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

23–25 May 2016

Oostende, Belgium



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Executive summary

The Working Group on Crangon Fisheries and Life History (WGCAN) 2016 meeting was held at ILVO in Oostende, Belgium, May 2016. The meeting was chaired by Josien Steenbergen (Netherlands). There were 10 participants representing 3 countries.

The members of WGCAN see the priority of this expert group in understanding the interactions between: i) the brown shrimp population (structure and abundance) and human activities (mainly fishing effort); ii) the shrimps and the environment (temperature, currents); and iii) the role of brown shrimps in 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. During this year's meeting an insight was provided into the state of the art of research on Crangon and Crangon fisheries in Belgium. On invitation of the chair, a guest speaker provided an update on the current MSC process of the Dutch, German and Danish industry.

Available stock parameters indicated a slight decrease in fishing effort in comparison to the previous two years. However effort was still 12 million horse-power hours at sea in comparison to about 10 million before 2013. Landings went down to a level comparable to 2012, while effort is larger in 2015 compared to 2012. This indicates that CPUE went down compared to 2012. Total annual landings amounted to 31 375 t where the German fleet contributed 11 902 t, the Dutch 16 448 t, the Danish 2104 t, the Belgian 531 t, the UK 316 t and the French 75 t (area 4/ 7d), respectively. Total mortality of shrimps >50 mm was slightly higher in 2015 (5.8 a-1) compared to 2014 (5.3 a-1). The share of shrimps > 60 mm in autumn decreased from 16 (2014) to 13% (2015). Both factors are influenced by both natural variability and fishing pressure. Average annual biomass of shrimps > 50 mm based on a swept-area estimate, was 4176 t resulting in a total annual production of 83 000 t (using $P = B \cdot Z$ and $Z = 5.8 \text{ a}^{-1}$).

1 Administrative details

Working Group name
Working Group on Crangon Fisheries and Life History (WGCAN)
Year of Appointment within the current cycle
2016
Reporting year within the current cycle (1, 2 or 3)
1
Chair(s)
Josien Steenbergen, the Netherlands
Meeting venue
Oostende, Belgium
Meeting dates
23–25 May 2016

2 Terms of Reference a) – z)

- 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 the Netherlands with horse power days calculated based on hours at sea. Investigate methods to gain a better understanding of the recruitment processes and density dependence. (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) Develop brown shrimp specific management decision support tools to evaluate strategies on how to sustainable and efficiently harvest the brown shrimp stock. (Lead persons: Marc Hufnagl, Tobias van Kooten, Karen van de Wolfshaar)
- d) Analyse and enumerate the effects of new gears (e.g. pulsetrawl, combined pulse-trawl and standard gears, large or new mesh types, pump system, letterbox etc.) and their implications on the Crangon stock, the bycatch, the catch efficiency and the possible lpue based management strategies. (Lead persons: Bart Verschueren, Josien Steenbergen)

- e) Analyse and evaluate possible methods to assess and manage the brown shrimp fisheries in the ICES region. Gather, compile and evaluate information on the onboard and ashore sieving fractions and processes and new national bycatch/discards data from e.g. DCF. (Lead persons: Josien Steenbergen, Axel Temming)
- f) Analysing infection levels with bacilliform viruses and/or the occurrence of other diseases and determining the potential effects they might have on the population. (Lead persons: Benigna van Eynde)
- g) Determining the potential on using brown shrimp as a species for use in aquaculture system. Improvement on how to rear and grow shrimps in the lab and to obtain "in-situ", real field growth rates for comparison. (Benigna van Eynde, Marc Hufnagl, Axel Temming)
- h) Optimize and harmonize German and Dutch surveys to improve comparability, to analyse spatio-temporal trends of stock indicators (biomass, distribution, mortality, etc.) and to ground-truth VMS derived lpue estimates. (Lead persons: Holger Haslob, Ingrid Tulp)
- i) 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. (Lead persons: all members)

3 Summary of Work plan

Work plan of three year cycle according to WGCAN report 2015:

Year 1 (2016)

Stock status indicators (ToR a) shall be updated and harmonized between countries.

Data for Manuscripts related to ToR b-d and f-g shall be available.

New hauls to be included in the analysis under ToR h shall be available.

New information from ToR I shall be reported.

