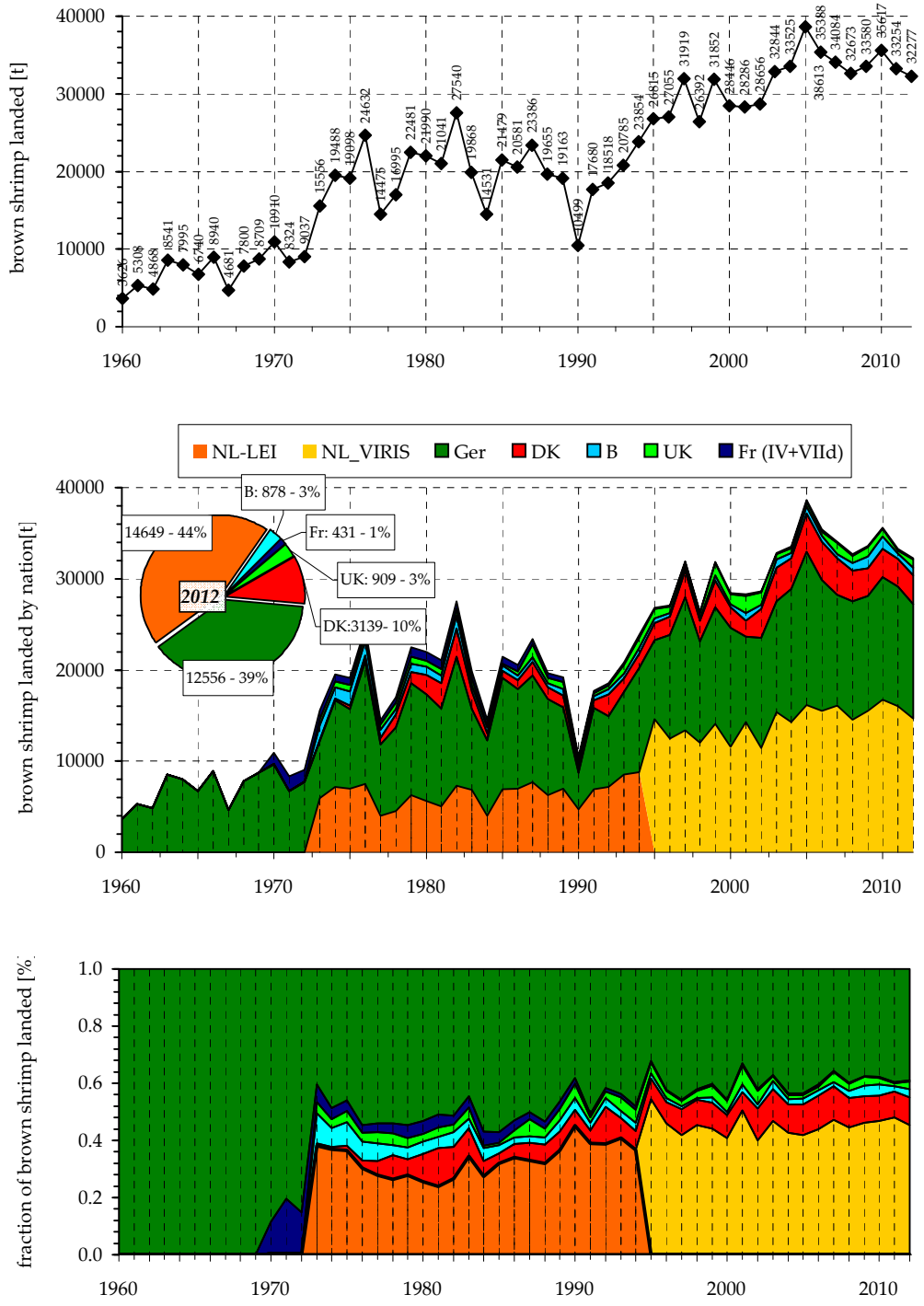

Figure 7 Upper panel: Total landings of *Crangon crangon* from the North Sea by nations. Middle panel: Landings of *Crangon crangon* from the North Sea [t] by country. Inserted pie chart landings in t and percentage by country for year 2011. Lower panel: Contribution of single countries to the total amount of shrimps landed by all countries (North Sea all nations).

