

ICES SYMPOSIA REPORT 2017

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ICES/PICES Symposium on Drivers of Dynamics of Small Pelagic Fish Resources

6–11 March 2017, Victoria, Canada

Oceans Past VI

16–18 May 2017, Sesimbra, Portugal

3rd ICES/PICES Early Career Scientist Conference

30 May – 2 June 2017, Busan, Korea

ESSAS International Open Science Meeting

11–15 June 2017, Tromsø, Norway

BONUS symposium:

Science delivery for sustainable use of the Baltic Sea living resources

17–19 October 2017, Tallinn, Estonia

International Flatfish Symposium

11–16 November 2017, Saint-Malo, France



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1 ICES/PICES Symposium on Drivers of dynamics of small pelagic fish resources

Venue and dates: Victoria, Canada, 6–11 March 2017

Conveners: Jürgen Alheit (ICES) and Yoshioki Oozeki (PICES)

Populations of small pelagic fish (SPF) such as sardine, anchovy, herring, capelin and mackerel provide about 25% of the total annual yield of capture fisheries, and the well-being of many coastal communities around the world, particularly in developing countries, depends critically on these resources. Small pelagic population sizes exhibit extreme fluctuations in abundance and geographic distribution due to the impact of environmental and anthropogenic influences. In spite of many internationally coordinated research efforts, we still do not have sufficient knowledge about the drivers of small pelagic fish recruitment and particularly the interactive effects of environmental and anthropogenic factors.

The Fisheries and Agriculture Organization (FAO) and the Intergovernmental Oceanographic Commission (IOC) organized 1983 an international symposium titled *“The Expert Consultation to examine Changes in Abundance and Species Composition of Neritic Fish Resources”* in San José, Costa Rica (FAO Fisheries Report 291, 1983, 3 Volumes). The symposium was a major success and inspired many research efforts on small pelagic fishes for the next three decades. The most memorable presentation in San José was that of Prof. Tsuyoshi Kawasaki on *“Why do some pelagic fishes have wide fluctuations in their numbers? Biological basis of fluctuation from the view point of evolutionary ecology”*. It was the first time many of those attending were confronted with the phenomenon of small pelagic fish population abundances varying synchronously in many unconnected regions of the global ocean. This is an issue that we are still attempting to understand, as the distances between the small pelagic stocks are great, atmospheric and ocean connections weak and unclear, and mechanisms unresolved.

The PICES/ICES international symposium on *“Dynamics of Small Pelagic Fish Resources”* was organized on 6–11 March 2017 in Victoria, BC, Canada, as a follow-up event to the FAO/IOC Conference, because there was no global symposium on SPF since 1983, and the exchange of information about SPF globally has declined since the end of the GLOBEC project in 2008. The goal of the symposium was to revitalize global international cooperation on investigations of SPF, and to identify, discuss and develop a framework to address unresolved questions such as the impact of climate and/or fishing pressure on the resilience of small pelagic populations using a comparative approach. Because of the importance of environmental and anthropogenic drivers on small pelagic resources, the participation of experts in the fields of physical oceanography, climate, and socio-economics was strongly encouraged.

The symposium was co-convened by Jürgen Alheit (ICES) and Yoshioki Oozeki (Japan, PICES) and coordinated by Alex Bychkov (PICES) and Wojciech Wawrzynski (ICES). They were assisted by the Scientific Steering Committee consisting of Miguel Bernal (FAO, CFCM), Arnaud Bertrand (IRD, France), Jennifer Boldt (DFO, Canada), Emanuele Di Lorenzo (PICES, USA), Salvador Lluch-Cota (CIBNOR-COBACYT, Mexico), William Peterson (PICES, USA), David Reid (ICES, Ireland), Svein Sundby (ICES, Norway) and Merete Tandstad (FAO). The major sponsors were PICES and ICES. The local sponsor was Fisheries and Oceans Canada. In addition, several scientific and industrial institutions co-sponsored the meeting.