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

a) Stock status indicators

I. Indicators updated (see section 5)

II. *paper published*: Ingrid Tulp, Chen Chun, Holger Haslob, Katharina Schulte, Volker Siegel, Josien Steenbergen, Axel Temming & Marc Hufnagl (2016). Annual brown shrimp *Crangon crangon* biomass production in NW Europe contrasted to annual landings. ICES journal doi:10.1093/icesjms/fsw141.

b) VMS , landings and Effort data

- I. *Manuscript submitted*: Not Easy To Catch: New insights into factors affecting catch rates of partly pelagic brown shrimps (*Crangon crangon* L.). Schulte, K.F., Temming, A., Hufnagl, M., Dänhardt A., Siegel, V., Neudecker, T., Wosniok, W.
- II. *Manuscript for submission*: Interchangeability of different approaches for estimating effort and catch from VMS- and commercial data. Schulte, K.F., Wosniok, W., Temming, A.

c) Brown shrimp specific management decision support tools

- I. *Project report*: “management options of brown shrimp (*Crangon crangon*) fisheries in the North Sea” available on: <http://edepot.wur.nl/366175>
- II. *Update presentation*: Effect of mesh size regulation and the effect on population of shrimp, update from a model study within the German CRANNET project by Marc Hufnagl. Project report (in German) available on: http://literatur.thuenen.de/digbib_extern/dn056016.pdf

d) Effects of new gears

- I. *Update presentation & demo*: on state of play pulse gear innovation by Bart Verschueren.
- II. *Project report (in Dutch)*: on the development and use of shrimp pulse gear combined with traditional pulse gear (COMBI puls 2) on board of the TH10; a comparative study. <http://www.th10.nl/documents/verschuerenth10.pdf>
- III. *PhD thesis*: Electrofishing: exploring the safety range of electric pulses for marine species and its potential for further innovation. / Soetaert, Maarten. Gent, 2015. 287p.
- IV. *Paper published*: Desender, M., Chiers, K., Polet, H., Verschueren, B., Saunders, J., Ampe, B., Mortensen, A., Puvanendran, V. and Decostere, A. 2016. Short-term effect of pulsed direct current on various species of adult fish and its implication in pulse trawling for brown shrimp in the North Sea. Fisheries Research. 179: 90-97.
- V. *Manuscript submitted*: Desender *et al.* (In press). Pulse trawling: evaluating its impact on prey detection by small-spotted catshark (*Scyliorhinus canicula*). Journal of Experimental Biology and Ecology.
- VI. *Manuscript for submission*: Desender *et al.* (In prep). Impact of pulsed direct current on embryonated eggs, larvae and young juveniles of Atlantic cod (*Gadus morhua* L.) and its implication in electrotrawling for Brown shrimp.
- VII. *Manuscript for submission*: Desender *et al.* (In prep). Electrotrawling: The impact of pulsed direct current on early life stages of Sole (*Solea solea*). North American Journal of Fisheries Management.
- VIII. *Update presentation*: new developments in the Netherlands regarding processing the (by)catch on board by Bart Verschueren.

- IX. **Project reports (in Dutch)** on new developments on processing (by)catch: Theunynck, R. & Verschueren, B. (2015). Slimmer verwerken, bijvangst beperken. ILVO rapport. & Verschueren, B., Lenoir, H. & Theunynck, R. (2016). Ontwikkelen en stimuleren van duurzame methoden en technieken. ILVO mededeling nr. 207. D/2016/10.970/20.
- e) **Possible methods to assess and manage the brown shrimp fisheries**
- I. **Presentation & demo:** Smart shrimp length measurement software and Belgian long-term survey data by Lies Vansteenbrugge & Bart Vanelslander.
- f) **Infection levels with bacilliform viruses and/or the occurrence of other diseases**
- I. **Update presentation:** Cultivation of Grey shrimp (*Crangon crangon*) and the study of *Crangon crangon* bacilliform virus by Benigna Van Eynde
- II. **Manuscript for submission:** Prevalence study of the *Crangon crangon* bacilliform virus in the European brown shrimp *Crangon crangon* from the Belgian Coast. Van Eynde, B., Christiaens, O., Delbare, D., Cooreman, K., Bateman, K., Stentiford, G., Dulleman, A., van Oers, M., Smagghe, G.
- g) **Potential on using brown shrimp as a species for use in aquaculture system**
- I. **Update presentation:** Cultivation of Grey shrimp (*Crangon crangon*) and the study of *Crangon crangon* bacilliform virus by Benigna Van Eynde
- II. **Update presentation:** of bachelor thesis under supervision of Marc Hufnagl: "Different Proxies to identify brown shrimp conditions".
- h) **Optimize and harmonize German and Dutch surveys**
- I. **No new update:** in 2015 there were no overlapping hauls between the surveys. Holger Haslob is however still planning to analyse the overlapping hauls in former surveys. To be discussed next year.
- i) **Exchange of information**
- I. **Update presentation:** of the MSC process by invited guest Phillip Oberdorfer.