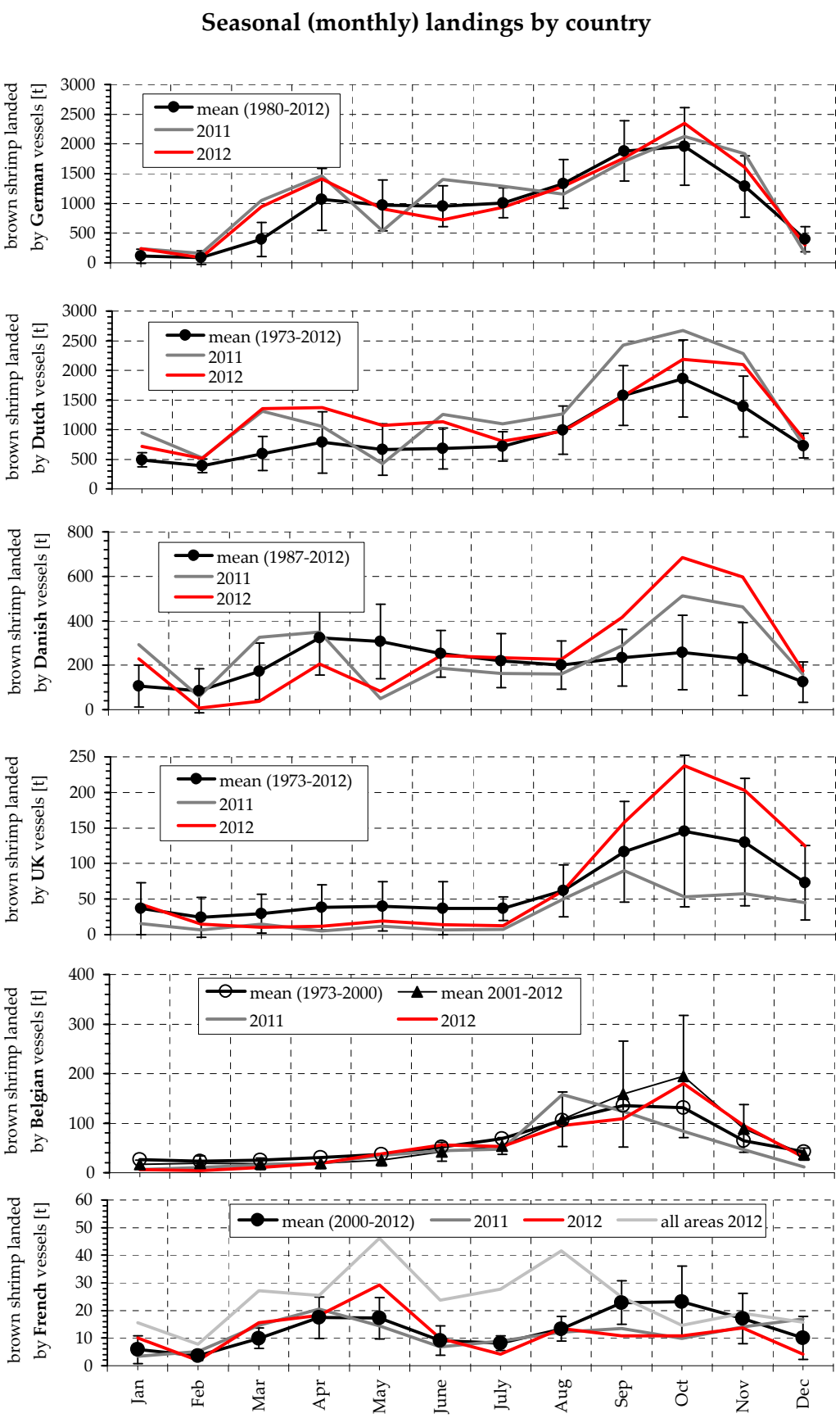

Figure 8 Consumption shrimps landed per month and country. Black line: long term average and standard deviation (whiskers). Grey line: total landings per month for the year 2011, red line: total landings per month for the year 2012. For France only: light grey line: all areas.

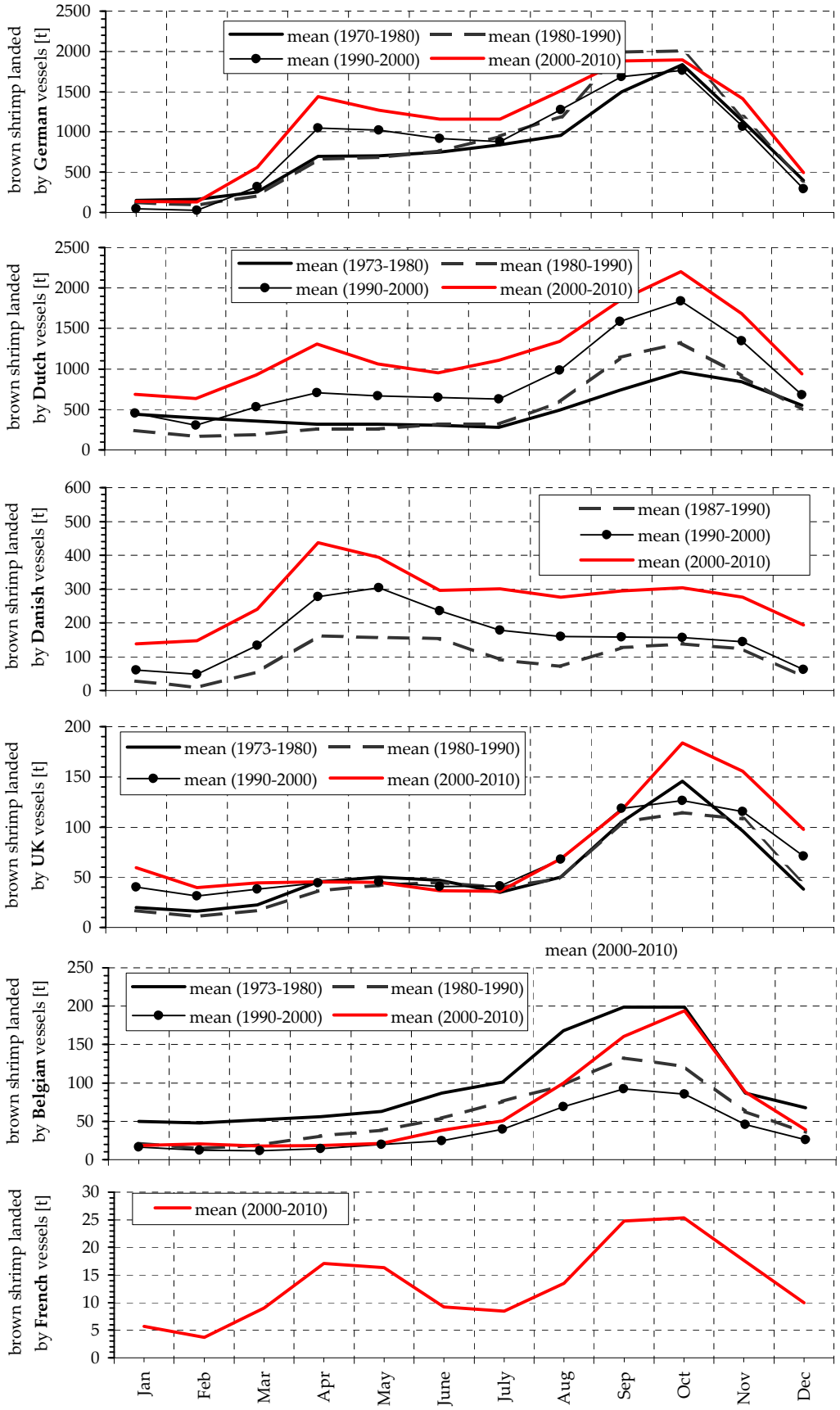

Figure 9 Decadal averages of monthly landed consumption shrimps per country. Black thick line: 1970s, grey dashed line: 1980a, black line with dots: 1990s, red line: 2000s.