The symposium was attended by 233 scientists from 31 countries, three of whom were veterans from the Costa Rica conference in 1983. The 5-day symposium consisted of an opening session, 6 theme sessions (conducted parallel by two/three sessions daily), poster presentations, and a plenary summing-up session. It was followed by a day of 6 concurrent post-symposium workshops.

The symposium was opened by the two co-conveners, Yoshioki Oozeki and Jürgen Alheit, who welcomed the participants and pointed out the scientific merits of Prof. Tsuyoshi Kawasaki, who sadly had died recently.

The opening session was concluded by two excellent lectures on “*Progress in small pelagic fish research in the 3 ½ decades since ‘Costa Rica’*” by Andrew Bakun and “*Causality linkages in atmosphere, ocean and marine ecosystems over the North Pacific: Modes, processes and prediction*” by Shoshiro Minobe. In the evening of the first day, PICES hosted its traditional highly popular and always successful welcome reception in the Royal BC Museum.

The six Topic Sessions on days 1–5 were:

- S1: Environmental control of spatio-temporal changes in population size, distribution and migration of small pelagic fish in the ecosystem context. Conveners: Emanuele Di Lorenzo (USA), Dimitri Gutierrez (Peru), Svein Sunby (Norway), and Yongjun Tian (China).
- S2: External drivers of change in early life history, growth and recruitment processes. Conveners: Dave Checkley (USA), Susanna Garrido (Portugal), Pierre Petitgas (France), Akinori Takasuka (Japan).
- S3: The role of small pelagic fish in food web dynamics between plankton and top predators. Conveners: Arnaud Bertrand (France), Salvador Lluch-Cota (Mexico), Bill Peterson (USA).
- S4: Comparison of methods for assessment of small pelagic fish populations. Conveners: Miguel Bernal (Italy), Jennifer Boldt (Canada), Momoko Ichinokawa (Japan), Reidar Toresen (Norway).
- S5: Future challenges for ecosystem-based management of highly variable fish populations. Conveners: Rick Fletcher (Australia), Dave Reid (Ireland), Merete Tandstad (Italy), Andres Uriarte (Spain).
- S6: Small pelagic fish and humans - social, economic and institutional dimensions. Conveners: Manuel Barange (Italy), Marloes Kraan (Netherlands), Mitsutaku Makino (Japan), Jörn Schmidt (Germany), Rashid Sumaila (Canada).

On the last day, concise and highly informative session summaries were given by Ryan Rykaczewski (S1), Susana Garrido (S2), Arnaud Bertrand (S3), James Ianelli (S4), Merete Tandstad (S5), and Marloes Kraan and Yoshioki Oozeki (S6).

At the closing ceremony, on the last day of the symposium, awards were given to early career scientists. The *Best ECS Presentations Awards* were given to Criscely Luján-Paredes (Peru), Claire Saraux (France), Tatsuya Sakamoto (Japan), Paul Kotterba (Germany), Emily Liljestrang (USA), Margarate Siple (USA). The *Best ECS Poster Presentation Award* was given to Martha Albo-Puigserver (Spain).

At the end of the closing ceremony, Jürgen Alheit thanked all participants for their enthusiastic and active role during the conference and pointed out again the very professional efficiency of the PICES team under the guidance of Alex Bychkov in

organizing the symposium. He noticed that quite a few old hands in the field of small pelagic fish research have recently retired, or will do so soon, and that it is time to 'pass on the torches' to the next generation. He encouraged the audience not to wait again several decades for the next small pelagic fish symposium but to organize such an event on a regular basis to maintain exchange of information and cooperation among scientists in this field, which was successfully re-started during the Victoria symposium.

