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Executive summary

The ICES Working Group on Zooplankton Ecology (WGZE) met at Cefas, Lowestoft, UK from 11 to 14 March 2013. The meeting was hosted by Sophie Pitois of Cefas and chaired by Piotr Margonski. It was attended by 24 scientists representing 9 nations. The objective of the meeting was to discuss and address the 9 terms of reference (ToRs) and to exchange information on recent activities in zooplankton ecology.

The WGZE flagship product is currently the Zooplankton Status Report (ZSR) which currently covers 62 time-series and 40 Continuous Plankton Recorder standard areas. Based on the data collected, more integrated analyses are planned considering climate, hydrology and plankton over the whole North Atlantic area to examine trends and community changes with consequences for foodweb dynamics. Initial zooplankton-focused “spatio-temporal maps” showing the spatial location and temporal trends (ToR b) of multiple time-series were presented and discussed during the meeting. Further development of the ZSR was discussed as well as the value of preparing a peer review publication(s) based on collected data, which would increase awareness of both the report and the WGZE time-series effort. Several other tasks were tightly linked to the ZSR data series in terms of expanding potential uses for the data. Allometric relationships are commonly used to quickly convert routinely collected monitoring data into estimates of zooplankton standing stock that are requested for the assessment and management of the marine ecosystem (ToR d). This ToR will continue next year to estimate zooplankton productivity and metabolic rates within the whole ICES area based on an allometric approach and data collected in the ZSR. Also a compilation of taxonomic categories including species and stages which are currently monitored (ToR e) was developed as a result of the continued expansion of the ZSR and in order to begin to integrate the results of the monitoring of zooplankton in the ICES area. The group decided that this ToR will continue next year with the ultimate aim of delivering the information on the WGZE website. Production of videos on zooplankton sampling/processing techniques as part of progress in updating the Zooplankton Methodology Manual (ToR a) continued. Meta-data describing sites within the ICES areas which monitor gelatinous zooplankton were gathered under ToR c) and will be presented on the WGZE website. ToR f) to update the information on plankton sorting centres and existing taxonomic expertise, to be posted on the WGZE website was completed. It was decided that only those centres or institutions which are providing sorting for the external clients will be presented in the table submitted to the WGZE website. Progress of the SGIMT was reviewed under ToR g). This study group is addressing issues of taxonomy that are directly relevant to zooplankton ecology as well as the broader ICES community.

Finally, the group reviewed the ICES response to the Norwegian request regarding the *Calanus finmarchicus* exploratory assessment (ToR h). WGZE decided to continue to support their previous call for a *Calanus* Workshop, which they would be willing to organise, but which requires external funding to fulfil its task. WGZE decided to continue with this ToR in 2014 to, for example, review reports on ongoing Norwegian and/or Icelandic *Calanus* fishing activities. In response to the Herring Assessment Working Group for the Area South of 62°N (HAWG) request on how WGZE may contribute to annual “briefing sheets” (ToR i), the group decided that more information is needed to be able to respond properly to this request. HAWG members were invited to the WKSERIES workshop to discuss possible framework of cooperation.

The next meeting of the WGZE will be held in Reykjavik, Iceland, 24-27 March 2014. Hildur Pe-tursdottir and Astthor Gislason (MRI) will be the local hosts.

1 Opening of the meeting

The ICES Working Group on Zooplankton Ecology (WGZE) met at Cefas, Lowestoft, UK from 11 to 14 March 2013. The local host was Dr. Sophie Pitois of Cefas. The meeting was attended by 24 scientists representing 9 nations (for details see the List of Participants, Annex 1).

The meeting started on Monday at 14:00. Piotr Margonski (WGZE Chair) opened the meeting and welcomed the members and guests of the group to Lowestoft.

Following a round of introductions, the participants were welcomed by Sophie Pitois who summarized logistics of the meeting.

2 Adoption of the agenda

The agenda for the WGZE 2013 meeting (see Annex 2) followed the Terms of Reference adopted as a resolution by the ICES SCICOM (2012/2/SSGEF06).

The agenda had been circulated among the working group members prior to the meeting and incorporated most of the suggestions and comments. Last minute adjustments were discussed and the agenda was adopted by unanimous vote. The Terms of Reference for this meeting were to:

- a) Complete production of videos on zooplankton sampling/processing techniques as part of progress in updating the Zooplankton Methodology Manual;
- b) Review the regional patterns observed in the changes that have taken place in the existing zooplankton time-series collected in the Zooplankton Status Report;
- c) Prepare metadata on available gelatinous plankton datasets including information on ongoing monitoring projects as well as on a spectrum of collected data (time, location, and species) ;
- d) Assemble a global compilation of existing allometric relationships relating zoo-plankton morphology to volume, mass, carbon, and nitrogen;
- e) Compile a list of taxonomic categories including species and stages which are currently monitored;
- f) Update the information on plankton sorting centres and existing taxonomic expertise, to be posted on the WGZE website;
- g) Review the progress of the SGIMT;
- h) Review the ICES response to the Norwegian request regarding the *Calanus finmarchicus* exploratory assessment.
- i) Discuss how WGZE may contribute to annual “briefing sheets” detailing the current state of the physical and biological environment in the ecoregions for which ICES generates advice.

3 Presentation “A consumer’s guide to the products of operational oceanography” by Rodney Forster, WGOOFE

Piotr Margonski suggested that the meeting start with Rodney Forster’s presentation about the activities of the Working Group on Operational Oceanographic products for Fisheries and Environment (WGOOFE), which might be extremely helpful when discussing the ToR i) of the WGZE agenda.

Rodney Forster described how WGOOFE was formed from a group of data users and data providers, and the initial progress made in defining user needs. This was done through face-to-face interviews of over 100 marine scientists. The results of the survey were presented (details in Berx, B., Dickey-Collas, M., Skogen, M. D., De Roeck, Y. H., Klein, H., Barciela, R., Forster, R. M., et al. (2011). Does operational oceanography address the needs of fisheries and applied environmental scientists? *Oceanography*, 24(1), 166–171). The next step for WGOOFE was to create a website in order to help guide users to the data that they need. This can be found at <http://groupsites.ices.dk/sites/wgoofe/Pages/default.aspx>. The WGOOFE system for ranking data portals based on the quality and accessibility of their contents was described. Finally, WGOOFE encourages feedback and requests from other ICES groups. An example was given in which WGOOFE is now working closely with the herring assessment group (HAWG).

4 ToRs a)-i)

4.1 ToR a) Complete production of videos on zooplankton sampling/processing techniques as part of progress in updating the Zooplankton Methodology Manual

Lead: Piotr Margonski

The original idea was to complete this task in 2013, but it was not possible as the ToR initiator, Mark Benfield, was not able to participate. Therefore, the group decided to postpone task completion until the next meeting.

Piotr Margonski presented a video on details of WP-2 net sampling made onboard of RV *Baltica* in the Bornholm Basin in August 2012. The idea is to provide subtitle comments/instructions (possibly in different languages) and based on that to create “how to do it” video. Rodney Forster and Peter Wiebe commented that when sampling intensively, the bar coding system for collected samples is very useful.

Janna Peters informed that University of Hamburg is planning to prepare a series of videos for students as a part of e-learning programme and that the first videos will be made during the April cruise in the Baltic Sea. However, it is unlikely that permission would be given to use these as a supplementary part of the Zooplankton Methodology Manual.

The Institute of Marine Research will make training videos regarding zooplankton sampling with different net types and onboard sample processing techniques. Padmini Dalpadado will keep WGZE informed about this activity.

Recording of plankton sampling by using the Niskin bottles is planned during the Ifremer cruise in June this year. Elvire Antajan promised to check if it is possible to use this video for WGZE purposes.

Lutz Postel summarized this session by saying that the production of the standard procedure video is very important tool for staff and student training.

4.2 ToR b) Review the regional patterns observed in the changes that have taken place in the existing zooplankton time-series collected in the Zooplankton Status Report

Lead: Todd O'Brien, Rapporteurs: Roger Harris and Padmini Dalpadado

This year's Zooplankton Status Report will be the ninth edition in the long-running report series first started by Luis Valdes. The first edition featured only 17 time-series and presented data from just one or two variables (“total zooplankton” and chlorophyll). This latest report is now based on data from 62 time-series (Figure 5.1, white stars) and 40 Continuous Plankton Recorder standard areas (Figure 5.1, red boxes) and features a broad variety of ancillary variables ranging from hydrographic data (temperature, salinity, nutrients, pigments) to meteorological data (e.g. windspeeds and precipitation) and examines the zooplankton community via taxonomic groups (e.g. “copepods”, “barnacle larvae”) and species (e.g. *Calanus finmarchicus*, *Temora longicornis*). The report is currently being assembled and it will be submitted to the ICES publication and editorial team by May 1st. It is hoped to be printed in time for release at the ICES Annual Science Conference in September.

