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Report of the Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC)

10–12 April 2018

Plymouth, UK



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Executive summary

The Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC) has held three meetings during 2016–2018 in Koblenz, Germany, and Plymouth, UK, gathering scientists from the General Mediterranean Fisheries Council (GPMC) and ICES communities. The meetings were attended by experts in climate variability, physical oceanography, plankton, fish biology and fishery management. WGSPEC proactively contributed to a series of outreach activities to disseminate the new findings of the group, share views and facilitate discussion on the sustainable management of fish and fisheries under environmental change. These activities included (i) the co-organisation of a session at the international PICES/ICES Symposium on Drivers of Pelagic Fish Resources in March 2017, (ii) the publication of two articles in the special issue of Deep-Sea Research II including the Symposium proceedings and (iii) a contribution as co-editor of the same volume, (iv) the organisation of daily events addressed to students and to the public with an interest in the impact of environmental change on fish and fisheries, in conjunction with the 2017 and 2018 annual meetings.

Expanding on the work done in previous years, during the reporting period WGSPEC reviewed the mechanisms and coupled ocean-atmosphere dynamics behind the ecosystem changes observed in the North Atlantic and Mediterranean, associated in particular with the fluctuations of the Atlantic Multidecadal Oscillation (AMO) and the contractions and expansions of the subpolar gyre (SPG). WGSPEC also showed that shifts in the North Atlantic Oscillation (NAO) and AMO phases were associated with significant changes in thermal preferences recently observed in Mediterranean stocks of small and medium pelagics, increasingly characterized by relatively warmer-water species.

The outcome of the work done by WGSPEC under ToR a) and ToR b) was summarized in two papers published in Deep-Sea Research II and in one paper presently in preparation.

Overall in 2016–2018, WGSPEC contributed to clarify mechanisms of the impact of climate change on small and medium pelagics in different North Atlantic and Mediterranean regions, producing new findings that can be used to improve the management of those fish stocks. The group also addressed a recommendation received from the joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBird) in 2017.

1 Administrative details

Working Group name

Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC)

Year of Appointment within current cycle

2016

Reporting year within current cycle (1, 2 or 3)

3

Chair(s)

Priscilla Licandro, UK

Athanassios Tsikliras, Greece

Meeting venues and dates

5–6 April 2016, Koblenz, Germany, (5 participants)

3–5 April 2017, Plymouth, UK (43 participants, including scientists and students)

10–12 April 2018, Plymouth, UK (47 participants, including scientists and students)

2 Terms of Reference

ToR	Description	Background	Duration	Expected Deliverables
A	Global comparison of climate variability impact on small pelagics	Support action for SICCME	1 year	Review paper submitted by December 2016
B	Impact of climate variability on recruitment of small pelagics in different regions of the North eastern Atlantic and Mediterranean	Support action for SICCME	1.5 Years	Review paper on environmental variability and anchovy recruitment in the Mediterranean and Northeastern Atlantic submitted by June 2018
C	Preparation of joint presentations for PICES/ICES Symposium in 2017 on Drivers of Pelagic Fish Resources		1.5 years	2-3 presentations given at the meeting in March 2017

3 Summary of Work plan

Year 1	Global comparison (A), Impact on recruitment (B), preparation of presentations
Year 2	Preparation of presentations
Year 3	Summing up of results of WGSPEC

4 Summary of Achievements of the WG during 3-year term

Papers accepted for publication

- Tsikliras AC, Licandro P, Pardalou A, McQuinn IH, Gröger JP, Alheit J (2018). Synchronization of Mediterranean pelagic fish populations with the North Atlantic climate variability. Deep-Sea Research II (in press) <https://doi.org/10.1016/j.dsr2.2018.07.005>.
- Alheit J, Gröger JP, Licandro P, McQuinn IH, Pohlmann T, Tsikliras AC (2018). What happened in the mid-1990s? Ecosystem changes in the Northeast Atlantic and the Mediterranean. Deep-Sea Research II (in press).

Datasets

- Time-series and regional-scale observations of anchovy eggs and larvae from different regions of the Mediterranean (Catalan, Ligurian and Aegean Seas) and Northeastern Atlantic (Gulf of Cadiz).