The day following the symposium was devoted to six concurrent post-symposium workshops:

- W1: Environmental control of spatio-temporal changes in population size, distribution and migration of small pelagic fish in the ecosystem context. Conveners: Jürgen Alheit (Germany), Emanuele Di Lorenzo (USA), Ryan Rykaczewski (USA) and Svein Sundby (Norway).
- W2: Methods and techniques for sampling and assessing small pelagic fish populations. Conveners: Jennifer Boldt (Canada), Matthew Baker (USA), Miguel Bernal (Italy) and Stylianos Somarakis (Greece).
- W4: Modeling migratory fish behavior and distribution. Conveners: Shin-ichi Ito (Japan) and Enrique Curchitser (USA).
- W5: Recent advances in the life stage ecophysiology of small pelagic fish: Linking laboratory, field and modeling studies. Conveners: Myron Peck (Germany), Kirstin Holsman (USA), Shin-ichi Ito (Japan) and Laure Pecquerie (France).
- W6: Remote sensing and ecology of small pelagics. Conveners: Shubha Sathyendranath (UK), Grinson George (India), Nandini Menon (India) and Trevor Platt (UK).
- W7: Simulation approaches of forage fish populations for management strategy evaluations. Conveners: Margarete Siple (USA) and Laura Koehn (USA).

2 Oceans Past VI: Historical Perspectives on the Elements and Dynamics of the Marine Socio-Ecological System

Venue and dates: Sesimbra, Portugal, 16–18 May 2017

Convener: Alison MacDiarmid (New Zealand)

Science Steering Group Chair: Henn Ojaveer (Estonia)

Local host: Cristina Brito (Portugal)

The Oceans Past series of conferences are a platform for dissemination and discussion of new research findings in the fields of historical marine ecology, and fisheries and maritime history. The conference held this year in Sesimbra was the sixth event since 2005. It was organised by the international Oceans Past Initiative (OPI) – a global research network for marine historical research. OPI's goal is to enhance knowledge and understanding of how the diversity, distribution and abundance of marine life in the world's oceans has changed over the long term to better indicate future changes and possibilities. The conference was financially supported by the EU COST Action Oceans Past Platform (OPP) coordinated by Prof. Poul Holm (Trinity College Dublin, Ireland).

The conference had over 70 registered participants. The participants at the conference are both natural and social scientists (ecologists, oceanographers, economists, historians, archaeologists), and the field is highly interdisciplinary. The participants came from 23 countries: Australia, Belgium, Croatia, Denmark, Estonia, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, South Africa, Spain, Sweden, Turkey, UK, and USA.

During the conference 49 talks, 12 posters and 3 key note addresses were presented. The conference talks were arranged into 11 following sessions:

- Changing values and perceptions of species
- Socio-ecological approaches
- Socio-political and gender aspects of marine resource use
- Whales and whaling (two sessions)
- Insights from archaeology
- Various Anthropogenic impacts
- Impacts of and insights into changing climate
- Trajectories of change (two sessions)
- Acquiring and communicating knowledge of marine systems

The three keynote addresses spanned a wide range of issues and included:

- “Nurture” and the “Anthropocene”: new perceptions of the Oceans’ Past dynamics’ (by Amélia Polónia);
- Fighting for fish: an historical perspective on fish wars (by Malcolm Tull);
- Ignore historical data and miss the boat: role of past information on quantitative analysis of marine resources (by Simone Libralato & Tomaso Fortibuoni).

Geographically, most presentations addressed case studies in the NE Atlantic, Mediterranean, and NW Atlantic, although some presentations addressed cases in the south Pacific and Indian Ocean (Australia, New Zealand).

Integral part of the symposium was OPP training school 'Transdisciplinary marine historical and ecological research – getting to grips with the big story of human interactions with the marine environment' organised and supervised by the symposium convener Alison McDiarmid. The aim of the training school was to enhance expertise skills on environmental history research and followed the steps of Developing the idea; Sharing a vision; Building the team; Finding the funding; Kick-starting the project; Maintaining the focus; Keeping in touch; Authorship issues; Obstacles to overcome. All the participants of Oceans Past VI Conference were invited to attend, upon registration, but priority was given to early career researchers.

The conference had strong participation and collaboration with members of ICES Working Group on the History of Fish and Fisheries (WGHIST). In addition, synthesis committee, management committee and working groups meetings of the COST OPP took place either prior to, during or immediately after the conference. This has allowed to fund substantial part (>50%) of participants from the COST OPP. In addition, attendance of several participants was funded by the Norfish project (2016–2020) funded as an ERC Advanced Grant to Prof. Holm.