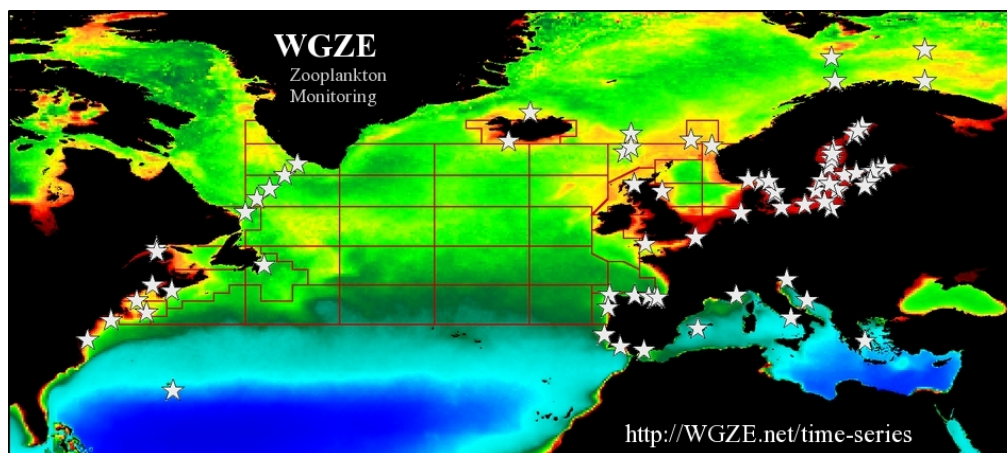


Figure 5.1. Map of zooplankton monitoring sites (white stars) and Continuous Plankton Recorder standard areas (red boxes) plotted on a background of average surface chlorophyll values. An interactive web version of this map is available online at <http://WGZE.net/time-series>

The spatial coverage of this WGZE time-series collection now allows us to look for regional and transatlantic temporal patterns within the zooplankton (i.e. this ToR). The concept of a “spatio-temporal map” figure showing the spatial location and temporal trends of multiple time-series using color-coded symbols (e.g. see Figure 5.2) was first presented at the joint WGZE/WGPME meeting last year in Málaga, Spain. This figure style was developed further and included in the “Spatio-Temporal Atlas of the North Atlantic” chapter of the ICES Phytoplankton and Microbial Plankton Status Report 2009/2010 (O’Brien et al. 2012, ICES CRR-313). A zooplankton-focused spatio-temporal atlas is now being developed for release in a future ICES Zooplankton Status Report (see Figure 5.2 for some prototype examples). Maps similar to Figure 5.2 were shown during the working group discussion to gather initial thoughts and reactions. Erica Head raised the issue of how high latitude SST is measured/presented when there is ice cover. Todd responded that he would look into this. Peter Wiebe pointed out the strong positive and negative trends in the 30 year analysis (not shown here) at adjacent stations in the Baltic and queried whether the Baltic is showing coherent trends. Eric Head noted that across the entire Atlantic the Phytoplankton Colour Index (PCI) is increasing in the 30+ year analyses (not shown here). The suggestion is that with warmer water, chlorophyll increases and that there may be a shift to smaller species. Angus Atkinson advised on the need to also consider appendicularia, which can feed on small particles. Peter Wiebe commented that winds in the upper 90% of speed have increased over the past 20 years. Angus Atkinson cautioned on being careful when considering CPR zooplankton data in the open ocean due to diel vertical migration.

Figure 5.2. The WGZE/WGPME Spatio-temporal Map: Each symbol in the map below represents the location and interannual trend of the specified time-series variable. Light blue symbols indicate a negative (decreasing value) trend, while pink symbols indicate a positive (increasing value) trend. The symbols’ shapes indicate either a WGZE/WGPME monitoring site (circles) or a CPR standard area (stars), as in Figure 5.1 above. A solid (filled) symbol indicates a statistically significant trend ($\alpha < 0.05$). In general, significance increases with time-series length (e.g. 30 year vs. 10 year), with the exception of very strong trends in the shorter year spans.

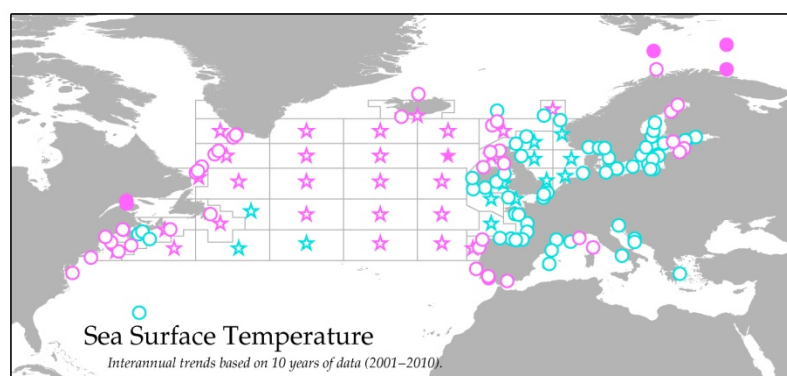


Figure 5.2.1. Spatio-temporal map of 10 year trends within the Sea Surface Temperature time-series.

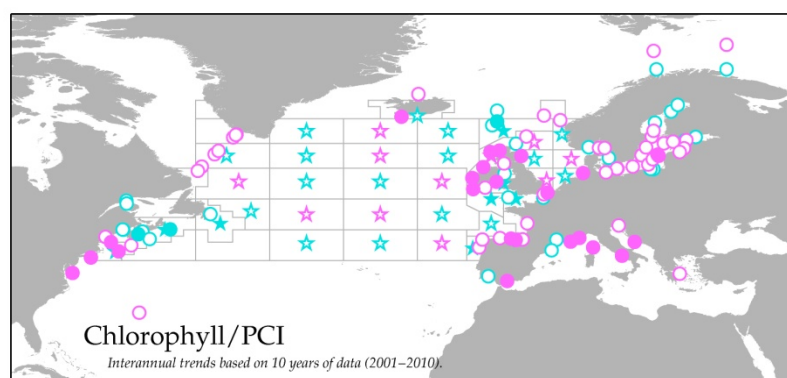


Figure 5.2.2. Spatio-temporal map of 10 year trends within the chlorophyll time-series. Phytoplankton Colour Index (PCI) values were used as a proxy for chlorophyll in the Continuous Plankton Recorder standard areas (star symbols).

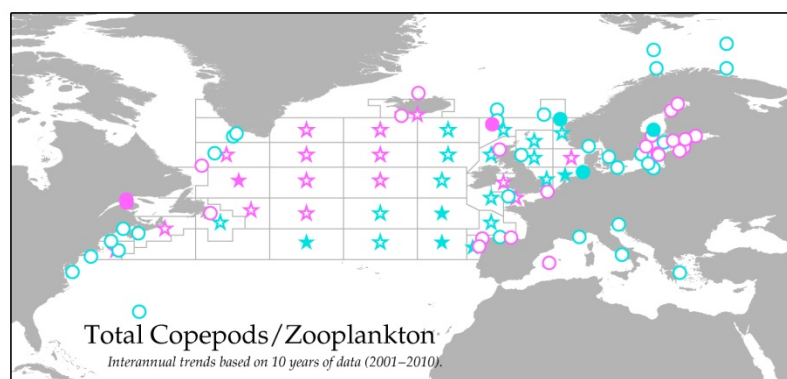


Figure 5.2.3. Spatio-temporal map of 10 year trends within the total copepod or zooplankton time-series.

Peter Wiebe suggested taking a full half a day at the next WGZE meeting to really focus on the questions that arise when looking at these multi-site regional studies. Piotr Margonski agreed and proposed that we arrange the next meeting with a whole day for analysis. Erica Head suggested that it would be helpful to arrange the working group participants into regional groups each with an assigned group leader. It was also suggested that the upcoming joint WGZE/WGPME ICES *Workshop on Synthesis of hydrographic, phytoplankton, microbial plankton and zooplankton time-series in the*

North Atlantic and adjacent seas (WKSERIES, see Section 15 in this report) would be an excellent opportunity to discuss and further develop this analysis.

Todd led a discussion proposing that future status reports should be produced on a three year cycle. A three year cycle would allow two years between each report for developing new analyses, adding new sites and authors, and for pursuing more in-depth or even peer-reviewed studies. With Todd also doing the WGPME phytoplankton status report, a three year cycle in both groups would also give him a one year break every third year. This third (no report from either group) year could also be used to do a joint study or report with the phytoplankton group. Initial discussion with the zooplankton group was generally favourable to the cycle change. One voiced concern asked whether a longer interim between reports may reduce interest or participation in creating the report series (by the data providers themselves). A counter to this comment suggested that three years of new data (vs. two years) is more likely to capture changes in the time-series. Another suggestion noted that a three year report cycle would tie-in better with ICES new three year working group work plan. As this change in report creation cycle was also dependent on a similar change made within the WGPME phytoplankton group (meeting the next week), final decisions will be made after WGPME has discussed the topic.

There was common agreement that the report is very useful and produces integrated assessment of several abiotic (temperature, salinity, river run-off, nutrients, wind-speed, precipitation etc.) and biotic (chlorophyll, phytoplankton and zooplankton abundance and biomass) variables. Piotr emphasized the output value of the report with respect to integrated assessment, for which importance is growing as one of SCICOM priorities, and that this relevance was good for the group. Furthermore, the necessity to publish this report in a medium that reaches a wider academic audience was recognized as an important task. Publication of a review article was suggested as a high priority for the group. A peer reviewed article that cites the achievements of the group should be written. This could be a short review or 'Perspectives' article linking to the CRR.

