DRAFT Theme Session P – Integrated assessments in support of regional seas ecosystem advice – beyond quality status reporting

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Introduction

The provision of integrated advice is a challenge, it is a process which must be supported by methods and tools that allow diverse sources of data and information on numerous pressure and state changes to be objectively and scientifically assessed. The emphasis of this Theme Session is to explore the approaches taken (in terms of frameworks, tools, and techniques developed) to integrate diverse sources of marine data for assessment purposes. The Theme Session wishes to highlight what we can learn by undertaking such analyses and the value it can add to the provision of integrated advice at a regional seas scale. The aim is to improve the management of human activities, and the regulation of pollution pressures, in a way not presently achieved by quality status reporting.

Papers were presented in the following areas of interest:

Examples of the type of data and indicators monitored for integrated assessment purposes. (what to measure).

Metadata analysis (numerical methods of analysis and approaches which accommodate diverse sources of data measured in different units and scales);

Lessons learnt (what are the limitations, assumptions, and benefits of integrated data assessment and how should the results be best presented to meets the needs for advice and management purposes);

Part 1 – What to Measure?

The first paper (P:01 Georgi M. Daskalov and Steven Mackinson: Abundance and trophic interactions in North Sea fish) described a study at the UK CEFAS laboratory, based on building an extensive Ecopath model of the North Sea, populated with extensive data sets, mainly from ICES sources and covering 80 ecosystem components. One objective of the study will be to explore environmental change hypotheses and alternative fisheries harvesting policies. All types of fishing gear presently used in the North Sea were included in the fisheries sub-model. The initial model set-up, following balancing of the food-web, was compared to the results of Sparholt (1991) simulation of the North Sea food-web and the Mackinson (2002) estimate of the North Sea ecosystem in 1880. One early result has highlighted a recent change towards a decreasing abundance of predator fish, with an increase in prey fish.

The paper which followed (P:02 Niels Daan: What is a “large fish”? - taking a species perspective) had as its background the development by OSPAR of an Ecological Quality Objective focusing on the proportion of “large fish” in the fish community. The paper raised the question of perspective, as the concept of what defines a “large fish” presently comes from a human perspective with, for example, the commercial and scientific communities having different views of what a large fish is. In the North Sea, almost all fish above 60cm is either cod or saithe, while “small fish” are either Norway pout and sprat. Dividing one by the other to reach a ratio has little ecological validity. Hence the proportion of “large fish” should be viewed from a species perspective. Here “large” means a mature fish that can contribute to the spawning population, i.e. ”small” is where L<Lmat (length at maturity), and “large” is where L>Lmat. Using this ration for the IBTS data set, ratios can be derived for the average species or the total catch. Both ratios are declining over the last 30 years – from 0.7 to 0.6. Separating

into species groups, the same trend applies more or less to all groups. However, the absolute levels differ between species groups. The “large fish” ratio is very variable between individual species, making the setting of an EcoQO very difficult. However, there is a clear signal in the average species ratio is more informative than the catch ratio. Comparing the trends in the ASR with the results of stock assessments using the SSB/TSB ratio, there appears no match which is concerning. When SSB/TSB is compared to F, there is a relation ship for haddock, whiting and saithe, but none for cod, which is again a concern. The main conclusion is that the proportion of large fish is not straight forward as an EcoQO.

Questions: Confounding effect of genetic changes under fishing pressure. Hence the length of maturity itself is decreasing. However, in the analysis presented here the Lmat is kept constant. In some assessments Lmat have been decreased. Why do surveys and assessments produce different results? Too much trust placed in assessments, as uncertainty is present especially due to miss-reporting. Changes in natural mortality may also be possible, for example natural mortality on the juveniles has decreased as we have removed the predators.

The third paper (P:05 D. K. Mills, M. Devlin, C. Kirk, and S. J. Malcolm: Towards improved monitoring and assessment of marine eutrophication) had the OSPAR Comprehensive Procedure for eutrophication as the staring point. The 2002 assessment highlighted “problem areas” and “potential problem areas”. The distribution of these raised political questions between ICES member states in the North Sea. The next assessment being performed this year, is required to be more integrated than the earlier assessment, and the paper demonstrated how new real-time measurements coupled with models will be used in an integrated way. During discussion the question was raised whether chlorophyll represents plant growth, and if whether surface observations from satellite or buoys can describe sub-surface production. A question was raised in relation making the distinction between simple status reporting and describing processes which change in time and space.

The next paper (P:06 P. Larcombe, *et al.*: Marine environmental change over decades to millennia - an evaluation of 'proxy parameters' and their potential use in understanding the state of the marine ecosystem) tried to join records of today with records from the past and trying to assess the significance of observed trends. The rational is that we use indicators of environmental status. Environmental drivers are over decades and centuries – much longer than most of our data sets. Recent projects have demonstrated significant shifts over time scales of centuries within northern European shelf seas. This calls into doubt the significance of some of the presently observed trends. The most promising proxies may come from arctica-islandica shells, microfossils in sediment cores and fish otoliths. In order to calibrate these proxies, contemporary samples are required.

The final paper (P:07 E Garnacho and P. Kershaw: Integrated assessment of chemical pollution pressures and state changes) in this section looked at the development of a model of the impact of chemical contamination applied to TBT as a test case. The aim is to integrate multiple driver-pressure-state-impact relationships, as well as diverse data sources and a range of socio-economic effects. The modeling approach will employ a Bayesian network approach, along with a range of other stochastic methods. In the discussion the ability of this modeling approach to rank possible effects in order of importance was questioned. Sensitivity tests were part of the modeling objectives, and this may help target observations. The modeling approach will be used to build more holistic integrated assessments in the future.