These three initiatives (ICES WGHIST, COST OPP, Norfish) and other ongoing projects, could potentially disseminate new results at the Oceans Past VII conference to be held in Germany, in October 2018 (local host Gesche Krause, AWI).

Oceans Past VI Programme and Abstract Book are available at <http://www.escolademar.pt/oceanspastvi/>.

3 3rd ICES/PICES Early Career Scientist Conference: "Climate, Oceans and Society: Challenges & Opportunities"

Venue and dates: Busan, Korea, 30 May – 2 June 2017

Conveners: Hal Batchelder (PICES) and Wojciech Wawrzynski (ICES)

The 2017 Early Career Science Congress “Climate, oceans and society: Challenges and opportunities” was held from May 30 to June 2 in Busan, South Korea. The venue offered by the Korean hosts was excellent, 140 participants came from ICES and PICES member states and also from third countries like Chile, Bangladesh and Nigeria. The conference was aimed at encouraging participation of young scientists in international scientific investigations and promoting their involvement in the management and stewardship of the marine sciences. This year’s theme sessions were on:

- climate effects on physical, chemical and biological processes;
- anthropogenic effects on the marine environment;
- patterns and processes in marine ecosystems, which were further divided into several sub-sessions.

Studies described tools and models for understanding patterns such as biodiversity hotspots, the dynamics of populations and communities, and fundamental processes in marine ecology and oceanography, while being of direct relevance for managing marine populations and determining human impacts. The introduction of anthropogenic substances to the ocean and their impacts was approached as well as the key question of how to adapt to ecosystem-based management while accounting for direct and indirect effects of human uses. Methods to facilitate communication and decision-making while improving the law-science interface were also of particular interest. Additionally, topics considered the ecosystem effects of melting sea ice, sea surface temperature rise, or ocean acidification and how it affects coral reefs. Emphasis was also placed on wave modelling and estimations of coastline changes due to erosion and sea level rise. Oral presentations and posters covered a broad spectrum of research areas related to marine ecosystems. Presentations were excellent and professional, their content highly relevant for both PICES and ICES and the entire conference can be viewed as a success.

Future ICES/PICES Early Career Science conferences (next one planned for 2022 in North America) may consider the following:

- Informing participants on how to become a member of the ICES/PICES working groups (as requested in Busan);
- Explaining what and how ICES and PICES networks work to introduce early stage professionals to the two organizations;
- Actively promoting networking processes between the ICES and PICES communities Promoting innovative ways to present research results and disseminate them via media.

A short video with interviews of the congress participants has been published: <https://www.youtube.com/watch?v=ueiiPdkpOf4>

4 ESSAS Symposium on “Moving in, out, and across Arctic and Subarctic Marine Ecosystems: Shifting Boundaries of Water, Ice, Flora, Fauna, People and Institutions”

Venue and dates: Tromsø, Norway, 11–15 June 2017

Conveners: Ken Drinkwater (Norway), Franz Mueter (USA) and Sei-Ichi Saitoh (Japan)

The conference took place at the Radisson Blue Hotel in Tromsø, Norway. Four ad-joint workshops were held (11 June) prior to the four day conference (12–15 June). The conference was organized by The Ecosystem Studies of Subarctic and Arctic Seas (ESSAS) program which is a regional program of the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project. ESSAS objectives are to understand how climate variability and climate change affect the marine ecosystems of Subarctic and Arctic seas and their sustainability, and in turn, how changes in the marine ecosystems affect humans.

The conference was co-sponsored by The International Council for the Exploration of the Seas (ICES), The Pacific International Council for the Exploration of the Seas (PICES), The Integrated Marine Biogeochemistry and Ecosystem Research (IMBER), Institute for Marine Research (IMR) Norway, FRAM - High North Research Centre for Climate and the Environment, The Research Council of Norway, International Arctic Science Council (IASC), National Oceanographic and Atmospheric Administration (NOAA), North Pacific Fishery Management Council, National Aeronautics and Space Administration (NASA) and Arctic Research Center of Japan.

