ICES Symposium Reports 2013

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Symposium on "Pollutant Responses in Marine Organisms" (PRIMO 17)
Algarve, Portugal, 5–8 May 2013

Symposium on "Acidification of the Arctic Ocean and Northern Seas: Trends and Consequences"
Bergen, Norway, 6–8 May 2013

World Conference on Stock Assessment Methods for Sustainable Fisheries
Boston, USA, 17–19 July 2013

Symposium on "Gadoid Fisheries: the Ecology and Management of Rebuilding"
St. Andrews, Canada, 14–18 October 2013

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

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1 Symposium on "Pollutant Responses in Marine Organisms" (PRIMO 17)

Venue and dates: Algarve, Portugal, 5–8 May 2013

The 17th International Conference on Pollutant Responses in Marine Organisms (PRIMO) convened in May at the University of the Algarve in Faro, Portugal. The symposium, which attracts scientists working in the field of marine ecotoxicology, takes place every second year, and the 2013 event represented the first time ICES has co-sponsored the event. ICES co-sponsored PRIMO this year, with a view to the improvement of links between the wider research community and ICES work, leading to advice on the monitoring and assessment of contaminants in the marine environment.

Some 300 delegates convened during the symposium representing a wide variety of academic governmental and industry ecotoxicologists and environmental chemists from around the world.

Approximately 150 papers and 200 posters were delivered over the three days of the Symposium, spread across fourteen topic areas in 3 concurrent sessions and 2 poster sessions. The scientific disciplines addressed by the symposium covered:

1) Exposome and exposomics
2) Cellular absorption, distribution and elimination
3) Endocrine disruption
4) Ocean acidification / climate change
5) Eepigenetics
6) Ecotoxicology of large marine vertebrates
7) Geno- and pheno-toxicity
8) Combination effects of environmental stressors
9) Emerging compounds / nanomaterials
10) Ecosystem-level effects
11) Tissue levels and immune responses
12) Detection of biological effects of deliberately dumped chemicals
13) Environmental assessment
14) Biomarkers

There were four keynote plenary lectures during the conference:

- Dr. Lora Fleming – "The Interconnections between the Oceans and Human Health"
- Dr. David Crews – "Epigenetic Modifications Induced by Environmental Endocrine Disruptors and Stress"
- Dr. Amy Ringwood – "Lysosomes as Targets for Nanoparticles"
- Dr. Mauro Rebelo – "Crowdfunding in Science"

ICES was represented on the PRIMO Scientific Committee by Co-Chair of ICES Working Group on Biological Effects of Contaminants (WGBEC) Matt Gubbins and Chair of the Marine Chemistry Working Group (MCWG) Katrin Vorkamp. The ICES co-conveners co-chaired several of the theme sessions during the conference.

ICES also sponsored 10 student presentation and poster awards, which were presented to the students by Matt Gubbins and ICES Science Programme Departmental Secretary Vivian Piil during the closing ceremony.

The proceedings of the symposium will be published online in Aquatic Procedia as well as in peer review journals Marine Environmental Research (field studies), Aquatic Toxicology (laboratory experiments) and Environmental Science and Pollution Research (environmental studies).

2 Symposium on "Acidification of the Arctic Ocean and Northern Seas: Trends and Consequences"

Venue and dates: Bergen, Norway, 6–8 May 2013

The AMAP/ICES symposium on "Acidification of the Arctic Ocean and Northern Seas: Trends and Consequences" was held in Bergen, Norway, 6-8 May.