Outreach events

- A session co-chaired and one presentation given at the joint PICES/ICES Symposium on Drivers of Pelagic Fish Resources, held in Victoria (Canada), 6–11 March 2017.
- A daily event, involving students and scientists, organized in conjunction with the 2017 WGSPEC meeting, entitled: “Introducing ICES to a new generation of scientists”. The event, that was also reported in the ICES Newsletter, aimed to introduce students and early career scientists to the activities promoted by the ICES and by other international organizations, such as OSPAR and PICES, and proposed talks to raise awareness on recent changes in fish communities that can be related to climate change (see program in Annex 5)
- A daily event, involving students and scientists, organized in conjunction with the 2018 WGSPEC meeting, entitled: “Fish and fishery Southwest - Sustainable management of fish and fisheries under environmental change”. The program included talks presenting new evidence of climate change impact on exploitable fish and invertebrate stocks and discussing measures adopted to improve the management of the fishery (see program in Annex 6).

5 Final report on ToRs, workplan and Science Implementation Plan

ToR a: Global comparison of climate variability impact on small pelagics

North Atlantic climate variability appears to be significantly related with changes observed in small pelagics (e.g. European sardine *Sardina pilchardus*, European anchovy *Engraulis encrasicolus*, round sardinella *Sardinella aurita* and European sprat *Sprattus sprattus*) and in mesopelagic fish stocks (e.g. Atlantic mackerel *Scomber scombrus*, Atlantic chub mackerel *Scomber japonicus*, Atlantic horse mackerel *Trachurus trachurus*, Mediterranean horse mackerel *Trachurus mediterraneus*), in different regions of the North Atlantic and Mediterranean. Expanding on previous work, WGSPEC reviewed the mechanisms and coupled ocean-atmosphere dynamics behind the climatically-induced ecosystem changes observed in these two connected basins.

Recent work of the WGSPEC also showed that shifts in the North Atlantic Oscillation (NAO) and Atlantic Multidecadal Oscillation (AMO) phases between 1970 and 2014 were associated with significant changes in thermal preferences of Mediterranean fish communities, measured as the mean temperature of the pelagic catch (MTpC). Over the years stocks appeared to be increasingly characterized by relatively warmer-water species, responding to AMO and NAO variability with a different time lag, depending from the region. In particular, pelagic communities from the central and eastern Mediterranean were those that responded most to AMO variability, whereas stocks of the central and western Mediterranean also responded to the NAO. The effect of the NAO on fish communities located in the eastern Mediterranean was on the contrary not significant.

ToR b: Impact of climate variability on recruitment of small pelagics in different regions of the North eastern Atlantic and Mediterranean

WGSPEC assembled available datasets of anchovy eggs and larvae from different regions in the north-western (Catalan and Ligurian seas) and eastern (Aegean Sea) Mediterranean and from the southeast Atlantic (Gulf of Cadiz). Considering the heterogeneity in sampling methodologies and in the spatio-temporal resolution of the observations, it was decided to primarily focus the analyses for ToR b) on the eastern Ligurian Sea, where anchovy eggs/larvae and environmental data are available during more than two decades.

Results showed consistency in term of size and seasonal timing between the stocks of anchovy larvae/eggs in the eastern Ligurian Sea and Catalan Sea, but relatively different interannual dynamics between the two adjacent regions. In the eastern Ligurian Sea anchovy spawning grounds are mainly concentrated on the continental shelf between La Spezia and Livorno (northern Tyrrhenian sea), with higher densities in shallow waters near to the rivers mouths. Interannual variability of anchovy recruitment appeared to be significantly impacted by temperature changes, with years characterised by an early spring warming associated with a more successful recruitment and a wider geographical distribution of anchovy larvae.

The results obtained under ToR b) will be summarised in a joint publication that is in preparation.

ToR c: Preparation of joint presentations for PICES/ ICES Symposium in 2017 on Drivers of Dynamics of Pelagic Fish Resources

The members of WGSPEC submitted two abstracts and gave one presentation on the main outcomes of ToR a) at the PICES/ICES Symposium in Victoria, Canada, in March 2017. After further discussion and revision of the results, the presentations were summarized in two articles now accepted for publication in the special Issue of Deep-Sea Research, including the symposium proceedings.