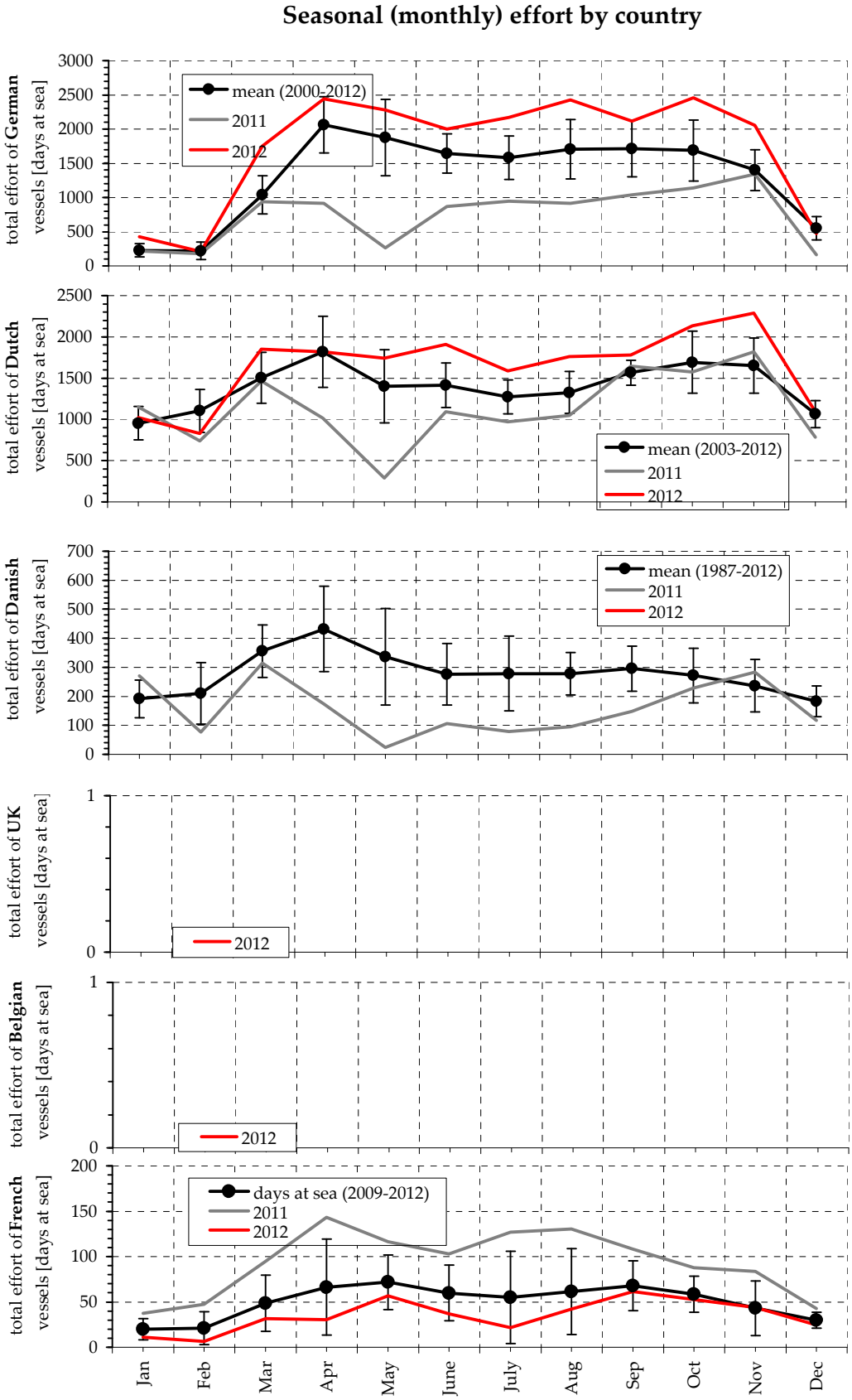

Figure 10 Monthly effort in days at sea per country. Black lines and whiskers indicate the long term means and standard deviations for the nations. Grey lines indicate the effort for 2011 the red line the effort for 2012. For Germany, Denmark and France: days at sea = returning to harbour - leaving time in hours x 24 for Netherlands calendar days at sea. No data for Belgium and UK