The conference had 123 registered participants with 21 countries represented. The symposium was organized in ten sessions with 33 presentations. The conference was broadcasted on the internet and the webcast was viewed by live audiences of up to 170 individuals with a total of 1850+ connections to date (the webcast is still available at www.ustream.tv). The key findings from the AMAP AOA Assessment were released at the beginning of the conference. Media interest was high from both the national/public broadcasting companies, international news agencies, newspaper and scientific journalists. Newspapers like The Guardian and The Independent, Huffington Post, Globe&Mail Canada and Tehran Times wrote articles. Lead scientist were interviewed by e.g. BBC (national and world service), Norwegian national broadcaster NRK, Canada, Sweden and others. The AOA science promotion movies posted on the AMAP vimeo site (https://vimeo.com/groups/189916/) also proved very successful –the full-length (12-minute) film has ca. 2500 plays (and ca. 3860 loads) and the short (3-minute) film ca. 1300+ plays and 4160 loads to date. There were two panel discussions; one arranged by the Association of Polar Early Career Scientists (APECS), and a final panel discussion with lead authors of the AOA assessment report.

3 World Conference on Stock Assessment Methods for Sustainable Fisheries

Venue and dates: Boston, USA, 17–19 July 2013

The ICES Strategic Initiative for Stock Assessment Methods was designed to assure that scientists can apply the best stock assessment methods when developing management advice for fisheries. This aim is shared by many RFMO and national fisheries organisations. The World Conference on Stock Assessment Methods (WCSAM) was organised as a milestone for the initiative.

At the conference (17–19 July 2013), many of the world's leading stock assessment experts met to test and discuss stock assessment methods. Over 220 participants from 27 countries participated in the conference. The conference provided a forum for presentations on the application and future of stock assessment methods. It considered single stock approaches for data rich and poor stocks, and also multispecies and ecosystem based approaches. A two day workshop preceded the conference (15-16th July) and provided the most comprehensive comparison among assessment methods to date The conference proper began with a challenging key note address by Sidney Holt, who expressed his opinion that MSY as a target is 'rubbish.'

The workshop found that with recent developments in stock assessment methods, a new set of "good practice" guidelines was required. It proposed an iterative route to create the guidelines. These guidelines should first target stock assessment methods but guidelines were also required for simulation testing. New assessment methods should be tested via simulation (applying the new assessment method to data simulated from the same or from alternative models). The workshop further highlighted that there are many challenges still to be resolved when applying multiple models to a single stock, or using generic tools. There was a tension between research groups that were pursuing the generic package approach with those constructing models tailored to particular assessments. The workshop agreed that more robust use of statistical analysis was required when investigating the performance of stock assessment methods.

A clear message from the conference is that a global initiative is needed to synthesise developments in stock assessment methods. Meaningful strategic investment is needed to support stock assessment research. Whilst the majority of research is conducted regionally to meet local objectives, these developments need to be brought together to benefit all RFMO and national efforts so as to ensure that parallel efforts add to our knowledge. A step in this direction could be establishment of stronger connections between the various regional methods working groups.

The fact that the environment varies is well appreciated throughout the stock assessment community. The evolution of assessment methods needs to account for variation in fish productivity and fishery behaviour across space and time. Stock assessment methods should evolve to include information from additional sources (e.g., genetics, tagging, climate and predation). Pure research without application to improve operational stock assessments will not meet the needs of society. Thus developers need to account for changes in management objectives, e.g. incorporation of an ecosystem approach. The need for active feedback loops between research, application and management decisions was demonstrated by many case studies from around the world. Despite the tendency to focus on fishery challenges in well-developed regions, many of the major problems for fisheries management are in de-

veloping countries. One session of the conference offered high resource, or high skills solutions that may not be applicable in developing countries. This illustrates that there are still major challenges in the development of methods appropriate across the globe. The contributions of young scientists to the conference were striking, suggesting a strong demographic wave of talented stock assessment scientists joining the research community, which promises to rise to the challenges before us in fisheries science.

4 Symposium on "Gadoid Fisheries: The Ecology and Management of Rebuilding"

Venue and dates: St. Andrews, Canada, 14–18 October 2013

The aim of the ICES/NAFO symposium on Gadoid Fisheries: The Ecology and Management of Rebuilding Symposium was to (i) address the historical dynamics and current status of gadoid stocks worldwide, (ii) present new scientific findings on the biology and ecology of these species that can be used to improve fisheries management, (iii) link biological changes to environmental changes that can be used to forecast species distribution and productivity related to climate change, and (iv) present and appraise the effectiveness of management actions before, during and after recovery.