The ICES WGZE and WGPME groups have assembled an extremely valuable (and unique) collection of plankton time-series data. Todd reminded the group that under the currently active WGZE and WGPME time-series data policies, any data submitted for these reports would stay within group only and would not be freely distributed to others without prior consent from the individual data contributors. It was then noted that if the group did make these data freely available, as another product under the WGZE and WGPME banner, it would be an incredible credit to and accomplishment of the working groups. The group discussed how access control to these data might be maintained (e.g. to ensure proper credit and citation of the original data authors). Peter Wiebe argued against having a password or mandatory registration on the data site and suggested that there was a need to automate data delivery. Peter also emphasized the value of these data compiled for use in a global analysis.

Some important summary points came out from the discussions: a) to establish a task group to explore and further analyse the results presented in the current report, b) evaluate the process and direction which we should proceed, c) to have a working group synthesis session at the ICES WGZE meeting in 2014, d) produce an executive summary on the trends observed, e) establish regional groups to work with Todd, f) establish a writing group to work on a draft review article.

4.3 ToR c) Prepare metadata on available gelatinous plankton datasets including information on ongoing monitoring projects as well as on spectrum of collected data (time, location, and species)

Lead: Sophie Pitois, Rapporteur: Elaine Fileman

At the beginning of this session three presentations were given.

The first one by Antonio Pliru (Cefas, UK) was about a survey on jellyfish in the North Sea that occurred in August 2012, this survey will be carried out again in 2013 and it is hoped that it will then occur every year: "Although jellyfish populations are known to fluctuate greatly, numerous studies suggest that jellyfish biomass is currently increasing in marine ecosystems. Factors such as climate change, eutrophication, fishing, aquaculture, human construction, species invasions may stimulate increases in populations of gelatinous species. Therefore, there is potential for blooms becoming larger and more frequent in EU waters. The spatial distribution of jellyfish in the North Sea was investigated during the English leg of the IBTS Ground fish survey from August to September 2012, onboard the "RV Cefas Endeavour". In total, 9 different species of scyphozoa and hydrozoans were identified, the most abundant groups were *Cyanea* spp. (*C. lamarckii* and *C. capillata*), followed by *Chrysaora hysoscella* and *Aequorea* spp. While *Cyanea* spp. were distributed throughout the North Sea, *Chrysaora hysoscella* were restricted to the southern area and *Aequorea* spp. appeared in large numbers in the southern and northernmost areas of the North Sea (none was found in the central region). Species assemblages of fish that co-occurred with *Cyanea* spp. were also investigated, and it was found that *Sprattus sprattus*, juvenile *Clupea harengus* and juvenile *Merlangius merlangus* co-occurred most commonly with *Cyanea* spp., while adult *Clupea harengus*, *Merluccius merluccius* and *Trisopterus minutus* were typically absent in areas of high *Cyanea* spp. abundance. Spatial relationships between environmental factors and the distribution of *Cyanea* were also investigated and depth and chlorophyll concentration were significant predictors of *Cyanea* abundance and presence. This study shows the potential of increasing the jellyfish data collection effort and how multidisciplinary surveys can offer the opportunity to conduct studies relating different groups of organisms with their ecosystems and how they relate to each other."

The second presentation was given by Maiju Lehtiniemi (Ymparisto, Finland) on monitoring of ctenophores and jellyfish in the Baltic Sea: "During the past 5 years there have been studies done on the Arctic ctenophore *Mertensia ovum* in the Baltic Sea. This ctenophore was identified from the Baltic for the first time 2009 but seems to be a glacial relict species that has been misidentified as *Pleurobrachia pileus* in the past and recently as *Mnemiopsis leidyi*. The species is very small in the Baltic with an average size of less than 1 mm. It has its highest abundances near the halocline where salinities are above 6 psu and temperatures below 7°C. *M. ovum* seems to feed mainly on microplankton and picocyanobacteria and not on copepods as is the case in the Arctic Sea. There are no targeted monitoring programs on jellyfish in the Baltic Sea. Thus the collection of public observations on the Moonjelly *Aurelia aurita* was started based on the Internet information exchange in 2010. In addition, preliminary tests for using acoustic methods in *Aurelia aurita* detection have been conducted. With acoustics it would be possible to obtain distribution and abundance estimates of the species."

The third presentation was given by Elvire Antajan (Ifremer, France) on the MEMO project (*Mnemiopsis* Ecology Monitoring and Observation) with focus in the southern North Sea and English Channel: "The comb jelly *Mnemiopsis leidyi* is an invasive spe-

cies with a history of detrimental impacts on marine ecosystems and industries. *M. leidy* was recently found in the southern North Sea; as a result, InterReg IVa-MEMO was started in January 2011 as a collaborative project between 5 institutes from 4 countries around the southern North Sea and English Channel. The general aim of the project is to investigate the characteristics, distribution and impacts of *M. leidy* in this region. Genetic tools will be developed to correctly identify *M. leidy*. The cross-border network of institutes involved will establish standard operational protocols and integrate local datasets, to facilitate interregional long term monitoring of *M. leidy*. The project will contribute to the establishment of common strategies for environmental risk assessment by modelling the potential impacts on the environment and industries, and by proposing follow-up tools and mitigation measures. Earliest records of *M. leidy* along the French coasts of the Eastern English Channel were carried out in autumn 2005 in Le Havre harbour where *M. leidy* seems to have established a population spreading westward within the Bay of Seine. Some specimens were also collected along the French and Belgian coasts of the North Sea and within Calais, Dunkirk, Ostend and Zeebrügge harbours in 2009. Our results suggest a multiple and simultaneous introduction of the species through ballast waters in main Northern European harbours”.

Finally Sophie Pitois (Cefas, UK) presented a table of meta-data describing sites within the ICES areas which monitor gelatinous zooplankton. Peter Wiebe suggested that this table could be loaded onto the WGZE website as an output. There may also be other groups that have not yet provided information for the table e.g. Plymouth L4 site. Sophie has amended the table format to take into account suggestions from the participants and has since updated it with new inclusions of various sampling surveys and monitoring programmes lead by the participating institutes. It was agreed that with the completion of the table and inclusion on the website this ToR would then be complete.

4.4 ToR d) Assemble a global compilation of existing allometric relationships relating zooplankton morphology to volume, mass, carbon, and nitrogen

Lead: Lutz Postel, Rapporteur: Erica J. H. Head

Lutz Postel started with the presentation which summarized the state-of-the-art. Two metrics are generally measured for zooplankton – biomass and abundance. Biomass may be expressed in terms of wet mass, dry mass, ash-free dry mass, protein, C etc. In addition, biomass per taxon is another useful metric (e.g. for total copepods or total *Calanus*). There are three main approaches: the morphometric methods, allometric relationships of length (width) to biomass, and individual biomass factors. The first is based on detailed measurements of length, width etc to give biovolume, but this is tedious to do. The second is based on length or width and is available for a large number of calanoid copepods (Mauchline 1998) and for a few other larger taxonomic units (Hirst, Roff et al. 2003). These compilations often require conversion factors of biomass which can be a substantial source of error. A compilation for estuarine species has been prepared by Russian colleagues.

The third method, using specific dry mass factors for individual taxa, has been applied in some cases e.g. for the North Sea (Martens and Beusekom 2008). In the Baltic Sea, individual specific C factors for taxa were calculated and used to produce empirical length/C content relationships (Postel et al. 2007). There is some scatter about the (exponential) fitted curve, although the relationships are species-specific.

All methods for looking at allometric relationships have advantages and disadvantages. E.g. often the samples are preserved, which causes shrinkage, leakage etc. Individual specific biomass factors are really needed, however, because historical data are often only provided in the form of species counts (abundances).

So far, data have been compiled for the Baltic and North seas. Several groups have been involved. C contents for individual taxa have been measured in some cases, and also looked at the literature to obtain conversion factors for C. Other data compilations include

- a) data from San Francisco Bay
- b) The Hirst et al. (2003) method that considers T – but involves various biomass sources which were converted to carbon using coarse ratios;
- c) Martens et al. (2008)

In the Baltic Sea, if lagoons are included, for 236 out of 305 taxa there are NO biomass conversion factors. In a German project for the open Baltic Sea (Postel et al., 2007) approximately 90% coverage was achieved.

The next possible step might be to compile species lists and conversion factors. But there should be assurance of taxonomic QC and uniformity of conversion factors and of how they are determined. MarBEF is involved in such an initiative, but the WGZE could gather data together for the entire N Atlantic. These lists should include environmental data (e.g. *in situ* temperature data and taxons' temperature tolerance ranges etc.)

A “smart option” is possible when working with “whole net tows” (i.e. Mixtures of species) and the total biomass is divided by the total number of organisms. This gives the biomass of an average individual. Such values may be used to calculate community metabolic rates and productivity, which are size related. There are many publications that have taken this approach. This approach was used along a transect off Namibia in 2011. Video plankton recorder data (taken during the cruise) will be used to look at size spectra of the zooplankton communities. This will allow comparison of a “sum of metabolic rates” for all size classes of organisms with the “average” value that was calculated using the “smart option”.

During the discussion that followed the presentation it was decided that the WGZE website is the best place for presenting and sharing the compiled list of allometric relationships.

Modellers are using size based biomass for their purposes, and we should make sure that the best existing information is available. Even if there are regional differences in C per organism, generally it is the abundance of the organisms that drives the rates (e.g. for egg production rates it is the abundance of females that matters). Regional differences may, however, tell more about differences in metabolic rates, with respect to environmental factors.

One approach might be to look at differences between “big” or “small” copepods, although since most zooplankton analysis is done by microscopic identification and enumeration, taxon based conversion factors are needed.