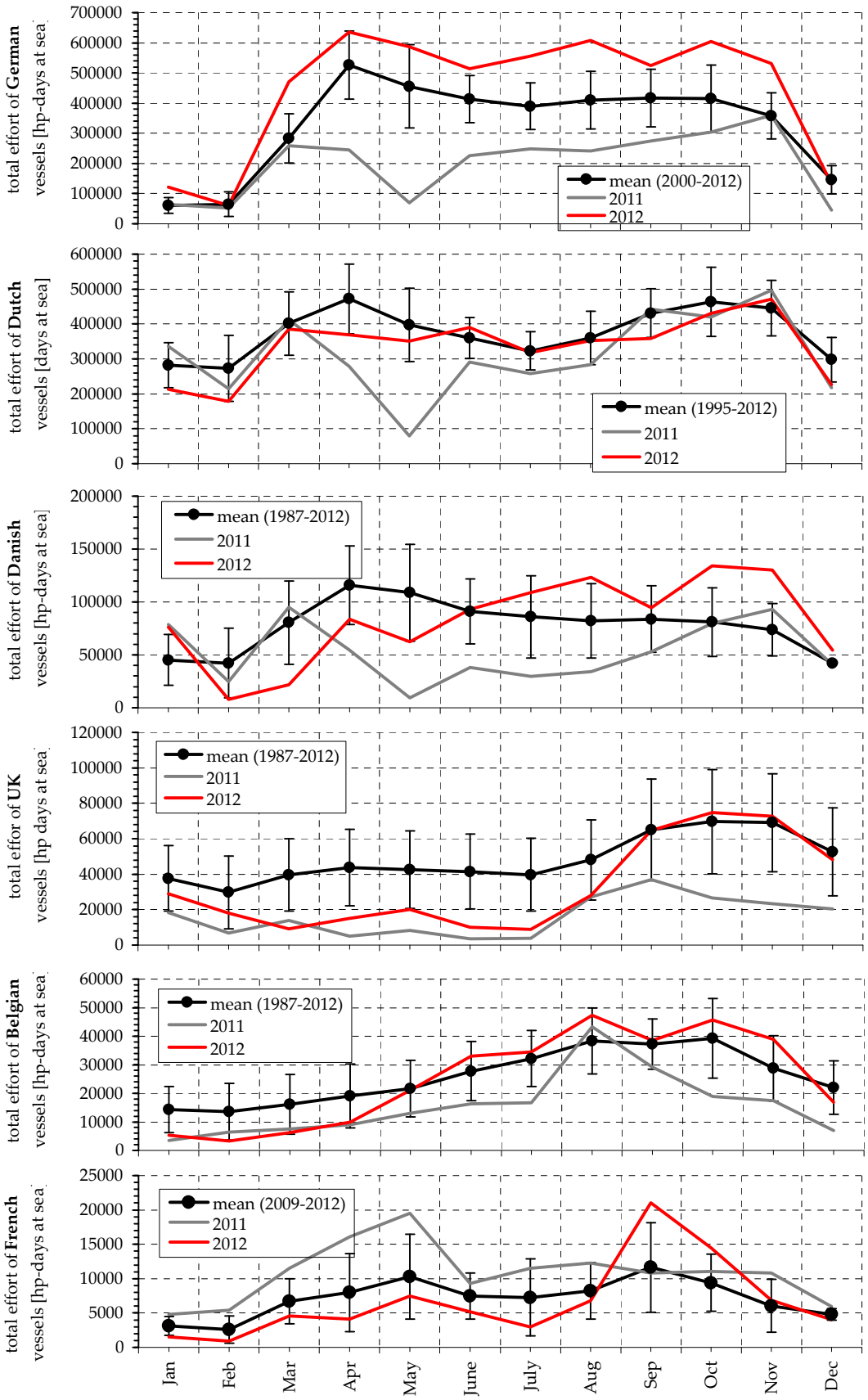

Figure 11 Monthly effort in horse power days at sea. Black line and whiskers indicate the long term mean and standard deviation for each nation. Grey line indicates the effort for 2011 and the red line the effort for 2012. For Germany, Denmark, Belgium and France: days at sea = returning to harbour - leaving time in hours x 24 x hp for Netherlands and UK calendar days at sea x hp