The Symposium targeted gadoids, namely cod, *Gadus morhua*, haddock *Melanogrammus aeglefinus*, pollock *Pollachius* spp., hake *Merlucciius* spp., and others. Gadoids remain one of the key groups of exploited demersal fishes worldwide. Recently, marked improvements in population sizes have occurred in a number of gadoid stocks spanning their geographic distributions. Many other stocks, however, remain at depleted levels. Given the commercial value and ecological importance of this group of fishes, the Symposium was highly warranted and brought together 100 participants representing 14 countries to present empirical data and theories to explain the varied recovery rates of gadoid stocks. Participants of Canada, USA, Norway, Chile, Denmark, France, Russia, Spain, Brazil, Australia, Japan, Germany, Finland and the United Kingdom collectively gave 56 oral contributions and presented 35 posters.

The symposium was hosted by Fisheries and Oceans Canada and the Technical University of Denmark. Edward A. Trippel (Canada), Friedrich W. Köster (Denmark) and Robert L Stephenson (Canada) acted as conveners. The Scientific Steering Committee consisted of Steve Cadrin (USA), Olav Sigurd Kjesbu (Norway), Jason Link (USA), Marina Santurtún (Spain), Doug Swain (Canada), and Jonna Tomkiewicz (Denmark).

Not since the early 1990s has there been international symposia dedicated to the biology and ecology of Atlantic cod (St. John's, Canada and Reykjavik, Iceland). In 2006, a Wakefield sponsored symposium on the resiliency of gadoid stocks to fishing and climate change was held in Anchorage, Alaska, with the program heavily focused on North Pacific gadoids (Pacific cod and walleye pollock). In 2009, an ICES/PICES/UNCOVER symposium on rebuilding depleted fish stocks - biology, ecology, social science and management strategies was held in Rostock addressing mechanisms of fish stock recovery and how to best implement stock recovery plans. The ICES/NAFO Symposium in St. Andrews went beyond these earlier symposia by contrasting gadoid stock dynamics in different ecosystems on both sides of the Atlantic, identifying not only ecological settings and management actions leading to recovery, but also considering management plans after and in the absence of rebuilding, acknowledging explicitly environmental change and species interactions.

Contrasting the recovery and non-recovery pattern observed among gadoid stocks across the Atlantic and elsewhere provided an opportunity to gain a better understanding of the important biological, ecological and anthropogenic factors and conditions driving gadoid population dynamics. Moreover, gadoid species differ significantly in key biological attributes that influence stock management advice

through implementation of suitable management reference points, harvest levels, closed areas and seasons, and fishing gear.

The **opening keynote** address on "The collapse of Canadian groundfish stocks – an eye witness account" was given by Jean-Jacque Maguire (Canada). Additional keynote speakers included Peter Wright (United Kingdom) in session 1, Jeff Hutchings (Canada) in session 2, Svein Sundby (Norway) in session 3, Peter Shelton (Canada) in session 4, Anna Rindorf (Denmark) in session 5, and Terrance Quinn (USA) in session 6.

Session 1 "Effects of life history on productivity and stock rebuilding"

This theme session considered the wide variability observed in life history traits among gadoid species/stocks and how these are associated with recruitment and rebuilding. Life history traits of importance that affect productivity and the intrinsic rate of increase include growth, condition, reproduction and survival. Reproductive characteristics examined included age and size at sexual maturity, fecundity, atresia and non-annual reproduction. Subpopulation structures, spawning stock structure and utilisation of spawning habitats were additional aspects considered. Advances in methodological techniques to more rapidly and accurately assess reproductive traits were given.