The Laser Optical Plankton Counter allows the measurement of the size spectra of zooplankton communities, which could allow us to use size-based C conversion factors. Quality control would be needed, however, to ensure that the conversions were appropriate. For example, when Lutz Postel and his colleagues looked at time-series

data, they found a decrease in wet weight biomass in the mid-1990s. When the sum of biomasses of the individual zooplankton was used, however, there was no change.

Lutz Postel reminded the group about the biochemical approach to estimating productivity and suggested that the kind of data discussed here allow a similar approach, e.g. using size-specific biomass to estimate community metabolic rates.

Piotr Margonski pointed out that the ToR refers to a “global” data compilation, which may be beyond the scope of the WGZE, and that we should focus at the North Atlantic compilation.

Several group members expressed their will to contribute data and Lutz Postel volunteered to provide a template, so that data will be in a comparable format. The group also recognized that they should also capture published data, and perhaps extend the spatial scale to the Arctic species, contacting colleagues who are likely to have such data (e.g. Carin Ashjian, Russ Hopcroft, AWI members).

It was concluded that the ToR needed to be re-written to reflect this new line of work.

Lutz Postel suggested that data from the Zooplankton Status Report as it currently exists could be used to calculate ocean-wide metabolic rates, which could be added to the upcoming, or future, reports.

Piotr Margonski agreed this might give some interesting patterns, and Peter Wiebe suggested that a comparison of the parameters for the various length/weight relationships for different regions might also give some interesting results. It was recognized that this would not be a trivial exercise, however, and that for now, perhaps, the emphasis should be in assembling the data, rather than carrying out a detailed analysis.

References

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4.5 ToR e) Compile the list of taxonomic categories including species and stages which are currently monitored

Lead: Peter Wiebe, Rapporteur: Kathryn Cook

This ToR was developed as a result of the continued expansion of the Zooplankton Status Reports and the realization that it was important to know what species were being monitored throughout the ICES area, and to begin to integrate the results of the monitoring of zooplankton in the ICES area. This report is based on data compiled by Damien Eloire, a student of Delphine Bonnet and Roger Harris, as part of his PhD thesis. The objective of the presentation was:

- 1) To show the results of the work that Damien did in assembling the lists of species that are currently being monitored in the Northeast Atlantic.

- 2) To solicit additional contributions to the species lists from monitoring stations not currently listed. Information missing from the current compilation needs to be provided as a list of species/taxa observed at the stations so that it can be added to the compilation.
- 3) To get suggestions for how members of WGZE would like to see this information presented to facilitate its usefulness, e.g. a web based system. Ultimately there is a need to integrate the results of this ToR with those of ToR d (Assemble a global compilation of existing allometric relationships relating zooplankton morphology to volume, mass, carbon, and nitrogen) as part of the evolution of the Zooplankton Status Report so that it is useful to the wider ICES and zooplankton communities.

From the work of Damien there is already an extensive list of 900+ taxonomic categories (including non-crustaceans, such as protozoans, bryozoans, rotifers, cnidarians, ctenophores, worms, molluscs, echinoderms, hemichordates, chaetognaths, cephalochordates, urochordates and chordates, as well as the crustaceans, such as cirripedes, cladocerans, malacostracans, ostracods, copepods). Each station currently included is listed with geographic information, contact details, some sampling information, and taxonomic categories are ticked if they are monitored. This gives information on the number of sites that count each taxonomic category. All sites currently included count cirripedes, cladocerans, malacostracans and copepods. However, very few have identified euphausiids to species level. It was noted that, at present, there are only 17 sites in the current spreadsheet, but there are now 63 sites in the Zooplankton Status Report. An e-mail request for species list and allometric information will be sent out to all relevant people using the contact list for the Zooplankton Status Report. Data should be sent to Todd O'Brien and cc'd to Peter Wiebe and Piotr Margon-ski.

Elvire Antajan suggested that the spreadsheet should include unique identification numbers for each taxonomic category, such as the AphiaID number used by the World Register of Marine Species, so that species name can be kept up to date. It was agreed that this is important and should be recorded as an action for this ToR.

Erica Head noted that if a species isn't found at a monitoring station it may mean that analysts are not looking for that species. Conversely, a species list grows as species are seen, but something that is encountered once every 10 years is not really being monitored. This led to a discussion about the definition of a species list: whether it should be a list of taxa that have been seen or a list of taxa that are looked for / counted. For example, in CPR sampling of the North Atlantic, the overall list of species looked for will be the same, but the list of species found in the subregions will be different. Todd O'Brien noted that there are two questions: where has species A been seen, and what sites are monitoring for species A. It was decided that 'what species have been found where' is the question that needs to be answered as part of this ToR, although it was felt that the word 'monitored' in the title may not be appropriate. Claudia Castellani noted that the list produced for this ToR could not be used to record the biogeography of a species, as this would need to include information from the literature. Roger Harris pointed out that the main driver for this ToR was to allow comparative analyses between stations.

Peter Wiebe and Todd O'Brien described their ideas on how this spreadsheet of species lists could be expanded and the information presented on the WGZE website. Currently it is possible to see what species there are for each station. There are no tools to pick a species and find the stations that measure it as yet, but it would be

possible to do this in the future. They envisage an interface where you can go in either direction with collapsing menus and can click on a map. It could also be tied into the allometric information resulting from ToR d, other hydrographic variables measured at these sites, and be cross referenced with WoRMS to validate species names. This would make the resource of interest to an even wider community. Erica Head asked whether the Ocean Biogeographic Information System (OBIS) presented histograms of how many times a species occurs at a site. Todd O'Brien replied that they had tried that but there had been concerns over a site being identified as low biodiversity when actually they are not looking for everything that might be there. Claudia Castellani suggested that websites that have useful information on a species could also be added as a link. Todd O'Brien reiterated that the vision for this ToR was not to produce a taxonomic diversity resource, but to find what sites are measuring what species.

Peter Wiebe concluded by stating that good progress has been made on this ToR since last year and that there is a sound basis for building a web based tool linked to the Zooplankton Status Report and the allometric relationships compiled in ToR d. This will be a powerful and unique tool that should be useful to many people. The group decided that ToR e and ToR d would be integrated into a single ToR to go forward for next year with the ultimate aim of delivering the information on the WGZE website. This extra information could be used in future Zooplankton Status Reports.

Peter Wiebe then briefly presented data that highlighted the issue that for allometric relationships you need to know exactly how length is measured. For example, krill lengths can be measured in 3 or 4 different ways, and copepods prosome length can be measure dorsally or from the side with significantly different results. This may be difficult information to discover in many cases when compiling data from a variety of sources.

Lutz Postel also briefly presented the way that species lists have been managed for the HELCOM in the Baltic sea by the Zooplankton Expert Network. They have a spreadsheet with species on left, sites on top with a tick for which species were seen at which sites. This was combined with an overall taxa list with species names and links to the Integrated Taxonomic Information System (ITIS) or WoRMS, and with allometric relationships, conversion factors, and carbon contents where available with comments and references.

4.6 ToR f) Update the information on plankton sorting centres and existing taxonomic expertise, to be posted on the WGZE website

Lead: Piotr Margonski

Discussion on this ToR began with visiting the Cefas plankton laboratory. WGZE participants were guided by Stephen Milligan, Plankton Laboratory Manager. In addition to the extensive phytoplankton analyses, Cefas has a long history of conducting zooplankton surveys for fisheries independent assessments of Spawning-stock biomass (SSB) of commercial fish and crustacean species using the Annual Egg Production Method (AEPM). Cefas instigated the triennial mackerel egg survey in 1977 to estimate the size of the mackerel spawning component to the west of the UK. This survey has grown with increased international participation (ten nations now participate) and the 2013 survey is currently underway, although Cefas withdrew following the 2004 survey. However, ichthyoplankton surveys continued with a series of surveys in the Irish Sea in 2006, 2008 and 2010 to estimate the SSB's of cod, haddock and plaice.

Other zooplankton work has continued with an increasing range of customers but particularly with those involved with offshore wind-farms and new nuclear power station developments. These have included baseline surveys for all plankton components around two proposed nuclear builds, with particular emphasis on studying the likely impacts of an increased thermal plume in adjacent waters and of entrainment in the cooling water systems. The Cefas plankton laboratory has also been involved with various other projects including studying the distribution and abundance of the invasive 'jellyfish' *Mnemiopsis leidyi* and its potential impact, and analysing net caught samples for the presence of microplastics.

Later, Piotr Margonski summarized the work done during the last two years. So far, six zooplankton sorting centres providing services for external clients were identified:

- NMFRI Plankton Sorting and Identification Center, Szczecin, Poland
- 'Materialhof', Rendsburg, Germany
- 'Aqua Ecology', Oldenburg, Germany
- Huntsman Marine Science Centre, Atlantic Reference Centre, St Andrews, Canada
- The Centre for Environment, Fisheries and Aquaculture Science (Cefas), Lowestoft, UK
- The Sir Alister Hardy Foundation for Ocean Science (SAHFOS), Plymouth, UK

For all of them detailed information was gathered concerning: official name, postal address, contact person e-mail, sorting capacity, range of taxonomic expertise, spatial coverage, and quality control procedures and certificates.