The aim of the symposium was intended to document the changes that have occurred in the distant to recent past, the processes that led to these changes, and how future changes are likely to further affect these marine ecosystems. Also it was to discuss how people who depend on these ecosystems may best cope with these changes and examine the economic and societal pressure that will come to bear on coastal communities and nations. To place the present day in a longer-term perspective, the symposium also included a session on the paleo-ecology of ecosystems in the Subarctic and Arctic regions related to changing temperature and sea-ice conditions of the past.

The meeting program included morning plenary sessions featuring keynote speakers and three parallel sessions in the afternoon. The general secretary of ICES, Anne Christine Brusendorff, gave a plenary talk on ICES in context of international collaboration and Subarctic and Arctic science. The titles of the scientific program of the four workshops and nine theme sessions was as follows:

- WKS1. Paleo-Ecology of Subarctic and Arctic Seas (PESAS) Planning Workshop
- WKS2. Climate change impacts on nearshore fish habitats in the Arctic
- WKS3. Using natural analogues to investigate the effects of climate change and ocean acidification on northern ecosystems
- WKS4. Arctic and sub-Arctic climate change impacts: a transdisciplinary perspective
- S1. Paleo-Ecology.
- S2. Advection and mixing and their ecosystem impacts
- S3. Timing/phenology and match-mismatch: are they critical issues?

- S4. Shifting habitats, persistent hot spots, and the distribution of benthos, plankton, fish, seabirds and marine mammals - observations, models, mechanisms and effects
- S5. Subarctic and Arctic Marine Ecosystems under Climate Change.
- S6. Multiple Stressors
- S7. Ocean Acidification
- S8. Science, Policy and Management
- S9. General Open Session

The workshops and symposium included a total of 194 presentations (opening, key notes, invited, contributed oral presentations (at workshops and main meeting), posters and conference summary) as outlined in table below.

| | 11 JUNE | 12 JUNE | 13 JUNE | 14 JUNE | 15 JUNE |
|-------------------------------|---------|---------|---------|---------|---------|
| Workshops presentations | 17 | | | | 3 |
| Opening | | 1 | | | |
| Invited plenary keynote | | 6 | 4 | 3 | 2 |
| Contributed oral presentation | | 30 | 47 | 38 | |
| Posters | | | 42 | | |
| Conference summary | | | | | 1 |
| Overall sum | 17 | 37 | 93 | 41 | 6 |

The conference was attended by 197 participants, including scientists, students, and managers interested in different aspects of Subarctic and Arctic research. The following countries were represented: Australia (1), Canada (14), China (1), Denmark (5), Faroe Islands (1), Finland (4), France (2), Germany (5), Greenland (1), Iceland (4), Ireland (1), Japan (18), Norway (86), Republic of Korea (8), Russia (3), UK (1), USA (40). ICES funds covered participation of early career scientists from several member countries.

It is not possible to mention in detail all the excellent presentations from the symposium but most important conclusions and key messages were collated and presented in a wrap up talk by one of the conveners (Franz Mueter). The most important points mentioned are that clearly recent warming, melting of ice and ocean acidification is affecting the ecology and ecosystems of the whole of Subarctic and Arctic. Fauna is borealizing, people is moving, traffic is increasing, institutional and management structure may need adjustment, adaptation is needed to effects of temperature changes on species composition and abundance of exploited species and management may need to become more flexible. Future work calls for human resources working in co-operation and across disciplines.

The proceedings of the symposium are planned for publication in the *ICES Journal of Marine Science* in 2018.