Session 2 "The ghost of fishing past: effects of fishing on recovery potential"

This theme session considered fisheries-induced evolution of life history traits, loss of genetic stock components or diversity due to fishing, effects of past fishing on the ecosystem and habitat and other effects that are linked to fishery exploitation. A series of open questions was addressed such as 1. Is growth reduced in some stocks due to size-selective fishing? 2. Do population shifts in age and size at sexual maturity have a genetic basis, and if so what conditions and time frame would be required for these life history traits to return to previous levels? 3. Do life-history changes associated with fishing have a negative, positive or neutral effect on recovery potential? Especially, depensation, a decrease in productivity at small population sizes, may limit the ability of severely depleted stocks to rebound; evidence of this phenomenon was reviewed and implications for recovery implications outlined.

Session 3 "Climate change and stock rebuilding"

This theme session examined how climate change influences fish population dynamics and in turn how this would impact rebuilding. Temperature, oxygen, and pH are key environmental variables predicted to become altered by the end of this century in a changing climate due to increased levels of atmospheric carbon dioxide. Especially the impact of changes in temperature on population dynamic rates and distribution were investigated and the linkage of climate related changes and management measures were addressed. Our capacity to predict climate change related stock, food web and community structure was reviewed and predictive models that examine latitudinal shifts in species distributions and changes in optimal growing zones, spawning habitats and migratory patterns were considered.

Session 4 "Case histories of successful or failed rebuilding"

This theme session discussed the differences that distinguish successful versus failed rebuilding (e.g., fisheries management practices, ecosystem differences, population biology differences). Contrasting the recovery and non-recovery patterns observed among gadoid stocks worldwide provided an opportunity to gain a better under-

standing of the important biological, ecological and anthropogenic factors and conditions driving gadoid population dynamics. Special emphasis was given to the performance of recovery plans and the role of changes in natural mortality both of the target and its prey species.

Session 5 "Community ecology and stock rebuilding: effects of predators, prey and competitors"

This theme session considered the importance of interactions with other taxa in determining the productivity of gadoid stocks and how this may limit or enhance rebuilding. Presentations on the effects of predation by seals and other marine mammals on gadoid recovery in a variety of ecosystems were given. In addition to these top-down processes by apex predators, presentations on bottom-up processes were made, linking physical processes, primary production and prey abundance to body growth, recruitment, survival and recovery of gadoid stocks. The effect of spatial and temporal dynamics of species interactions on gadoid stock dynamics and rebuilding was another subject addressed. Finally, possibilities for incorporation of these processes in stock assessment and fisheries management were explored.

Session 6 "Stock assessment and fisheries management"

Cod, haddock, pollock and hake differ significantly in key biological attributes that may influence management approaches required to promote rebuilding or maintain sustainable fisheries. This session explored the role of stock assessment in successful management and rebuilding. For example, model misspecification (e.g., incorrect representation of natural mortality) and incomplete or erroneous input information (e.g., lack of catch information) were identified to play a role in failures to maintain sustainable fisheries or rebuild depleted stocks. Furthermore, the effects of uncertainty in stock structure and mixing of stocks on stock assessments and perceived stock status were explored and the sensitivity of biological reference points for fisheries management to changes in reproductive success, stock productivity and distribution investigated.

A **panel discussion** on the final day of the symposium was facilitated by Rob Stephenson and permitted industry and managers to give their perspectives on the findings of the symposium. This stimulated audience discussion surrounding the reported methods potentially available to rebuild stocks as well as identifying obstacles.

The **expected outcome** of the symposium includes a summary on state of the art, enhanced understanding, improved predictability and identification of future research needs with respect to:

- biological, ecological and anthropogenic factors and conditions driving gadoid population dynamics;
- interacting effects of relaxed fishing pressure, changing environmental conditions, and altered fish community structure on gadoid stock dynamics;
- the impact of changes in ecosystem structure and productivity on gadoid dynamics and resiliency of stocks;
- the effectiveness of fisheries management measures in rebuilding depleted stocks and preventing stocks from collapsing.

The proceedings of the symposium will be published in a special volume of the *ICES Journal of Marine Science*.

Acknowledgements

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