As part of the information inventory, several institutions provided information on their staff taxonomic expertise, sometimes including even regular students training programmes, however, due to various reasons some are not able to provide sorting on a "commercial" basis. After discussion among the group's participants, it was decided that only those centres or institutions which are providing sorting for external clients will be presented in the table submitted to the WGZE website.

The other issue is a list of taxonomic experts willing to share their knowledge and provide help with identification of the certain taxa. Based on last year's conclusions, the list of those experts has to be treated with caution and it will not be presented at the WGZE website.

4.7 ToR g) Review the progress of the SGIMT

Lead: Ann Bucklin, Rapporteur: Jasmin Renz

Ann Bucklin presented an overview of the Study Group on Integrated Morphological and Molecular Taxonomy (SGIMT), including the current membership and ToRs.

SGIMT ToR a) Expand membership; ensure balance of expertise, morphological / molecular approaches, across taxonomic groups.

The study group currently includes 19 members from different countries, most within the ICES area, but several from outside the region. New members with an interest/expertise in taxonomic research are still being recruited and are welcome to join the study group.

SGIMT ToR b) Develop a web platform for exchange of scientific information

Over the last year, a web portal was developed for the study group, hosted under the website of the ICES Working Group for Zooplankton Ecology (see <http://wgze.net/sgimt>). The web portal currently contains information about the goals of the study group as well a list of taxonomic links to other websites that present material (photos, identification keys, methodology manuals, and others) for the identification of marine zooplankton organisms. It is planned that, with the help of Todd O'Brien, information from the Census of Marine Zooplankton website (see <http://cmarz.org>), which is inactive due to the completion of this large project, will be transferred to the SGIMT web portal. These contents will include a large amount of non-copyrighted pdfs and Internet links for species identification, as well as photo material.

In this context the question was raised, if there is a possibility to include information in the standard websites hosted by ICES or whether these sites only contain basic information about Working and Study Groups. SGIMT will consider this question during the coming year (for details see <http://www.ices.dk/community/groups/Pages/SGIMT.aspx>).

Members of the WGZE were encouraged to send any information on material related to species identification and links to not copyright protected material to Jasmin Renz, who will include this information into SGIMT web portal.

Further contents, that will be included into the web portal in the near future, were presented by Ann Bucklin, e.g. a table containing information on species identification using molecular methods, which was compiled by Silke Laakmann, as well as information on optical methods for species identification. Material for this topic will be collected and provided by Mark Benfield.

SGIMT ToR c) Design and submit a proposal for an ICES taxonomy workshop

The general focus would be identifying species boundaries using molecules and morphology. The workshop(s) might include presentations by experts on selected 'case studies' in zooplankton taxonomy, such as cryptic species, poorly known assemblages, bipolar species, or invasive species, among others. There is a need for information about usual levels and uses of ICES Workshop funding. Furthermore it has to be clarified, e.g. if the workshop will focus on molecular or morphological or integration and if it will be a hands-on workshop. A decision has to be made on organizers, local hosts, and venue.

SGIMT ToR d) Assist in the revision and development of zooplankton species identification keys

In a discussion with WGZE members it became clear that the expertise needed for such a task cannot be fulfilled by members of the Study Group. A formal recommendation will therefore be made that this ToR will be passed back to the Working Group for Zooplankton Ecology.

Within this ToR it was furthermore discussed that the link to the ICES leaflets for zooplankton identification is not currently working; ICES will be informed of this problem.

SGIMT ToR e) Prepare a review article, methodology manual, or other peer reviewed summary of available techniques, approaches, and protocols

Ann Bucklin gave a short summary of topics discussed to date that could be covered by this article, which could be detailed descriptions and methodological guidance for molecular approaches to range of issues, including the identification of prey species in gut contents using QPCR, PCR and sequencing, and probe hybridization, the identification of individual specimens using RFLP, species-specific PCR, DNA sequencing, and DNA barcoding and the identification of species in mixed samples using in situ hybridization (ISH, FISH), microarrays, and environmental sequencing (amplicon and 454).

SGIMT ToR f) Advise on the application and use of integrated morphological / molecular approaches for marine science and management

Ann Bucklin gave an overview over the ICES ASC 2013 session F: Complexity and structure of planktonic foodwebs: who really eats whom? The session will be convened by Elaine Fileman (UK), with conveners Ann Bucklin (USA), Pennie Lindeque (UK), and Janna Peters (Germany).

The report ended with an outlook for the Study Group's meeting goals for the upcoming meeting subsequent to the Working Group meeting. These goals include a review of SGIMT ToRs, reports and recommendations, pursuing the work for including material and information in the SGIMT web portal, and work on detailed outlines for the review article and the ICES taxonomy workshop proposal.

4.8 ToR h) Review the ICES response to the Norwegian request regarding the *Calanus finmarchicus* exploratory assessment

Lead: Webjørn Melle by correspondence and Peter Wiebe, Rapporteur: Hildur Petursdottir

With a letter to ICES in 2012, the Norwegian Ministry of Fisheries and Coastal Affairs requested an "exploratory assessment of *Calanus finmarchicus* in the Norwegian Sea" (Annex 3). After discussions between the Secretariat and the Advisory and Science Committee Chairs, they asked the ICES Working Group on Zooplankton Ecology (WGZE) to look at the request and consider how best to address it. At last year's meeting in Malaga, Spain, there was a long discussion led by Jeff Runge that included a description of a manuscript synthesizing what is known about *Calanus finmarchicus* from a basin perspective, which has been submitted to Progress in Oceanography (See discussion in ICES CM 2012/SSGEF:06). The final conclusion was summarized in the justification for ToR h for this meeting. The preferred approach was to host a workshop to consider not just the request, but its broader context. A summary of suggested topics was produced by WGZE for inclusion at the proposed workshop. Jeff Runge and Webjørn Melle (by the WGZE), Jason Link (through ACOM) and Mike Heath (through SCICOM) were approached to assess their willingness to co-chair such a workshop and they all were accepted.

The four co-chairs were invited to correspond to:

- Finalize the list of ToRs – the original ToRs were developed by the WGZE and have been edited by a number of individuals.
- Plan the residential meeting.
- Plan intersessional work.

- Start publicizing the workshop among those players that would be essential to secure a successful outcome.

The finalized ToRs are presented in Box 1 below.

Box 1: ToRs prepared for the *Calanus* Workshop:

2012/X/SSGEFXX The **Workshop on the “Exploratory Assessment of *Calanus finmarchicus* (WKCALANUS)**, convened by Webjørn Melle (Norway), Jeff Runge (USA), Michael Heath (UK) and Jason Link (USA), will meet on [Date – preferably autumn] at [Venue – preferably CPH], and will report to SCICOM and ACOM via SSGEF, with the following Terms of Reference:

- To review the understanding of the ecology and dynamics of *Calanus finmarchicus*,
- To evaluate the data sources and methodology that would be needed to conduct an exploratory assessment of *C. finmarchicus*, including survey and modelling needs.
- To make an exploratory assessment of the abundance and production of *C. finmarchicus* based on available data, and evaluate appropriate candidates for Biological Reference Points.
- To evaluate quantitatively the ecosystem effects of harvesting of *Calanus finmarchicus*, including effects on dependent species, and the potential by catch effects of the fishery.
- To evaluate future assessment schedules and frequencies of both the stock and demands on it; in order to improve the understanding of the functioning of the ecosystem and to ensure resource sustainability.
- To provide advice on improved data collection for the development of future assessments of *C. finmarchicus*.

Science workshops are normally funded via member countries (in many instances this means the experts’ own Institutions). However, as this was an advisory request from a member country, the Secretariat decided to explore the willingness of Norway to contribute to the funding especially to ensure participation of the relevant experts within the time schedule as the ministry suggests in their request, and to investigate whether they want their original request to stand or want to change their approach to a normal ICES science process.

The Norwegian response was to request implementation of the normal science process instead. They have also realized that if a formal advice request is to be submitted it should come from the Northeast Atlantic Fisheries Commission (NEAFC) (in which case there is a process for funding within the existing MoU).

Since this there have been no known initiatives in this matter from Norway towards Webjørn Melle or ICES.

In Norway, work towards a management plan (including a harvest rule, quota, and assessment of *Calanus* in the Norwegian Sea) is planned by the Norwegian Fisheries Directorate and the Institute of Marine Research. However, this task has been postponed to 2014, due to internal priorities at IMR. *Calanus* AS has requested and been approved a scientific catch quota of 1000 tonnes in Norwegian waters for 2013 by the Norwegian Ministry of Fisheries and Coastal Affairs. As a prerequisite for the allowance, subsamples of all trawl catches must be taken by *Calanus* AS and examined for bycatch of fish eggs and larvae by independent experts. The Norwegian Fisheries Directorate can decide to place inspectors onboard during the fishery.

As reported by Hildur Petursdottir, in a contributed talk, an exploratory survey on *Calanus* was made on the southwest shelf off Iceland in collaboration with *Calanus* AS, Tromsø, Norway (<http://www.calanus.no/About-us.aspx>) to see if *Calanus* densities were high enough to make commercial harvesting profitable. Kurt Tande and Astthor Gislason were on the survey cruise in 2012. Eighty percent of plankton was in upper 50 m at stations where catches were high enough for harvesting. In January

2013, a request was made to the Iceland Ministry to harvest 300 tons in 2013 and this was approved. Areas selected for fishing are to be determined by the Marine Research Institute and the harvesting is to be done with an observer on board.