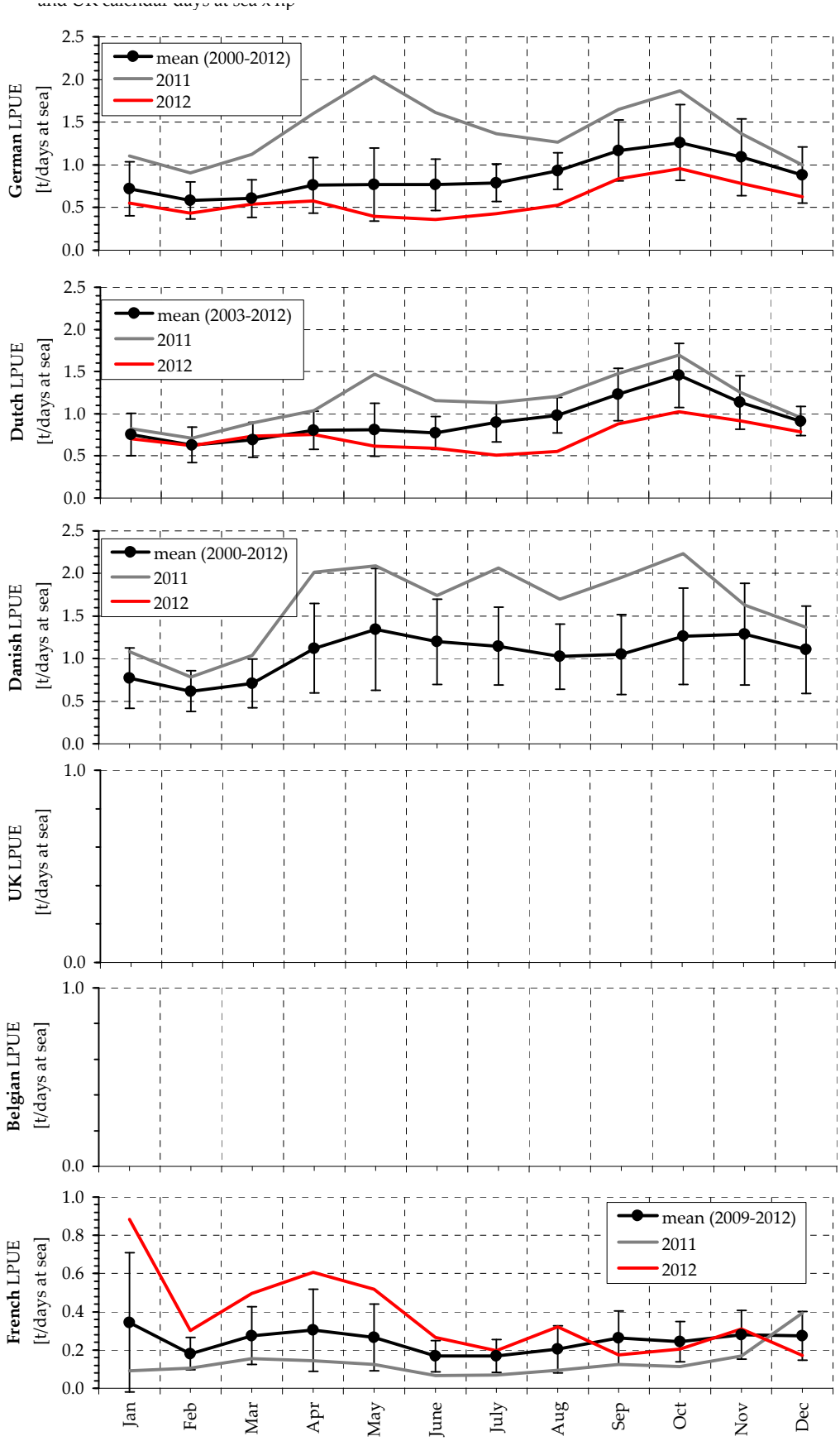

Figure 12 Monthly landings per unit effort in t per days at sea. Black line and whiskers indicate the long term mean and standard deviation for each nation. Grey line indicates the effort for 2011 and the red line the effort for 2012. For Germany, Denmark and France: returning to harbour - leaving time in hours x 24 for Netherlands calendar days at sea. No data for Belgium and UK

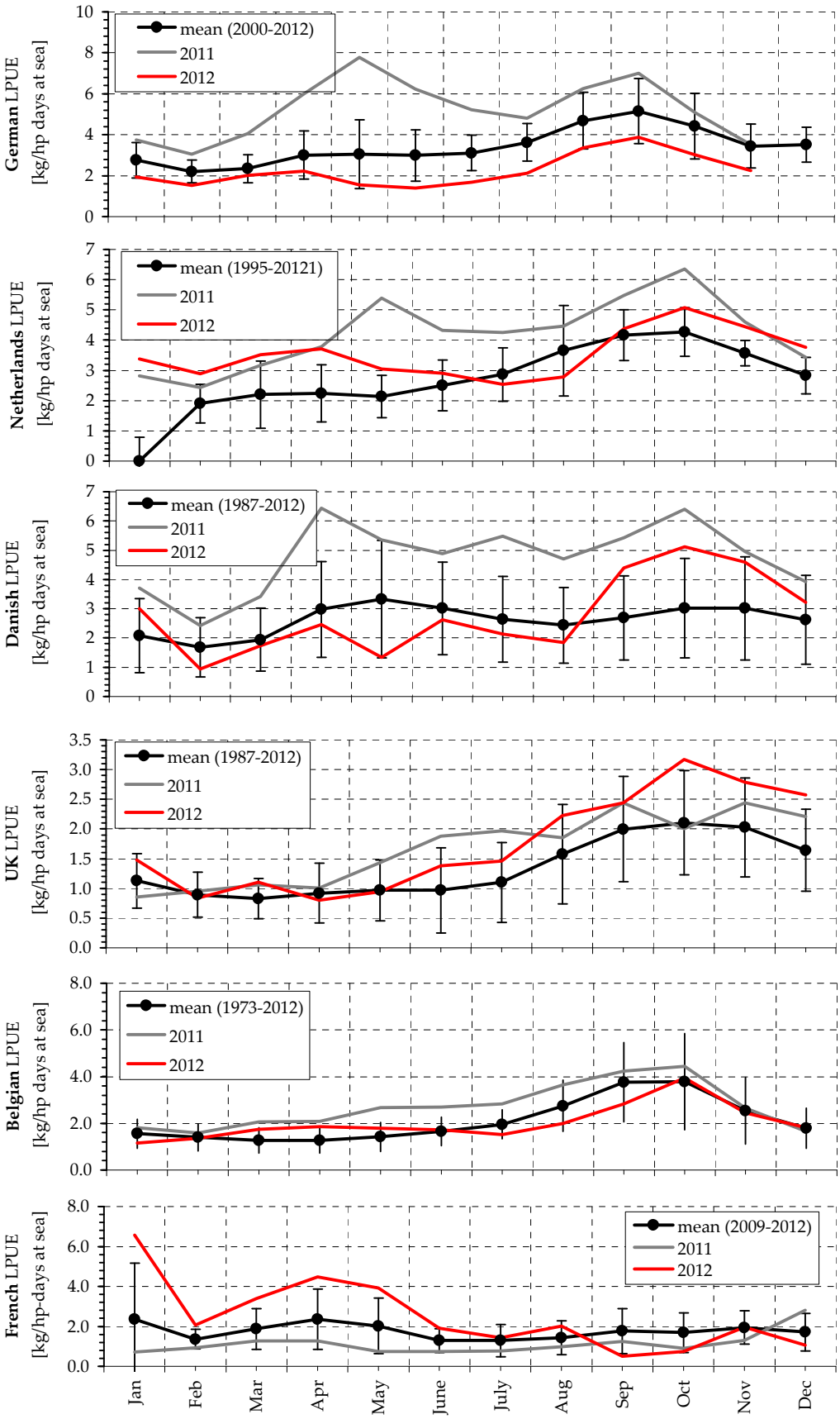

Figure 13 Monthly landings per unit effort in kg per horsepower days at sea. Black line and whiskers indicate the long term mean and standard deviation for each nation. Grey line indicates the effort for 2011 and the red line the effort for 2012. For Germany, Denmark, Belgium and France: days at sea = returning to harbour - leaving time in hours x 24 for Netherlands calendar days at sea. No data for Belgium and UI