Part 2 - Holistic assessments - drawing data together across themes

In part 2, the results of pilot integrated assessments were discussed. The first presentation summarised progress in the Baltic (P:03 Christian Möllmann, B. Müller-Karulis, R. Diekmann, J. Flinkman, G. Kornilovs, E. Lysiak-Pastuszak, J. Modin, M. Plikshs, Y. Walther, and N. Wasmund: An integrated ecosystem assessment of the Central Baltic Sea and the Gulf

of Riga), a joint effort between ICES and HELCOM with cooperation of the World bank funded Baltic Sea Regional Project (BSRP). Up until now this process had not included an integrating component between the different parts of project. Hence a common workshop (WKIAB) was established to attempt a REGNS-like integration between themes. The region itself is sub-divided into sub-ecosystem regions such as the central Baltic (influenced by inflow from North sea) and the Gulf of Riga (shallow semi-enclosed bay). An initial database was assembled with 75 biotic and abiotic variables for the central Baltic, and 31 for the Gulf of Riga. Analyses applied included PCA, time-series analyses and a traffic light approach. The latter approach appears to show a shift in the central Baltic ecosystem over time since 1975, for example with cod declining over the period, and sprat increasing. A similar ecosystem shift was found in the Gulf of Riga, although different components of the ecosystem were involved. The PCA analysis implied three ecosystem regimes had been present over the period examined. The first regime shift was related to climatic change, the second to an inflow from the North Sea. In summary, the integrated assessment showed changes at all trophic levels, with relationships between climatic and ecosystem components. The analysis provided a more concise picture of ecosystem dynamics, but there is more work needed in order to translate this approach to as management tool.

The second paper presented a similar analysis for the North Sea, produced by the REGNS ICES group (P:09 Andrew Kenny, P. Kershaw, D. Beare, M. Devlin, J. B. Reid, P. Licandro, A. Gallego, K. Winpenny, C. Houghton, M. Langston, H. R. Skjoldal, and A. Perkins: Integrated assessment of the North Sea to identify the relationship between human pressures and ecosystem state changes – implications for marine management). The initial step was the assembly of the underlying database which contained 113 ecosystem parameters, covering 4 trophic levels plus abiotic components. For the over view analysis, spatial as well as temporal analyses were performed. The spatial analyses defined the abiotic sub-regions. The biological clusters are significantly related to these. It was questioned whether these ecological regions corresponded to political divisions of the North Sea, and that this may provide problems in assessments. The traffic light approach was also taken with the North Sea data. Distinct “regime shifts” were noted during the period, with two regimes, one prior to 1983 and one post 1996, with intermediate changes in between. In conclusion, it appears that the North Sea ecosystem does not change abruptly between 1973 and 2004, but rather two stable periods separated by one of variability. The weight of evidence is crucial in predicting ecosystem change with confidence and good indicators of stable state are probably not the same as indicators of early change in ecosystem state.

The following paper (P:04 Doug Beare, Andy Kenny, Peter Kershaw, Eddie McKenzie, M. Devlin, J. Reid, P. Licandro, K. Winpenny, C. Haughton, M. Langston, H. R. Skjoldal, and A. Perkins: Building multi-discipline, multivariate databases for use in integrated assessments: experiences and recommendations) presented some of the difficulties that were encountered in assembling the data sets required by the REGANS analysis. The data fields assembled contained all essential metadata. The database was made accessible via the Internet, and SQL data enquiries have been made available. It was considered that this database will be valuable tool in the future, although questions still remain – for example how to handle fishing effort. The community needs to try and reduce duplication of effort, and develop a single source of data for future integrated assessments.

The final paper (P:10 Michael Langston, A. D. Perkins, D. J. Beare, R. W. Gauldie, P. J. Kershaw, J. B. Reid, K. Winpenny, and A. J. Kenny: Combinatorial algorithms and high performance implementations for elucidating complex ecosystem relationships from North Sea historical data) described developing advanced statistical tools in order to find ecological relationships in complex data. In the discussion it was asked whether this approach could be operationalised. The speaker felt this was completely possible.

Final paper – Lessons learnt from the ICES REGNS process and pointers to way forward and open up to discussion of next steps

The final paper (P:08 A. J. Kenny, P. J. Kershaw, and Doug Beare: The REGNS experience – lessons learnt) attempted to draw lessons from the REGNS process. Integrated assessment breaks down into two strands; process (i.e. the way we work and are organized) and products (numerical assessments of data). Three different user groups are striving for integrated assessment, eg. management, policy/advice and the scientific groups. One lesson learnt was the importance of recognizing these separate groups and their different needs. The REGNS group decided to address the scientific needs of Integrated Assessment whereas the newly established Working Group on Regional Ecosystem Descriptions addressed the policy requirements of IA.

Summary

In the discussion which followed, it was asked what is the advice to ICES in respect, of for example fisheries. This is the importance of having a year to consider the output of REGNS, and to consider how the REGNS product can be used for advice. Possibly consensus on the identification of ecological regime shifts might be one example of how the REGNS type analysis can be used and it is helping to identify the 'key' variables describing stable ecological state, in addition to identifying possible variables which detect the early signs of regime change – these variables are not the same. In terms of data quality, spatial and temporal averages may introduce further degradation to the data quality, although ironically at the same time averaging smooths out differences in the data and helps to reveal gross trends in space and time.

How the methods described in the session deal with uncertainty is not clear, but possibly one way of dealing with this is to use ecological models.

Both sessions were well attended, with active discussions.

Reccomendations

The outputs of REGNS and WKIAB should be reviewed over the next year by WGRED and ACE in order to consider how these integrating approaches can be applied within the ICES advisory process.