5 Progress report on ToRs and workplan

a) Stock status indicators

Updated stock status indicator figures are available in Annex 3.

Landing statistics

In each county the landings of North Sea shrimp in 2015 have dropped (Figures 1–6). The Dutch and German Fisheries are together responsible for 89% of all landings, with respectively 52% (Netherlands) and 37% (Germany). The share of the German landings have increased in 2015 from 33–37% (Figure 1). Total North Sea shrimp landings were 31 375 tonnes in 2015, lowest since 2003 when landings were below 30 000 tonnes. After 2003 landings have been constantly higher than 30 000 tonnes, with a peak in 2005 with 38 613 tonnes (Figure 7). A strong seasonal pattern in the landings, with a peak in au-

tumn (as described the WGCAN report 2015), was observed in 2015 for the German, Dutch, UK and Belgian fisheries (Figure 8).

Effort has now been largely standardized for all fleets. Besides for the Dutch fleet all figures, effort and lpue values are based on hours at sea divided by 24 (for details see WGCAN report 2015). Efforts in days at sea (Figure 10; only available for German, Dutch and UK fisheries) and horse power days at sea (hp-das, Figure 11) for German and Dutch fisheries were in 2015 comparable to 2014 in the first 4 months, but lower from May onwards. For both countries effort in October was higher than the year before. In general the effort was higher than the long term mean for Germany and the Netherlands. In Denmark the effort was higher than the other years in the winter period (December, January, and February) and lower in other months. In France and Belgium the effort was lower than the long term mean.

Landing per Unit of Effort (LPUE) in t/days at sea (Figure 12 for Germany, Netherlands and UK only) and in kg /hp days at sea (Figure 13) was in the first half of 2015 generally higher for German, Dutch and Danish fisheries than in the year before. However the LPUE's in the second half of 2015 were generally lower than the LPUE's in that same period in 2014. The overall lpue was 2.55 kg/hp hour, which is lower than the long term average (the long term average from 2002–2015 was 3.20 kg/hp hour).

Fraction of large shrimps

The fraction of shrimps > 60 caught in the DYF and DFS surveys conducted during autumn decreased over time. Although between 2003 and 2008 the share of >60 mm shrimps increased from 15 to 20% it decreased thereafter to less than 15% in 2015 (Figure 19).

The fraction of shrimps > 70 mm caught in the DYF and DF surveys conducted during autumn decreased since the beginning of the survey to now less than 2% (Figure 19).

Mortality

The mean annual mortality increased in 2015 from 5.3 to 5.8 (Figure 20; methods see Hufnagl *et al.* 2010).

Biomass production

The following paper has been published:

Ingrid Tulp, Chun Chen, Holger Haslob, Katharina Schulte, Volker Siegel, Josien Steenbergen, Axel Temming, and Marc Hufnagl, 2016. Annual brown shrimp (*Crangon crangon*) biomass production in Northwestern Europe contrasted to annual landings. ICES J. Mar. Sci. 2016: fsw141v1-fsw141.

The autumn swept-area biomass estimate based on the Demersal Fish and the Demersal Young Fish Survey (methods see WGCAN report 2012) has been updated. Average annual biomass of shrimps > 50 mm and based on a swept-area estimate, was 4176 t resulting in a total annual production of 83 000 t.

Cooperation with other EGs

Cooperation with WGBEAM on improving survey designs to match with the requirements of the brown shrimp swept area biomass estimate and to derive correction factors for the use of different gears.