The WGZE discussed the way forward. One question was whether to immediately pursue plans for the workshop on this issue through SCICOM as a bottom up process. Since the WGZE had not received any information from SCICOM about this turn of events before the meeting, it was difficult to know what to recommend. There was consensus that such a workshop was essential and should take place, since the exploitation of a lower trophic level requires assessment along the lines defined by the workshop ToRs. But it was also obvious that Norway was not interested in pursuing this issue as a top down process in the ICES system. It was also considered important that the planners of the workshop have access to the management plans being prepared by Norway and Iceland. One suggestion was to hold the workshop in association with the Annual Science Conference to reduce the travel costs of participants or to have a non-Norwegian convener host it. It was recommended that Piotr Margonski, as chair of WGZE, seek more information from SCICOM about the possible next steps in moving forward on this very important issue.

Based on after-the-meeting discussions with Manuel Barange (SCICOM Chair) it was decided that two possible options exist: to continue with the idea of organising the workshop but in such a case it is going to be a self-funded event (no external resources), or to withdraw the workshop suggestion.

In a series of post-meeting Email discussions, WGZE have concluded that a Calanus Workshop, or even a series of workshops, is a very important step towards lower trophic level assessment and it was decided to support this initiative. However, it was decided that such a workshop (or series of workshops) cannot be held until external funding is available, since it is essential that the workshop(s) be attended by experts in zooplankton/ fisheries ecology and fisheries/ecosystem management, and some of these areas of expertise are beyond those within the WGZE. For future Calanus Workshop(s), taking into account the lack of external funding and the fact that Jeff Runge declined from co-chairing due to funding constraints, WGZE nominated Erica Head (Canada) as its representative. The group considers the original list of ToRs suggested for the Calanus Workshop to be still relevant.

As an immediate action, WGZE decided to continue with the ToR "Review the ICES response to the Norwegian request regarding the Calanus finmarchicus exploratory assessment" for 2014, including some inter-sessional, preparatory work to review the relevant assessments as well as report(s) on fishing activity by "Calanus AS" in 2013. The WGZE regards this, however to be only a partial contribution to what should be a much more holistic "ICES perspective" regarding such an important management issue, namely the potential for increasing exploitation of lower trophic levels at the very base of the food chain.

4.9 ToR i) Discuss how WGZE may contribute to annual "briefing sheets" detailing the current state of the physical and biological environment in the ecoregions for which ICES generates advice

Lead: Piotr Margonski, Rapporteur: Angus Atkinson

The Herring Assessment Working Group for the Area South of 62 N (HAWG) in their 2012 report requested, via SCICOM, the creation of annual briefing sheets for use in

their annual (spring) meetings, on the current physical and biological conditions in the 4 sea areas:

- 1) North Sea
- 2) Celtic and Irish Seas
- 3) Malin Shelf
- 4) Western Baltic, Skagerrak and Kattegat

The briefing sheets would cover:

- a) Temperature
- b) Primary production
- c) Zooplankton abundance

These briefing sheets would be approx 1 page text in length, plus figures.

Suggested variables would be presented on a seasonal basis and covering the last year, and placed in the context of longer term trends. Expert interpretation of the trends, in addition to the time-series would greatly increase the value of such a product.

This ToR was generated via SCICOM, and while temperature and primary production can be handled elsewhere (for example with satellite data and WGOOFE), as there was no direct communication with HAWG, we have little further information on the finer level of detail required, for example on which zooplankton species/sizes are of interest and whether bulk properties such as biomass are requested.

Todd O'Brien and Angus Atkinson suggested that the Zooplankton Status Reports comprise a valuable compilation of time-series spanning the areas requested. However the fixed monitoring stations are all very coastal and localised compared with the large sea areas requested. Further the monitoring sites do not encompass the above areas 2 and 3, and the Status Reports are not produced every year. Only the SAHFOS CPR survey could hope to cover the area requested, although data are analysed only with a time-lag from collection. Claudia Castellani (SAHFOS) provided information that only areas 1 and 2 (mentioned above) are regularly sampled by CPR and for area 3 only historical data exist. Area 4 is not covered by CPR. Martin Edwards (SAHFOS Deputy Director/Chief Scientist) agreed to help with the preparation of the briefing sheets on plankton for the areas covered by the CPR survey but more, detailed information is required.

Lutz Postel and Padmini Dalpadado reiterated the common sentiment that preparation of tailored reports has big resource implications for anyone tasked with compiling such briefing sheets. A first port of call could be to check the content of the annual status reports of the various agencies doing the monitoring. Examples could be Baltic monitoring and Norwegian Arendal site and its wider area. These may provide some "off-the-shelf" products. Padmini Dalpadado provided a link to the Norwegian zooplankton status report website: http://www.imr.no/filarkiv/2013/03/dyreplankton_i_de_norske_havomradene.pdf/nb-no.

Overall agreed summary of response: we need more information on exactly which zooplankton species and properties (numbers/biomass) and more specific information on the exact region to be able to respond properly to this request. However from the information we have, the intensive monitoring currently being done is too close inshore to reflect the broad sea areas. The exception is the CPR data from

SAHFOS, but most of its data are analysed with some delay from when they are sampled. Options are either to use existing products from the Plankton Status Reports or those from the monitoring agencies therein, or to request more tailored reports direct from SAHFOS, with cost implications. Participation of HAWG members in the plankton time-series analysis workshop (WKSERIES) this October could generate mutual topics of interest.

5 Progress Reports

5.1 Progress Report: Measuring egg production rates for *Calanus finmarchicus* - should we be doing it differently?

Authors: Erica J. Head and Marc Ringuette, Presenter: Erica J. Head, Rapporteur: Janna Peters

In situ egg production rates (EPRs) for *Calanus finmarchicus* throughout the North Atlantic are highly variable, even at a single site and even when effects of chlorophyll (food) concentration and female size are considered. In addition, surprisingly, *in situ* EPRs do not appear to be related to temperature. Most researchers run egg production experiments with groups of females incubated individually over 24 h periods and most use set-ups designed to prevent cannibalism. In 2010, we carried out experiments in the Labrador Sea, in which we moved females to fresh incubation vessels every 6 h for a total of 24 h and we calculated EPRs for each 6 h period. Egg-laying was not synchronous, but EPRs calculated over the entire 24 h periods appeared to be higher than those seen in previous years using standard 24 h incubations. In 2012, to investigate this further, we ran two experiments in parallel at each sampling station: in one females were moved to fresh vessels every 6 h and in the other they were left in the same vessels. The 24 h EPRs were higher by a factor of 1.5-2.4 for the females that had been moved every 6 h. In addition, when the effect of chlorophyll concentration was accounted for, these higher EPRs (together with those from 2010) were significantly positively correlated with temperature. Our interpretation is that cannibalism was occurring in the standard 24 h incubations. The 24 h EPRs that we have measured in the past have been among the highest ever recorded, and the proportion of small clutches, among the lowest. This suggests that our experimental set-up is at least as good as any other and that cannibalism is probably occurring in our and all other set-ups. We strongly urge other groups to investigate this further in order to confirm or refute our findings. It may be that we need to change our standard methods: if so, the sooner, the better.

Erica's talk provoked a lively discussion among the WGZE although, unfortunately, few of the researchers who measure egg production rates for *C. finmarchicus* on a routine bases were actually present. The discussion urged the need to intercalibrate and optimize commonly applied methods for *in situ* egg production measurements of *C. finmarchicus* (i.e. incubations in Petri dishes, beakers, plankton wheels) on an international basis.

5.2 Progress Report: Zooplankton online ringtest – a new tool for quality management

Authors: Christina Augustin and Matthias Rust, Presenter: Christina Augustin, Rapporteur: Silke Laakmann

To ensure sufficient quality in zooplankton analysis regular ringtests are a classical tool to evaluate preparation and classification excellence of participating institutions. In conventional ringtests the natural zooplankton sample is split equally and sent to the participants, who are responsible for adequately preparing the sample and for counting and identifying species. After analysing the sample, the results, which are the total number of identified specimens, are sent to the ringtest initiator.

Such a ringtest has been assessed in 2007 in the Baltic Sea area among members of the HELCOM ZEN group. The statistical analysis revealed significant discrepancies between different counters, but the source for the differences (mis-classification, varia-

tions in sample composition or preparation) could not be deduced due to missing context of the isolated results.

Therefore in 2012 a new ringtest from the ZooCount Platform - a solution for web based, digital counting in large images - was adapted to allow better statistics and ease the conduction of a ringtest. Two different samples were prepared. The first scenario was a high resolution scan of a classical counting sample, the second scenario was an artificial montage and consisted of pictures of certain species which caused very different results in the 2007 ringtest.

In October 2012, for the period of one month the ZooCount system was used by 18 participants to simultaneously analyse the digital samples provided. Each counter identified and marked the specimen in a comfortable web browser interface. The exact locations were stored and allowed to create detailed statistics report that considers the counter inter-correlation.

First results of 18 counters show that for scenario 1 about 1130 different locations with 89 species categories were identified. The scenario 2 resulted in 42 different locations with 69 different species categories. These results indicate that such a new online based ringtest can improve quality by identifying single misidentifications and helping to improve the classification excellence.

It is planned to carry out such a test once a year and publish results as a HELCOM ZEN report.

Conclusion of the following discussion is that the tool presented is very useful for training students and researchers.