5 **BONUS symposium: Science delivery for sustainable use of the Baltic Sea living resources**

Venue and dates: 17–19 October 2017, Tallinn, Estonia

Conveners: Henn Ojaveer (Estonia), Jan Dierking (Germany) and Stefan Neuenfeldt (Denmark)

Science Steering Group chair: Andris Andrusaitis (Finland)

The symposium was organised by two EU BONUS projects: Integrating spatial processes into ecosystem models for sustainable utilisation of fish resources (INSPIRE) and Biodiversity changes – investigating causes, consequences and management implications (BIO-C3). It consisted of science delivery not only for the scientific community but also, through stakeholder panel discussions, for the policy-relevant cross-sectoral audience of key end users. The following BONUS projects contributed to the symposium: GOHERR, BALTICAPP, BAMBI, BLUEWEBS, CHANGE, BALTCOAST, OPTIMUS and INTEGRAL.

The conference had nearly 150 registered participants. The participants came from 14 countries: Austria, Belgium, Canada, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Netherlands, Norway, Poland, Sweden and US.

During the conference 72 talks, 35 posters and 3 key note addresses were presented. The conference talks were arranged into 5 following sessions:

Session 1: Potential and genetic basis for colonisation, acclimation and adaptation (to report advances in our knowledge relative to the potential and genetic basis for colonisation, acclimation and adaptation of selected native and alien invasive species/populations).

Session 2: Process-based knowledge on spatial population dynamics, species interactions and habitat connectivity (to quantify population dynamics and species interactions of key Baltic species in a spatially explicit context, and identify processes generating spatial structure and heterogeneity; to also address potential hazards to the connectivity between identified key habitats, including the impact of human induced and climatic environmental changes on habitat connectivity).

Session 3: Ecosystem internal and external drivers of change affecting biodiversity (to further advance the knowledge on functional links between selected biodiversity metrics and single/synergistic external pressures (e.g., fishing, eutrophication, climate change, biological invasions) and resulting alterations in food-web interactions affecting biodiversity).

Session 4: Temporal dynamics in biodiversity (to focus on the past patterns and future projections in biodiversity under changes in key drivers and pressures affecting biodiversity).

Session 5: Ecosystem-based adaptive management in the context of new understanding in spatio-temporal heterogeneity (to report on (1) advances to expand the knowledge base in the field of spatially explicit advice for ecosystem-based adaptive management, accounting for the spatial heterogeneity in species distributions, and (2) showcase the emerging socio-economic dimensions of marine management).

The **three keynote addresses** were:

- Spatial and temporal dimensions in European marine biodiversity research: Geographic gradients in benthic biodiversity over the Baltic and Europe, and a reflection on European developments in marine biodiversity networking (by Herman Hummel);
- Response of North Sea flatfish populations to centuries of exploitation: lessons for management (by Adriaan Rijnsdorp, Georg Engelhard, Ann-Katrien Lescrauwaet, Jan Jaap Poos, Tobias van Kooten);
- How to catch fish, preserve habitat, conserve other critters, derive energy, avoid too much bad stuff, have lots of tourists, utilize the ocean, and keep people happy all at once (by Jason Link).

The stakeholder panel discussion on '**Science delivery for sustainable use of the Baltic Sea living resources – where to go from here?**' was arranged into three panels:

- 1) Main challenges of integrating multiple interests in sustainable ecosystem management (moderated by Georg Martin, University of Tartu);
- 2) Main challenges of sustainable balanced management in fisheries (moderated by Kaire Märtin, Ministry of Environment of Estonia);
- 3) Main challenges for matching research and policy/management needs (moderated by Liina Eek, Estonian Research Council).

Representatives from HELCOM, ICES, OSPAR, JPI Oceans, EFARO, WWF as well as relevant ministries in Estonia, wider Baltic Sea region and the European Commission were invited to panels.

The conference programme, stakeholder panel discussion agenda and book of abstracts are available at: <http://www.bonus-inspire.org/symposium>

6 International Flatfish Symposium

Venue and dates: 11–16 November 2017, Saint-Malo, France

Conveners: Anik Brind'Amour, Marie-Laure Bégout and Olivier Le Pape

Agrocampus Ouest and the French Research Institute for Exploitation of the Sea (IFREMER) were pleased to host the 10th International Flatfish Symposium (<http://www.flatfishsymposium.com/international-flatfish-symposium-2017>) from 11 to 16 November 2017 in Saint-Malo (France).