Cooperation with Advisory structures

Crangon Advice, WKCCM, ADCRAN

Science Highlights

Although total effort was again higher than the long term average, the overall LPUE was lower than the long term average which indicates a high fishing pressure. Low LPUE's in autumn in most of the areas indicate weak year class of the 2015 cohort. At the same time effort did increase to a long term maximum in October in Germany as well as in the Netherlands, increasing the risk of growth overfishing.

b) VMS , landings and Effort data

New manuscripts are submitted and are currently under review (see section 4).

Changes/ Edits/ Additions to ToR

The ToR was not further discussed in 2015 due to absence of key members for VMS-work. VMS will be on the agenda again next year.

Cooperation with other EGs

No cooperation

Cooperation with Advisory structures

No cooperation.

Science Highlights

VMS data in combination with landings can be standardized and then used for analysing population dynamics and populations shifts.

The variability of the results can be evaluated by comparing different VMS data interpolation methods.

c) Brown shrimp specific management decision support tools

A mechanistic model of the dynamics of Brown shrimp and its fishery was built in 2015 at IMARES; Summary Steenbergen *et al.*, (2015):

“The model describes the shrimp population and fleet dynamics in the eastern coastal zone of the North Sea from the south of the Netherlands up to the Danish west coast. The model was run for all fleet sizes between 200 and 800 vessels, and landings, discards, effort and landings per unit effort were evaluated.

As the second part of the project, a model of the dynamics of brown shrimp and its fishery was constructed and analysed. The aim was to provide a scientifically sound ecological knowledge base for the exploration of management options for the North Sea brown shrimp fishery. A mechanistic approach was used for the model; the model for brown shrimp is a dynamic energy budget (DEB) model. The population dynamics are modelled using the physiologically structured population dynamics framework, and the fleet dynamics model uses an agent-based modelling approach. The mechanistic approach resulted in a model that is based on the processes which lead to observed patterns, rather than on the patterns themselves. The parameterization of the model has been derived independently, without any complex fitting or calibration to the system we aim to describe.

The model describes the shrimp population and fleet dynamics in the eastern coastal zone of the North Sea from the south of the Netherlands up to the Danish west coast. The zone is divided into nine areas, based on the spatial distribution of the shrimp fleet, estimated on the basis of VMS data. In the model, individual vessels follow a harvesting strategy based on catch results and movement costs. A combination of data analysis (VMS, Vessel Monitoring System) and consultation of representatives of the Dutch brown shrimp fishery was conducted to get a better understanding of the behaviour of fishermen.

Based on this consultation, the fleet has been divided into 'local' vessels, consisting of fishermen which are predominantly active in a single area and more mobile vessels that may fish in all the areas. Each vessel is assumed to start fishing on Monday, but has an opportunity to stop fishing for the remainder of the week if the catches fall below a threshold Landings per Unit of Effort (LPUE) value. Furthermore, of the entire local and mobile fleet, half of the vessels do not fish for shrimp between December and February.

The strongly mechanistic basis of the model and the independently established parameterization, coupled with good correspondence of the dynamics exhibited by the model to that observed, make that the model can be reliably used to estimate the effects of various management scenarios."

Effect of mesh size regulation and the effect on population of shrimp, update from a model study within the German CRANNET project by Marc Hufnagl. Selectivity characteristics of cod-ends with mesh openings from 18 to 34 mm were included into a complex yield-per-recruit life-cycle model for brown shrimp (Temming & Hufnagl 2014) and the results indicate that any increase in mesh opening from the currently used mean of the fleet (20 mm) will lead to a larger yield, population biomass and egg production after a short-term decrease (e.g. 3 month for 26 mm).

Changes/ Edits/ Additions to ToR

None.

Cooperation with other EGs

No cooperation.