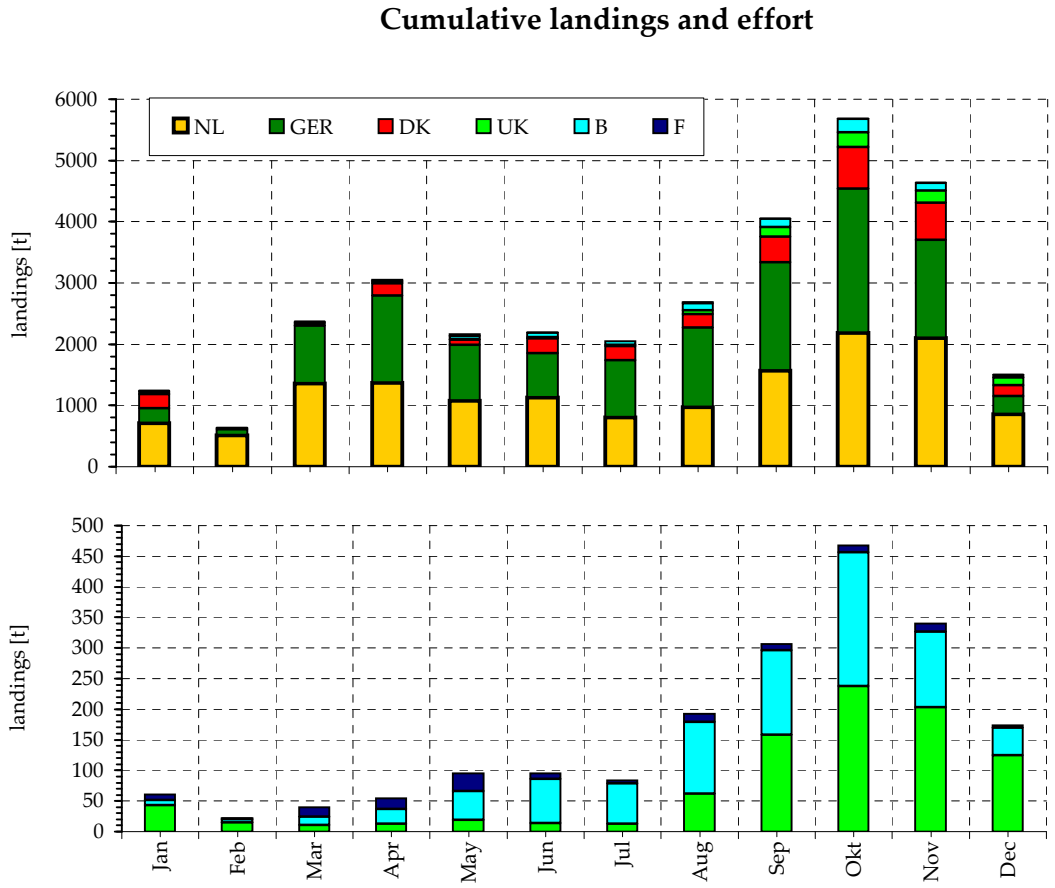

Figure 14 Cumulatirve monthly total landings per nation. Upper panel all nations, lower panel only UK, France and Belgium

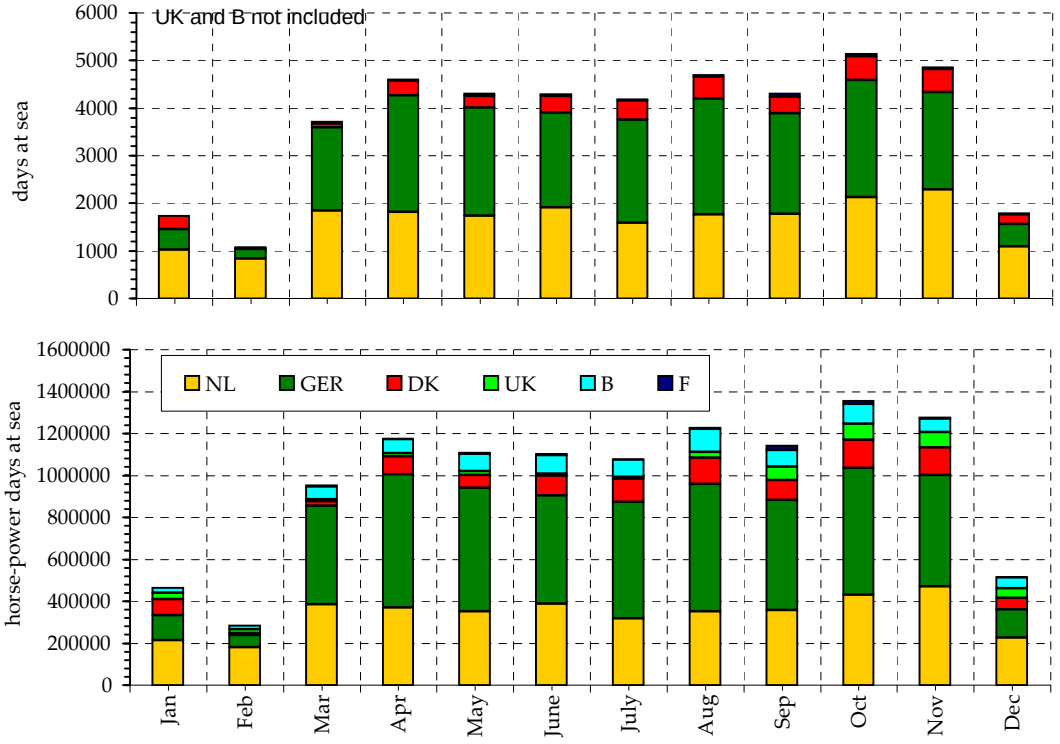

Figure 15 Cumulative monthly efforts per nation and month for 2012. Upper panel days at sea, lower panel horse power days at sea. For Germany, Denmark Belgium and France: days at sea =returning to harbour - leaving time in hours x 24 for Netherlands and UK calendar days at sea. Middle panel no UK and B data included.