6 Any other Business

6.1 Update on the Workshop on Synthesis of Hydrographic, Phytoplankton, Microbial Plankton and Zooplankton Time-series in the North Atlantic and Adjacent Seas (WKSERIES)

Author: Lidia Yebra by correspondence, Presenter: Piotr Margonski

The WKSERIES Workshop is organized by WGZE and WGPME.

The Zooplankton and the Phytoplankton and Microbial Plankton Status Reports now cover time-series of 40 and close to 100 sites, respectively, located in Western and Eastern North Atlantic, Nordic, Barents, Baltic, North Sea, northwestern Iberian, and Mediterranean Seas. Parallel reports on hydrography also exist. Hence, there is potential for more complex joint analysis of existing time-series data on phytoplankton and other planktonic microbes, zooplankton, hydrography, and climate as summarized in the existing ICES Plankton Status Reports time-series data.

Synthesis of these data provides an opportunity to create a more comprehensive examination of long-term plankton community changes, foodweb dynamics/shifts and more precise model parametrizations. The understanding of the ecosystem change due to climate and anthropogenic impacts may benefit from the multiple time-series analyses. The results of the Workshop will provide ICES with a synthetic pan-regional view of the relationships between the physical, chemical environment and plankton communities in the context of climate change.

The workshop will be held at ICES Headquarters, October 15-18, 2013. Additional information and details will be available online at <http://WKSERIES.net>.

During discussion, WGZE members were concerned as to whether the information about the workshop is being distributed widely enough to ensure participation of appropriate researchers and relevant contributions.

Lidia Yebra, one of the workshop initiators and its co-chair, will not be able to participate due to her maternity leave, and therefore, she asked for designation of an additional co-chair representing WGZE at the workshop. The group decided to nominate Todd O'Brien (USA) as an additional co-chair, since he is an active member of both WGZE and WGPME.

6.2 Update on the Joint OSPAR/ICES Study Group on Ocean Acidification (SGOA)

Author: Mark Benfield by correspondence, Presenter: Piotr Margonski

The Joint OSPAR/ICES Study Group on Ocean Acidification (SGOA) held its first meeting in Copenhagen, Denmark from 11–14 December 2012. The meeting was hosted by the ICES Secretariat. The meeting was co-chaired by Evin McGovern (Ireland) and Mark Benfield (USA) and was attended by 18 scientists representing eight nations. Two of the members participated via WebEx conference. The main objective of the meeting was to discuss and address the Study Group's eight (ToRs).

It is clear that there are many OA-related chemical data collection activities ongoing in the OSPAR area, but, these may still be inadequate. Data collection is often linked to other monitoring and research activities or as part of large-scale research projects. These are typically short- to medium-term projects and there are few commitments to long-term ongoing monitoring. Monitoring of the biological impacts of OA is still in its infancy and is not routinely undertaken.

SGOA summarized the likely main effects of future OA on different groups of marine organisms present in the OSPAR region. There has been a rapid increase in research into potential biological impacts of OA, including responses to multiple stressors such as combined pH and temperature changes. This research points to highly variable responses at inter and intraspecific levels. Two notable challenges associated with developing biological impact indicators are: a) the large latitudinal range encompassed; and b) the uncertainty in defining the most suitable indicators due to our limited understanding of the potential biological consequences. Nevertheless, some candidate indicator species and groups to detect OA impacts have been provisionally identified by the Study Group.

- Mark Benfield specified three major tasks being of potential interest for WGZE:
- Share information on OA monitoring activities not summarized by SGOA.
- Add to the list of sensitive taxa and any OA-related zooplankton research.
- Identify relevant zooplankton time-series, e.g. where are pteropods enumerated?

6.3 Update on 2013 ASC Theme Session F: Complexity and structure of planktonic foodwebs: who really eats whom?

Presenter: Piotr Margonski

Piotr Margonski briefly reminded the group that during 2013 ICES Annual Science Conference, there will be a WGZE-related session, Theme Session F. Co-conveners are: Elaine Fileman, Ann Bucklin, Pennie Lindeque, and Janna Peters.

This session encourages submissions on a range of topics and particularly welcomes the following:

- Laboratory, field, and model studies of critical processes structuring planktonic foodwebs.
- Quantification of natural diets and feeding rates, including molecular approaches to prey detection and quantification.
- Novel and combined analyses of foodweb structure and complexity.
- Analyses of changes in predator/prey and grazing associations in the zooplankton assemblage, including roles of protists, nano-, micro-, and meso-zooplankton in controlling prey populations.
- Applications of results from laboratory culture studies to the natural environment.
- Discoveries of new or unknown trophic relationships.
- Ecological, evolutionary, and cost - benefit studies of mortality, selection, predator avoidance, feeding behaviour, etc.

6.4 Discussion on WGZE Science Highlights

Lead: Piotr Margonski

There will be a Science Highlights Session within the opening presentation at the 2013 ASC provided by the SCICOM chair. Therefore, Expert Groups were requested to provide 1 or 2 slides each with suggestions on groups' highlights.

After discussion it was decided that:

- The WGZE flagship product is the Zooplankton Status Report which currently covers 62 time-series and 40 Continuous Plankton Recorder standard areas. Based on collected data, more integrated analyses are planned considering climate, hydrology and plankton over the whole North Atlantic area to examine trends and community changes with consequences for foodweb dynamics.
- The other scientific products are peer reviewed papers (e.g. recent Skjoldal et al. 2013), the Zooplankton Methodology Manual, and contributions to the ICES Identification Leaflets.

7 Theme session suggestions for the forthcoming ICES Annual Science Conferences

Based on a lively discussion it was decided to support the following two theme session proposals for 2014 ASC:

- 1) The Deepwater Horizon oil spill: what have we learned that will help us understand future environmental impacts relating to pelagic ecology [conveners: Mark Benfield (USA) and Cabell Davis (USA)]
- 2) This last-year initiative was discussed again and two issues were raised: i) consider the revision of the session scope to make it broader by e.g. including effects on benthic-pelagic coupling, and ii) to suggest an additional European co-convener.

The role of zooplankton in exploited ecosystems: contrasting top-down and bottom-up stresses on pelagic foodwebs [conveners: Angus Atkinson (UK), and Erica Head (Canada) and Webjørn Melle (Norway)]

These theme sessions proposals will be submitted in response to the call for proposals distributed by the Secretariat in spring 2013.

Annex 1: List of participants

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Annex 2: Agenda

Monday March 11, 2013

14:00 – 14:20 Meeting Open, Introductions, Logistics, Adopt Agenda (Sophie Pitois, Cefas, UK and Piotr Margonski, NMFRI, Poland)

14:20 – 14:40 “A consumer’s guide to the products of operational oceanography” (Rodney Forster, Working Group on Operational Oceanographic products for Fisheries and Environment, WGOOFE)

14:40 – 15:30 Complete production of videos on zooplankton sampling/processing techniques as part of progress in updating the Zooplankton Methodology Manual (**ToR a**, Piotr Margonski, NMFRI, Poland)

15:30 – 16:00 Coffee Break

16:00 – 17:00 Prepare metadata on available gelatinous plankton datasets including information on ongoing monitoring projects as well as on spectrum of collected data (time, location, and species) (**ToR c**, Sophie Pitois, Cefas, UK)

17:00 – 17:30 Discussion on 2014 ToRs and Theme Sessions (Piotr Margonski, NMFRI, Poland)

Tuesday March 12, 2013

09:00 – 10:30 Review the regional patterns observed in the changes that have taken place in the existing zooplankton time-series collected in the Zooplankton Status Report (**ToR b**, Todd O’Brien, NOAA-NMFS, USA)

10:30 – 11:00 Coffee Break

11:00 – 12:00 Review the regional patterns observed in the changes that have taken place in the existing zooplankton time-series collected in the Zooplankton Status Report (**ToR b**, Todd O’Brien, NOAA-NMFS, USA)

12:00 – 12:30 Visit to the Cefas plankton lab (Steve Milligan, Cefas, UK)

12:30 – 14:00 Lunch

14:00 – 15:30 Review the progress of the SGIMT (**ToR g**, Ann Bucklin, Univ. of Connecticut, USA)

15:30 – 16:00 Coffee Break

16:00 – 17:00 Update the information on plankton sorting centres and existing taxonomic expertise, to be posted on the WGZE website (**ToR f**, Piotr Margonski, NMFRI, Poland)

17:00 – 17:30 Discussion on 2014 ToRs and Theme Sessions (Piotr Margonski, NMFRI, Poland)

Wednesday Mar 13, 2013

09:00 – 10:30 Assemble a global compilation of existing allometric relationships relating zooplankton morphology to volume, mass, carbon, and nitrogen (**ToR d**, Lutz Postel, IOW, Germany)

10:30 – 11:00 Coffee Break

11:00 – 12:30 Compile the list of taxonomic categories including species and stages which are currently monitored (**ToR e**, Peter Wiebe, WHOI, USA)

12:30 – 13:30 Lunch

13:30 – 18:00 Field trip

Thursday Mar 14, 2013

09:00 – 09:45 Review the ICES response to the Norwegian request regarding the *Calanus finmarchicus* exploratory assessment (**ToR h**, Peter Wiebe and Webjørn Melle by correspondence)

09:45 – 10:30 Discuss how WGZE may contribute to annual “briefing sheets” detailing the current state of the physical and biological environment in the ecoregions for which ICES generates advice (**ToR i**, Piotr Margonski, NMFRI, Poland)