Cooperation with Advisory structures

Crangon Advice, WKCCM, ADCRAN

Science Highlights

Brown shrimp specific management decision support tools can be used to evaluate strategies on how to sustainably and efficiently harvest the brown shrimp stock.

d) Effects of new gears

Comparative fishing with a conventional beam trawl and a pulse trawl:

A series of comparative experiments was conducted on the Dutch eurocutter TH 10. During 3 commercial trips on the Southern Dutch North Sea coast, a normal shrimp beam trawl, fitted with conventional ground gear with 37 bobbins, was directly compared with a lightweight pulse trawl. The pulse trawl was a combination of a classic beam with trawl shoes and a new 'square' net design. In order to stimulate the shrimp to leave the sediment, an electrical pulse field (12 electrodes) was combined with a reduced, straight bobbin rope (12 bobbins alternated with 10 rubber discs). The catch comparisons showed that during the three sampled voyages in September and October each time more consumption shrimp were caught in the pulse gear. Over the 3 voyages together a catch increase of 30.8% in the average marketable shrimp volume was observed. For a good interpretation of this difference: A hypothetical difference of 100% would mean that the pulse gear doubles the catches of the traditional gear.

Also the amount of by-catch of undersized shrimp was much higher with the pulse gear relative to the traditional gear. For each litre of consumption shrimp on average 0.85 litre of small, undersized shrimp was caught with the pulse gear, compared to 0.68 litre with traditional gear. Earlier research has shown that the survival of discarded shrimp is high and ranges from 75 to 85%.

The difference in the quantity of fish and invertebrates by-catch (excluding shrimp) between the pulse and traditional gear was in general less distinct. Per litre of marketable shrimp on average 1.73 litre of by-catch (fish and invertebrates) was caught with the pulse gear and 2.03 litre with the traditional gear. Some commercial fish species that are omnipresent in shrimp catches, might shortly fall under the EU discard ban. In this regard, the significant reduction in the by-catch of plaice (-25.9%), dab (-30.6%) and flounder (-71.4%) with the tested pulse gear on TH 10 is encouraging. These differences were especially observed in the smallest length classes. This illustrates once again that the pulse technique is ideal in compensating the limitations of the sieve net.

The results in this study are very strongly linked with the gear design of the pulse trawl present on the TH 10. The results of these field trials cannot simply be generalized to other pulse gears available on other vessels. This highlights the importance of gear design in achieving the objectives: by-catch reduction and minimal seafloor contact.

New developments in catch handling and processing:

A new catch processing system was tested and evaluated on the shrimp cutter GRE 5. The idea was to shorten the sorting process on board, by constantly pumping the catch from the codend on deck. This is in contrast with the conventional catch sorting and processing, which is based on peak processing of bulk catches, brought on deck every 1.5 hours. As a consequence unwanted by-catch is only shortly exposed to the trawl and the processing equipment. The premise is that the short turnaround time contributes to a

better discard survival. Based on this preliminary study it cannot be confirmed whether this is the case.

The field tests showed that the fish pump might work for the shrimp fishery in the Wadden Sea. However, reliability during testing was not always guaranteed as technical failures, occasional damage or blockage of the suction hose, hampered the tests. It is very likely that these children's diseases can be solved in the future. Currently it is unclear how efficient and reliable the pump will be in deeper water and during bad weather conditions.

Apart from the pump, also a completely new catch sorting mechanism was tested. Herein a camera detection system replaces the conventional rotating sieve. The results were rather poor. First of all, the system had difficulty in making a clear distinction between shrimp and other animals. On top of that, correct sorting of shrimp in different size classes turned out very difficult. Currently it is hard to predict whether system modifications and further developments will lead to better results in future testing.

Changes/ Edits/ Additions to ToR

None.

Cooperation with other EGs

No cooperation.

Cooperation with Advisory structures

No cooperation

Science Highlights

Analyze and enumerate the effects of new gears (e.g. pulsetrawl, combined pulsetrawl and standard gears, large or new mesh types, pump system, letterbox etc.) and their implications on the Crangon stock, the bycatch, the catch efficiency and the possible IPUE based management strategies.

e) Possible methods to assess and manage the brown shrimp fisheries

In the Netherlands and Germany information on discards is collected within the yearly DCF programme. Results will be published in a report that is due to be finished by the end of 2016. No new information on the onboard sieving fractions and processes was available as of now.

Currently a cooperation project involving the University of Hamburg, MSC GbR, the Coöperatieve Visserij Organisatie and the Danske Fiskeres PO has been started to scientifically guide the MSC process and to identify methods for an easy and effective self-monitoring of the fleet. The main aim is to monitor the effectiveness of the mesh size increase and to identify potential changes in stock indicators.

Changes/ Edits/ Additions to ToR

None.