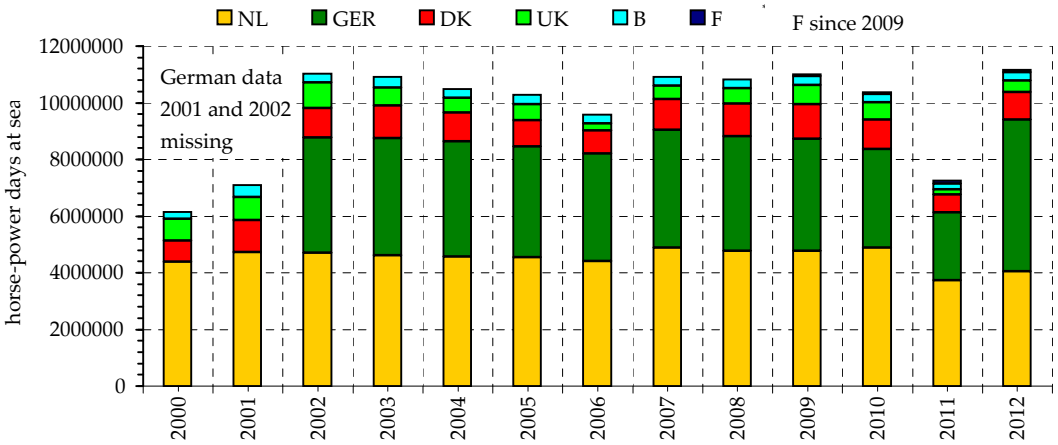

Figure 16 Cumulative efforts in horse-power days at sea per nation and year

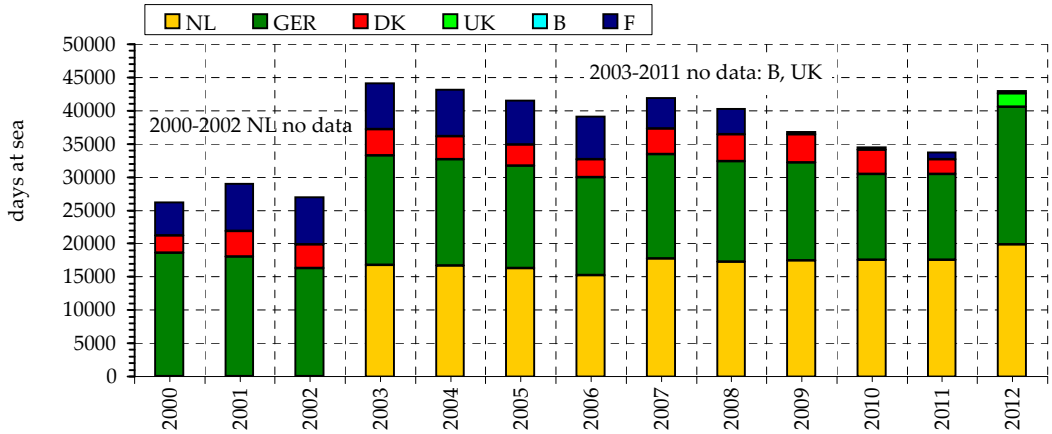

Figure 17 Cumulative efforts in days at sea per nation and year. For Germany, Denmark and France: days at sea = returning to harbour - leaving time in hours x 24 for Netherlands calendar days at sea. No data for Belgium and UK. For 2000-2002 not Dutch data.

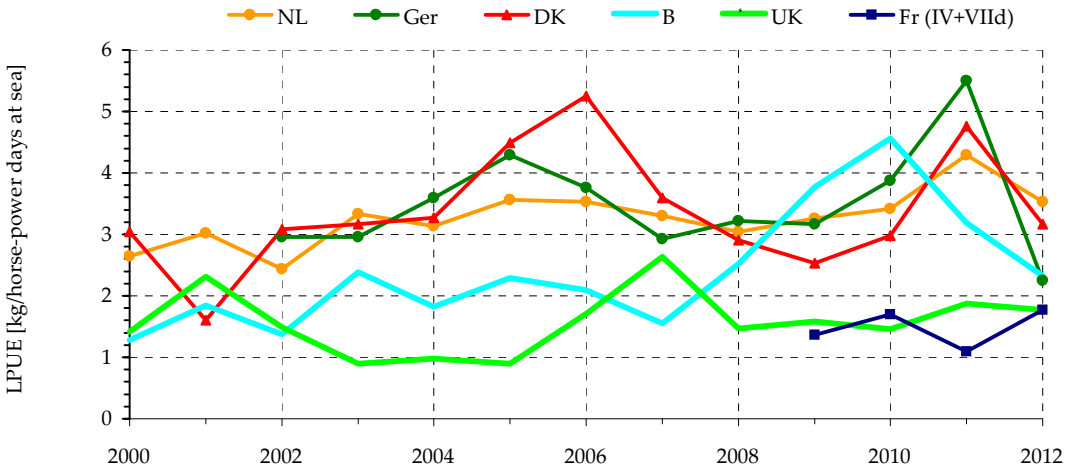

Figure 18 Annual landings per unit effort per nation in kg per horse power days at sea. For Germany, Denmark Belgium and France: days at sea = returning to harbour - leaving time in hours x 24 for Netherlands and UK days at sea = calendar days at sea.