6 Cooperation

Cooperation with other WG

In 2017 WGSPEC addressed a recommendation received from the joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBird). The details of the recommendation and the answer given by WGSPEC are reported here below.

Background

It has been observed that population sizes of seabird species feeding on small fish at or close to the surface are declining, whereas those of species diving into deeper layers of the water column are doing better. JWGBIRD is interested to verify vertical shifts in the abundance of small pelagic fish, which would help to explain the population trends of seabirds.

Recommendation of JWGBird

Assess the current status of and (past and future) trends in the availability of small pelagic fish for surface-feeding predators with special focus on the period from 1990 onwards, with particular emphasis on the North Sea.

WGSPEC answer to JWGBird recommendation:

WGSPEC briefly investigated the availability of time series that would allow verifying changes in the vertical distribution and/or the abundance of small pelagic fish at depth in the North Sea. Due to the lack of time series reporting vertically resolved densities of small pelagic fish, WGSPEC decided to verify a potential decrease of fish available to North Sea seabirds feeding at the surface, using long-term data of fish egg and larvae collected by the Continuous Plankton recorder (CPR). As the decline of seabirds was observed after the year 2000, primarily from early spring to summer, monthly averages of fish eggs/larvae recorded by the CPR in the North Sea between February and July 2000–2015 were compared with densities reported in the same months in previous decades (years 1958–1999). Results showed that in recent years, fish eggs/larvae have declined in early spring almost entirely across the whole North Sea region. Even though fish eggs/larvae data at high taxonomic resolution are only available until 2005, based on previous information on fish larvae distribution we can infer that in the north-western North Sea such decline was due to a decrease in the sandeel stock. After 2000 an inshore decline of larvae has been also observed during the summer months, particularly in the central and western North Sea. Further investigations are needed to better understand such change, as in these regions the distributions of different fish species do overlap.

7 Summary of Working Group self-evaluation and conclusions

The full copy of the WGSPEC self-evaluation is given in Annex 3.

The WGSPEC has completed its current ToRs and will not continue for a new term in its present format.

Annex 1: List of participants

NAME	INSTITUTE	COUNTRY (OF INSTITUTE)	EMAIL
Jurgen Alheit	Leibniz Institute for Baltic Sea Research	Germany	juergen.alheit@io-warnemuende.de
Benjamin Ciotti	University of Plymouth	United Kingdom	benjamin.ciotti@plymouth.ac.uk
Paul Dando	Marine Biological Association	United Kingdom	pdando@mba.ac.uk
Donna Dimarchopoulou	University of Thessaloniki	Greece	ddimarch@bio.auth.gr
Joachim Gröger	Thunen Institute	Germany	joachim.groeger@ti.bund.de
Jason Hall-Spencer	University of Plymouth	United Kingdom	jason.hall-spencer@plymouth.ac.uk
Nick Higgs	University of Plymouth	United Kingdom	nicholas.higgs@plymouth.ac.uk
Priscilla Licandro (co-Chair)	Plymouth Marine Laboratory	United Kingdom	prl@pml.ac.uk
Ian H. McQuinn	Maurice-Lamontagne Inst.	Canada	Ian.McQuinn@dfo-mpo.gc.ca
Thomas Pohlmann	University of Hamburg	Germany	thomas.pohlmann@uni-hamburg.de
Sophie Rainbird	Marine Biological Association	United Kingdom	soprai@mba.ac.uk
Athanassios Tsikliras (co-Chair)	University of Thessaloniki	Greece	atsik@bio.auth.gr

Annex 2: Agenda

WGSPEC 2017 meeting



Figure 1. Students and scientists attending the open event “Introducing the ICES to a new generations of scientists” at the 2017 WGSPEC meeting.