Cooperation with other EGs

No cooperation.

Cooperation with Advisory structures

No cooperation.

Science Highlights

Possible methods to assess and manage the brown shrimp fisheries in the ICES region are analysed and assessed. Information on the onboard and ashore sieving fractions and processes and new national bycatch/discards data from e.g. DCF is gathered and compiled.

f) Infection levels with bacilliform viruses and/or the occurrence of other diseases

Benigna Van Eynde presented the progress of her PhD. One part of her PhD project focusses on the presence of a *Crangon crangon* bacilliform virus. This virus was discovered by Stentiford *et al.* in 2004 and from preliminary data it seemed that this virus occurs with a prevalence of nearly 70–90 % along the British Coast.

Therefore a detection method based on PCR was designed to screen for this virus in wild *Crangon crangon* caught along the Belgian Coast and other places in Europe, like the Baltic Sea, the Mediterranean Sea, the Black Sea, etc. During the Belgian DYFS survey in 2015 wild shrimp were caught along the Belgian Coast and with the new detection method a prevalence between 80 and 95 % was found. Interesting to notice is that although this virus is very prevalent, it does not seem to affect the wild stocks. Therefore more research is needed to evaluate the effect of the virus on wild and reared *Crangon crangon*.

In this part of the project also the pathogenesis of the virus and the transmission will be studied. As well as the potential to use RNA interference as a vaccine against the virus. This is still under investigation.

Changes/ Edits/ Additions to ToR

None.

Cooperation with other WG

No cooperation.

Cooperation with Advisory structures

No cooperation.

Science Highlights

Analyzing infection levels with bacilliform viruses and/or the occurrence of other diseases and determining the potential effects they might have on the population.

g) Potential on using brown shrimp as a species for use in aquaculture system

The cultivation of *Crangon crangon* could form a promising alternative for the Belgian shrimp fishery, but from first experiments it seems that the cultivation of this species is still very difficult and optimization is needed. One of the biggest problems here is cannibalism and the lack of an artificial diet.

Therefore this project focusses on both the development of an artificial diet and the optimization of the rearing conditions (temperature, density, salinity, etc.). Both parts will contribute to the closing of the lifecycle of the grey shrimp in captivity.

For the design of the diet, the focus is on the attractiveness, the texture and the nutritional composition. The shrimp can be attracted with several amino acids to the feed, but if the texture is not right, they do not eat it. This is still a big problem with the artificial feed and long term experiments failed because of low food intake. Therefore new feed will be developed with other textures and nutritional compositions in order to ensure good palatability.

In this part also the rearing of eggs and larvae will be studied. Here different feeds, housing systems and environmental conditions will be tested. This part is still under investigation.

Bachelor thesis under supervision of Marc Hufnagl: "Different Proxies to identify brown shrimp conditions".

Changes/ Edits/ Additions to ToR

No changes.

Cooperation with other EGs

No cooperation.

Cooperation with Advisory structures

No cooperation.

Science Highlights

Determining the potential on using brown shrimp as a species for use in aquaculture system. Improvement on how to rear and grow shrimps in the lab and to obtain "insitu", real field growth rates for comparison.

h) Optimize and harmonize German and Dutch surveys

We were informed by the chair of WGBEAM that the Netherlands and Germany couldn't carry out any overlapping hauls in 2015. This was mainly because of time constraints for the German survey in 2015. However we aim to analyse the overlapping hauls of the past. There are some data on overlapping hauls from a study 2006 (U. Damm). These data are available at the TI and were already analysed by Katharina Schulte. In addition we have some more parallel hauls from RV Isis and RV Clupea from 2014. These additional hauls can be involved in the analyses.

It could be possible to do more parallel hauls with RV Isis and Clupea in the future but it is difficult because it can only be done when there is enough time to meet besides the regular survey grid of both surveys.

Changes/ Edits/ Additions to ToR

None.

Cooperation with other EGs

WGBEAM

Cooperation with Advisory structures

No cooperation

Science Highlights

Optimize and harmonize German and Dutch surveys to improve comparability, to analyze spatio-temporal trends of stock indicators (biomass, distribution, mortality, etc.) and to ground-truth VMS derived l_{pue} estimates.

i) Exchange of information

Update MSC

Invited guest Phillip Oberdorfer provided an update about the MSC process. Dutch, German and Danish fisheries entered a full assessment in January 2016. As part of the MSC process a management plan is developed and in place since 1 January 2016.