10:30 – 11:00 Coffee Break


11:00 – 11:20 Progress Reports: Measuring egg production in *C. finmarchicus* (Erica J. Head, DFO, Canada)

11:20 – 11:40 Progress Reports: Online zooplankton ringtest (Christina Augustin, IOW, Germany)


11:40– 12:00 Progress Reports: Exploratory survey on the abundance and distribution of *Calanus finmarchicus* southwest of Iceland as a potentially harvestable resource (Hildur Petursdottir, Marine Research Institute, Iceland)

12:00– 12:40 AOB (including info on linked activities such as WKSERIES, SGOA, Theme Session F), Discussion and Closure

Annex 3: Letter of the Norwegian Ministry of Fisheries and Coastal Affairs



DET KONGELIGE
FISKERI- OG KYSTDEPARTEMENT
ROYAL MINISTRY OF FISHERIES AND COASTAL AFFAIRS



International Council for the Exploration of the Sea
H. C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark

Your ref: Our ref: Date:

200600829- /BBE

Request on exploratory assessment of *Calanus finmarchicus* in the Norwegian Sea □

The copepod species *Calanus finmarchicus* is abundant in all parts of the Norwegian Sea, and is one of the most abundant zooplankton species of the North Atlantic. It is the major herbivore of the Norwegian Sea ecosystem, and the main food of important pelagic fish stocks. The role of *C. finmarchicus* for fish productivity in the large marine ecosystem of the Norwegian Sea and the Norwegian coast, calls for a better understanding of the stock dynamics. For this reason, the Ministry of Fisheries and Coastal Affairs hereby requests ICES to conduct an exploratory assessment of *C. finmarchicus* in the Norwegian Sea, in accordance with the attachment.

Yours sincerely,

Vidar Landmark
Director General

Elisabeth N. Gabrielsen
Acting Deputy Director General

Copy:
Institute of Marine Research
Directorate of Fisheries

ENCLOSURE 1

<p>Postal address: P O Box 8118 Dep N-0403 Oslo, Norway</p>	<p>Office address: Grunnegata 1 Oslo, No: 072 517 815</p>	<p>Telephone *: +47 22 23 90 90 Web: www.fiskeridir.no</p>	<p>Telex: +47 22 24 95 85</p>	<p>Facsimile: Bakke Bommestich, +47 222 46493 post@fiskeridir.no</p>
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Annex 4: WGZE terms of reference for the next meeting

The **Working Group on Zooplankton Ecology** (WGZE), chaired by Piotr Margonski, Poland, will meet in Reykjavik, Iceland, 24-27 March 2014 to:

- a) Finalize production of videos on zooplankton sampling/processing techniques as part of progress in updating the Zooplankton Methodology Manual;
- b) Examine regional and transatlantic distribution and temporal patterns with zooplankton time-series to discern significant changes over time and to identify potential environmental or climate drivers;
- c) Refine and extend the compilation of information on taxonomic categories that are currently monitored in the ICES area including species and stages, individual specific biomass, and ecologically relevant information such as existence ranges, genetic primers for species identification, to be made available and displayed via the WGZE website as an interactive web-based map system;
- d) Prepare the background data needed for calculation of zooplankton productivity and metabolic rates in the ICES area based on allometric approaches i.e. a database in terms of total abundance and total biomass, metadata, with the first calculations available before the meeting in 2014;
- e) Review the progress of the SGIMT;
- f) Review the progress in development of the software and hardware for “automatic” identification and counting of zooplankton organisms;
- g) Compile the information on micro-plastics pollution and its effects on zooplankton communities;
- h) Review of the WGZE scientific achievements as a basis for preparing the multi-annual activities planning.
- i) Review the ICES response to the Norwegian request regarding the *Calanus finmarchicus* exploratory assessment.

WGZE will report by 1 May 2014 (via SSGEF) for the attention of SCICOM and ACOM.

Supporting Information

Priority	The activities of this group are a basic element of the SSGEF, fundamental to understanding the relation between the physical, chemical environment and living marine resources in an ecosystem context. Reflecting the central role of zooplankton in marine ecology, the group members bring a wide range of experienced expertise and enthusiasm to bear on questions central to ICES concerns. Thus the work of this group must be considered of very high priority and central to ecosystem approaches.
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Scientific justification	<p>Term of Reference a):</p> <p>SCICOM Code: 000 (Capacity Building). Updating the ICES Zooplankton Methodology Manual has been identified as a priority activity by this group. Many techniques mentioned in the manual are most effectively communicated visually. A series of short videos will be produced by teams within the group, leading to production of a video series that compliments concepts in the ICES Zooplankton Methodology Manual.</p> <p>Term of Reference b)</p> <p>SCICOM Codes: 115, 162, 321, 322. The Zooplankton Status Report continues to evolve as a major published output of the WGZE. It covers the zooplankton time-series of 116 sites located in whole North Atlantic area as well as accompanying dataserie on sea surface temperature, chlorophyll concentration and surface salinity data (Baltic Sea only). It gives a rare opportunity to examine regional and transatlantic distribution and temporal patterns in existing zooplankton time-series and to identify potential environmental or climate drivers..</p> <p>Term of Reference c)</p> <p>SCICOM Codes: 161, 162, 321. This would be a major product from the group and would be of relevance to various previous and current ToRs. Such a list is fundamental information needed in order to recommend indices and how to apply them.</p> <p>Term of Reference d)</p> <p>SCICOM Codes: 152, 161. Allometric relationships are commonly used to quickly convert routinely collected monitoring data into estimates of zooplankton standing stock that are requested for the assessment and management of the marine ecosystem. At present a wide variety of allometric relationships are available for many zooplankton taxa in the literature; however, there are many taxa for which, useful allometric equations are lacking. Based on data collected in the Zooplankton Status Report it is possible to estimate zooplankton productivity and metabolic rates within the whole ICES area based on allometric approach.</p> <p>Term of Reference e)</p> <p>SCICOM Codes: 121, 122, and 346. This study group is addressing issues of taxonomy that are directly relevant to zooplankton ecology as well as the broader ICES community. Close linkages between the WGZE and the SGIMT will ensure that the latter is successful and will keep members of the former informed about new developments in this area.</p> <p>Term of Reference f)</p> <p>SCICOM Code: 000 (Capacity Building). Sample analyses including taxonomic identification, counting and measuring procedures are costly and time consuming. Recent development of software and hardware suitable for implemetation of “automatic” identification and counting of zooplankton organisms need to be reviewed.</p> <p>Term of Reference g)</p> <p>SCICOM Codes: 241 and 245. Microplastics, are a widespread, ubiquitous and accumulating contaminant in marine ecosystems. These particles of a few µm in size are being ingested by a wide range of marine organisms including zooplankton. Ingestion could lead to the transfer of toxic chemicals up the food chain. Monitoring of microplastics and their potential impact on individual organisms and zooplankton communities will be summarized</p> <p>Term of Reference h)</p> <p>SCICOM Code: 000 (Capacity Building). During WGZE 2014 meeting, group will prepare the multiannual ToRs for the following three years period. This has to be done based on so far achievements and scientific priorities which lead the group work over the last years. Review will help focusing discussion on multiannual plan.</p> <p>Term of Reference i): SCICOM Code: Codes: 162,211, and 312. WGZE considered the Calanus Workshop as a very important step towards lower trophic level assessment and it was decided to support this initiative. However, it has to be suspended till some external funding is available as such workshop(s) should be attended by experts far beyond the WGZE internal capacity. WGZE decided to continue with this ToR in 2014, including some inter-sessional, preparatory work but it should be treated as a partial</p>
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Resource requirements	Resource required to undertake the activities of this group is negligible. However, ICES must be committed to provide some sponsorship and support for workshops (WKSERIES and possibly WKCALANUS)
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	The Group reports to the SSGEF, SCICOM and ACOM. Mainly WGZE provides scientific information on plankton and ecosystems and welcomes input from other committees and expert groups.
Linkages to other committees or groups	Any and all expert groups interested in marine ecosystem monitoring and assessments, modelling and/or plankton studies, including fish and shellfish life histories and recruitment studies. Strong working links have been developed between WGZE and Mediterranean colleagues (CIESM). WGPME will likely work closely with WGZE on issues of microzooplankton ecology and trophic coupling between phytoplankton and zooplankton.
Linkages to other organizations	Links with the WGPME and WGHABD are intended and some contact is maintained. The Plankton Status Report is of interest and practical use to a range of interested groups within ICES, PICES, CIESM, and GOOS with other national and international research groups and agencies. Increasingly marine research, marine management and even marine institutes are re-aligning to take an ecosystem view. These linked and collaborative approaches between many expert groups must be encouraged. IGBP, SCOR, ESF, COML/CMarZ, and others have research activities meetings etc., of interest and relevant to the activities of the WGZE. Contacts are maintained through networking and collaborative activities.

Annex 5: Recommendations

Recommendation	Adressed to
1. Continue with an idea to organize the WKALANUS when external funding is available and with Erica Head as a new co-chair	SSGEF, ACOM
2. Propose Theme Sessions for the 2014 ASC	SSGEF
3. Add Todd O'Brien as an additional WKSERIES co-chair	SSGEF
4. Invite HAWG members to WKSERIES to discuss further cooperation	HAWG