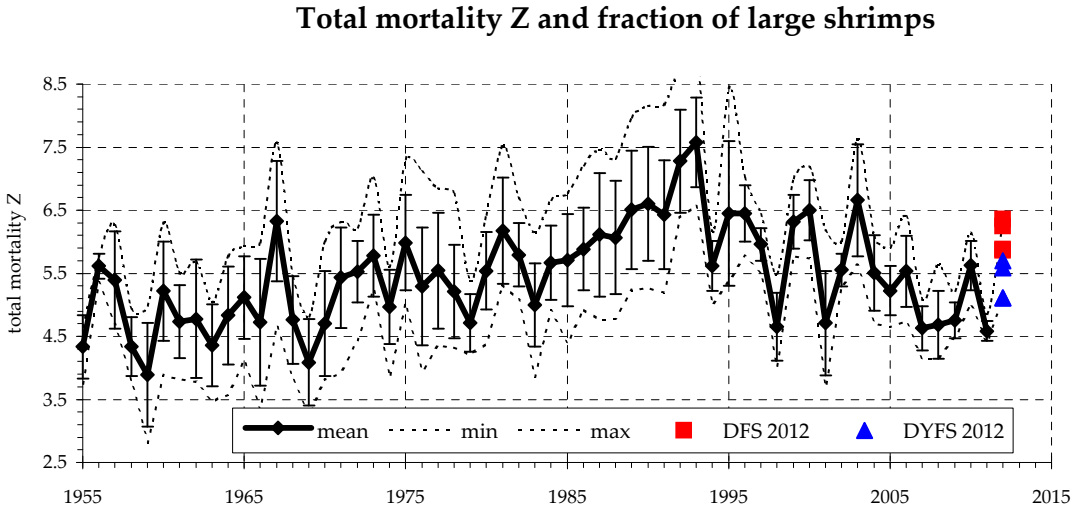

Figure 19 Total annual exponential mortality rate Z [a^{-1}] estimated using length-based methods. The time series indicated by the bold line was calculated using the mean of four different surveys (German Demersal Young Fish Survey: DYFS, Dutch Demersal Fish Survey DFS, German Bycatch Series from East Frisia and Büsum). Four different methods were used: Beverton & holt, Jones and van Zalinge, Ssentongo & Larkin and Length Converted Catch Curve. The methods and as well as the validation of the methods are presented in Hufnagl et al. (2010, 2012). Data for 2012 are indicated by red rectangles (DFS) and blue triangles (DYFS).The mean in 2012 for both surveys and all methods was Z =5.7 a-1.

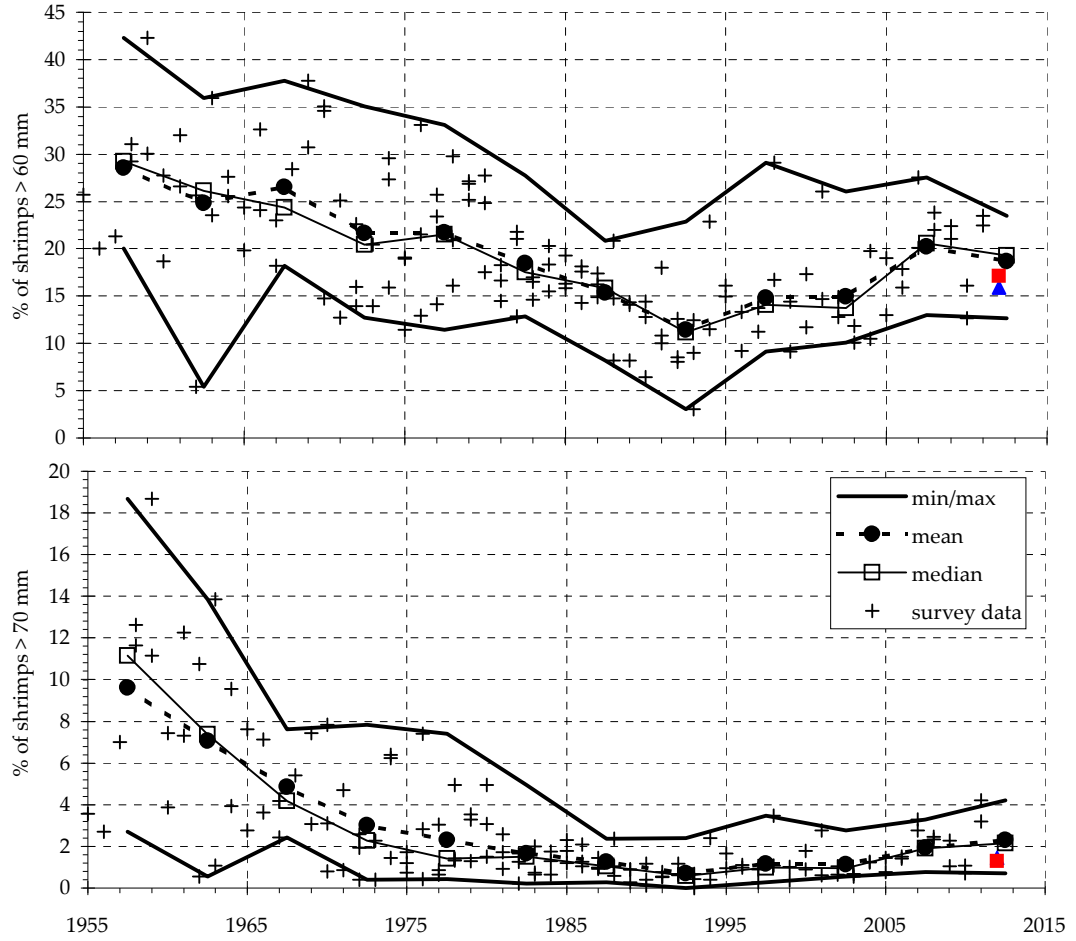

Figure 20 Fraction of shrimps >60 mm (upper panel) and >70 mm (lower panel) estimated using different surveys (German Demersal Young Fish Survey: DYFS, Dutch Demersal Fish Survey DFS, German Bycatch Series from East Frisia and Büsum, Hufnagl et al. 2010). Data for 2012 are indicated by red rectangles (DFS) and blue triangles (DYFS).