The management plan can be found with the following link: <http://www.nsrac.org/wp-content/uploads/2015/11/Paper-5.1a-Brown-Shrimp-Mgmt-Plan1.pdf>.

Some of the key elements in the Management plan were (partly) initiated and advised by WGCAN. These elements will also be of interest for the WGCAN in the future. WGCAN foresees an important role for itself in providing the scientific advice to enable and evaluate of whether the management plan is delivering on its objectives, including (but not necessarily limited to):

- Reaching the target of high long-term sustainable yields,
- Avoiding recruitment overfishing,
- Minimizing unwanted by-catch.

Elements of the management plan directly feeding into the objectives above are:

C3. Sorting of the catch: rules on sorting of the catch are intended to minimize the amount and maximize the survival of unwanted bycatch in the fishery (undersized shrimps as well as other marine organisms), they include: use of a sievenet (max 70 mm) or grid (max 20 mm between the bars), barspacing of the sorting machine on board is adjusted to the size of marketable shrimp and have a constant waterflow, rules for sieving on land and maximum sievage amounts. Relevant Tor: **ToR d.**

C4. High long-term sustainable yield: involving a stepwise increase in mesh size starting from May 2016 with 22 mm in steps of 2 mm to a maximum of 26 mm in 2020. Model results have indicated that indicate that one way to achieve high long-term sustainable yields would be to increase the standard mesh-size to 26 mm. In between steps the model will be validated with field data, and based on the outcome advice will be provided regarding the implementation of the rule. Relevant ToR: **ToR c and e.**

C5. Avoiding recruitment overfishing: Harvest Control Rule based on LPUE and effort reductions as was advised by this Working Group to be the best management practice at this moment. Relevant ToR: **ToR c.**

ILVO science update

ILVO developed an electronic method as an alternative for the time consuming manual measuring of shrimp lengths: "SmartShrimp". Length measurements of shrimp are a time-consuming manual task and therefore error prone. Moreover, personal habits of the measurer could bias the data. Additionally, at ILVO (Belgium) the original data flow consisted of 1) writing the measurements on paper, 2) enter the data into excel and 3) incorporate the excel into an Access database. To ensure a higher efficiency and data quality, there was a need for a more automatised system to avoid errors.

ILVO developed (in-house) the SmartShrimp application. This application is run on a computer, which is connected to a camera. The camera is mounted above a glass plate and headlight where the shrimps are positioned on in an organised manner. Using a specific algorithm, the contour of the shrimp is recognised and the shortest line from antenna basis to telson is identified and used to generate measurement data. For each picture taken, measurements from all shrimp on the glass plate are directly registered into the database, which benefits the efficiency. Additionally, the quality of the measurements improves as the accuracy is better. This SmartShrimp application has also been used to measure *Macoma baltica* shells.

ILVO presented the long term dataset of their DYFS survey which is ongoing since 1973 and covers 32 fixed sampling stations along the Belgian coast. In addition, stomach data were collected in the years 1970 and 1998-2001.

Changes/ Edits/ Additions to ToR

Stomach data of the Belgian DYFS survey will be made available, and provide new insights in Crangon (natural) mortality under ToR a.

Belgian data of DYFS will be added to the Swept area estimate under ToR a.

Cooperation with other EGs

N/A

Cooperation with Advisory structures

N/A

Science Highlights

Self-management of the Crangon fisheries under the current MSC is based on the HCR that was discussed in WKCCM and WGCAN 2010. MSC process and management plan involves research needs in terms of evaluation of measures and need for information on the status of the stock.

6 Revisions to the work plan and justification

Work on all ToRs have progressed following the work plan, some ToRs were more thoroughly discussed during this year's meeting than others. Additionally Belgium aims to participate more active in the future. The Belgian DYFS data will be added in the swept area estimate under ToR a) and Stomach data of the Belgian DYFS survey will be made available, and provide new insights in Crangon (natural) mortality under ToR a).

7 Next meetings

Next meeting will be held in Hamburg, Germany (Thunen Institut), 22–24 May 2017.

Annex 1: List of participants

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Annex 2: Recommendations

None.