Annual meeting of the ICES Working Group on Small Pelagic Fish, their Ecosystems and Climate Impact (WGSPEC)

Marine Station, University of Plymouth, Plymouth (UK), 3rd – 5th April 2017

Monday 3rd April

Introducing the ICES to a new generations of scientists

09:00-09:15 Welcome to the annual meeting of the ICES WGSPEC hosted by the University of Plymouth (Benjamin Ciotti, University of Plymouth)

09:15-09:40 The role of ICES/PICES/OSPAR and the contribution of the ICES WGSPEC to the marine ecosystem research (Priscilla Licandro, Plymouth Marine Laboratory)

09:40-10:05 Impact of ocean-atmosphere interactions on the North Atlantic marine ecosystem (Jurgen Alheit, Leibniz Institute for Baltic Sea Research, Germany)

10:05-10:30 Synchronization of Mediterranean pelagic fish populations with the North Atlantic climate variability (Athanassios Tsikliras, University of Thessaloniki, Greece)

10:30-11:00 Coffee break

11:00-11:25 Range expansion of the boreal smelt species *Osmerus eperlanus* in the southern part of its range post-1960. (Paul Dando, Marine Biological Association, UK)

11:25-11:50 Growth dynamics of juvenile fishes in nursery areas: the link between inshore environmental variability and recruitment (B. Ciotti)

11:50-12:15 MBA long term science, history and observations. (Aisling Smith, Marine Biological Association)

12:20-14:00 Lunch - Networking Session involving invited speakers, students and attendees;

14:00-16:30 Discussion on Recommendation received by the joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBird) – (P. Licandro; Tom Pilgrem, University of Plymouth/Sir Alister Hardy Foundation for Ocean Science, UK)

Agenda of the open day event – “Fish and Fishery Southwest” at the 2018 WGSPEC meeting



Figure 2. Students and scientists attending the open event “Fish and Fisheries Southwest” at the 2018 WGSPEC meeting.

Fish and Fisheries Southwest: 2nd Annual Meeting **“Sustainable management of fish and fisheries under environmental change”**

10th April 2018, Plymouth Marine Laboratory 09:00 – 13:00

The Fish and Fisheries Southwest meeting provides a forum for fish biology and fisheries research in Plymouth and the Southwest UK. It unites the local community of scientists, researchers and students, together with some international visitors from ICES, for a day of talks and discussion. All those with an interest in fish and fisheries research or in the work of ICES are invited to attend. The meeting this year will focus on understanding how changes in the environment, from large scale climatic and oceanographic processes to small scale habitat alterations, influence fish and fisheries and how society is making progress in incorporating these pressures into fishery management measures. Students and early career researchers are particularly encouraged to participate. The meeting will include an introduction to the work of ICES, details of opportunities to get involved and the chance to talk with members of the working group about their work.

The Meeting will be held at Plymouth Marine Laboratory, Prospect Place, Plymouth, PL1 3DH. <http://www.pml.ac.uk/>.

Further details can be found here:

http://pml.ac.uk/News_and_media/Events/Fish_and_Fisheries_Southwest_2nd_Annual_Meeting

In order to register your attendance, or if you have any questions, please contact Priscilla Licandro (prl@pml.ac.uk) or Ben Ciotti (benjamin.ciotti@plymouth.ac.uk).

Fish and Fisheries Southwest: 2nd Annual Meeting
“Sustainable management of fish and fisheries under environmental change”

10th April 2018, Plymouth Marine Laboratory 09:00 – 13:00

PROGRAMME

09:00-09:10 Priscilla Licandro, Plymouth Marine Laboratory & Ben Ciotti, University of Plymouth “Welcome and Introduction”.

Theme: Fish and Fisheries under Environmental Change

09:10-09:30 Athanassios Tsikliras, University of Thessaloniki (Greece) “The status of Mediterranean fisheries within a climate change context”.

09:30-09:50 Jason Hall-Spencer, University of Plymouth “The effects of ocean acidification of fish in the wild”.

09:50-10:10 Rachel Brittain, the Marine Biological Association “MBA Long-term monitoring of demersal fish assemblages off the coast of Plymouth, UK”.

10:10-10:30 Nicholas Higgs, University of Plymouth “A crawfish comeback in the UK? How an extinct fishery may be coming back to life”.

10:30-10:50 Jen Lewis, University of Exeter “Using otolith microchemistry to explore seasonal movements of range expanding gilthead seabream *Sparus aurata*”.

10:50-11:10 COFFEE BREAK

Theme: Implementing sustainable management of Fisheries

11:10-11:30 Thomas Stamp, University of Plymouth “The role of managed re-alignment schemes as compensatory habitat for estuarine fish”.

11:30-11:50 Shubha Sathiyendranath & Trevor Platt, Plymouth Marine Laboratory “Societal Applications in Fisheries & Aquaculture using Remotely Sensed Imagery (SAFARI)”.