Objectives

The flatfish symposia have, since their first edition, provided a platform for all flatfish scientists to share their interest and knowledge in the biology and ecology of this group of fish species. The program focused on flatfishes stimulated interactions among various scientific disciplines (systematics, morphology, physiology, genetics, ecotoxicology, technology, modelling, population dynamics, ecology, fisheries and aquaculture science, etc.).

Following the previous meetings, the 10th International Flatfish Symposium, entitled “Ten International Flatfish Symposia and 30+Years of Advanced Research: Flatfish Ecology in 2017” aimed at:

- Present emerging research on the biology and ecology of flatfish species across the globe,
- Quantify linkages between flatfishes, atmospheric, oceanographic, and other abiotic and biotic components of the ecosystem,
- Explore management tools for assessing and improving the sustainability of flatfish populations and related human activities (fisheries and aquaculture).

This 10th edition welcomed 130 attendees. The Symposium has attracted a diversity of participants from across the globe, in total 5 continents and 19 countries were represented.

Themes

The 10th International Flatfish Symposium included all areas of research concerning flatfish ecology. Scientific contributions (8 keynotes, 67 talks and 33 posters) were structured in 5 sessions:

- Ecology (spatio-temporal connectivity along the life cycle, essential flatfish habitats, and understanding short to long term changes);
- Interspecies comparisons and interactions (flatfish versus flatfish; flatfish versus other species);
- Experimental ecology and evolution (observations in the field, common garden, caging, etc.), biotechnology, and other research technologies, including aquaculture and other applications;
- Anthropogenic pressures (multi-stressor; e.g. global change, eutrophication, and pollution) in addition to (or excluding) fisheries;
- From local- to global-scale issues in research and ecosystem-based management.

To sum-up, the main insights of the symposium were:

- Large improvements in knowledge concerning flatfish movements and behaviour at different life stages. New tagging tools and improvement in analysis of natural tracers (otoliths, genetics, stable isotopes, etc.) allowed enhancing multi-tracers research activities. Accordingly, knowledge on spatial connectivity at different life stage is progressing further. If stocks are useful management units, the metapopulation dynamics of flatfish lead to both spatial structure at small scale, below stocks units, and exchange between populations, with consequences on effectiveness and appropriateness of management measures.
- Deeper enquiries of anthropogenic pressures impacting flatfish were covered with a large panel of pressures accounted for. i.e., granulate extraction, beach nourishment, wind farms, xenobiotics, eutrophication, direct and indirect effects of fishing, new fishing practice (pulse trawling). New approaches were also presented to infer on local impacts (e.g. exposure to xenobiotics, at population scale).
- Ongoing progress concerning biotechnology and flatfish aquaculture.

A selection of papers based on keynotes, talks and posters will be published in two special issues of *Journal of Sea Research*, in 2018 and 2019.

In addition, and for the first time, the symposium hosted a workshop entitled “The Scientists-Stakeholders dialogue for Flatfish fisheries management, international contrasts”. Representatives of French fishermen (Producers organisations and national fisheries committee) joined the symposium for a 2.5 hours session. After a short presentation by scientists and stakeholders of the situation in France, the discussion embedded the whole scientists’ community to share experience. We focused on the very different existing situations from countries where the dialogue is more than advanced with narrow collaboration in collating data and assessing resources (Norway, North America; Denmark, Scotland and The Netherlands in the UE), to others where this dialogue is poorly developed (England, Portugal). The discussion allowed to point out the challenges for dialogue improvement: good management of resources (proof of the interest for scientific advice, for Pacific halibut for instance), respective trust (enhanced by transparency in fundings and constraints), teaching/training in the basics of scientific advice to fishermen, existence of fishermen representative structure (the lack of such structure limits an efficient dialogue in England) and, more, the need for a large communication of the scientific results toward the whole fishermen community.

Visit the symposium website at: <http://www.flatfishsymposium.com/international-flatfish-symposium-2017>