11:50-12:10 Marie-Fannie Racault, Plymouth Marine Laboratory “Remotely sensing the biophysical drivers of *Sardinella aurita* in Ivorian Waters”.

12:10-12:30 Andrey Kurekin, Plymouth Marine Laboratory “Use of Remote Sensing for Monitoring Illegal Fishing off Ghana”.

12:30-12:50 Ali Hood, Shark Trust “The role of advocacy in driving a sustainable fisheries agenda”.

Annex 3: WGSPEC self-evaluation 2016–2018

- 1) Working Group name:
Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC)
- 2) Year of appointment:
2016
- 3) Current Chairs:
Priscilla Licandro (UK) & Athanassios Tsikliras (Greece)
- 4) Venues, dates and number of participants per meeting.
 - 5–6 April 2016, Koblenz, Germany, (5 participants)
 - 3–5 April 2017, Plymouth, UK (43 participants, scientists and students)
 - 10–12 April 2018, Plymouth, UK (47 participants, scientists and students)

WG Evaluation

- 5) If applicable, **please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.**

WGSPEC mainly contributed to the following ICES Research priorities, in particular to Goal 1.

- Goal 1: Develop an integrated, interdisciplinary understanding of the structure, dynamics, and the resilience and response of marine ecosystems to change;
- Goal 2: Understand the relationship between human activities and marine ecosystems, estimate pressures and impacts, and develop science-based, sustainable pathways
- Goal 3: Evaluate and advise on options for the sustainable use and protection of marine ecosystems

- 6) In bullet form, **list the main outcomes and achievements of the WG since their last evaluation.** Outcomes including publications, advisory products, modelling outputs, methodological developments, etc. *

- Two papers accepted for publication in a peer-reviewed journal:
 - Tsikliras AC, Licandro P, Pardalou A, McQuinn IH, Gröger JP, Alheit J (2018). Synchronization of Mediterranean pelagic fish populations with the North Atlantic climate variability. Deep-Sea Research II (in press) <https://doi.org/10.1016/j.dsr2.2018.07.005>.
 - Alheit J, Gröger JP, Licandro P, McQuinn IH, Pohlmann T, Tsikliras AC (2018). What happened in the mid-1990s? Ecosystem changes in the Northeast Atlantic and the Mediterranean. Deep-Sea Research II (in press).
- Organisation of outreach events: including a session at an international Symposium (joint PICES/ICES Symposium on Drivers of Pelagic

Fish Resources, held in Victoria, Canada, in March 2017) and two daily events in conjunction with the 2017 and 2018 annual meetings;

- **Datasets:** Time series and regional-scale observations of anchovy eggs and larvae from different regions of the Mediterranean (Catalan, Ligurian and Aegean Seas) and Northeastern Atlantic (Gulf of Cadiz).

- 7) **Has the WG contributed to Advisory needs?** If so, please list when, to whom, and what was the essence of the advice.
 - In 2017 WGSPEC addressed a recommendation received from the joint IC-ES/OSPAR/HELCOM Working Group on Seabirds (JWGBird).
- 8) **Please list any specific outreach activities of the WG outside the ICES network** (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.
 - See Outreach activities at point 6
- 9) **Please indicate what difficulties, if any, have been encountered in achieving the workplan.**
 - N/A

Future plans

- 10) **Does the group think that a continuation of the WG beyond its current term is required?** (If yes, please list the reasons)
 - No
- 11) If you are not requesting an extension, **does the group consider that a new WG is required** to further develop the science previously addressed by the existing WG.
 - No

(If you answered YES to question 10 or 11, it is expected that a new Category 2 draft resolution will be submitted through the relevant SSG Chair or Secretariat.)
- 12) What **additional expertise** would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR?
 - N/A
- 13) **Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used?** (please be specific)
 - WSPEC's new findings contribute to a better understanding of the mechanisms and coupled ocean-atmosphere dynamics behind the climatically-induced ecosystem changes observed in the North Atlantic and Mediterranean. Thanks to WGSPEC's work fish stocks and regions mostly affected by changes can be better identified. This should be taken into account when management actions are planned for conservation purposes or for the implementation of a sustainable fishery.