# ICES WGSPEC REPORT 2017

SCICOM Steering Group on Ecosystem Processes and Dynamics

ICES CM 2017/SSGEPD:04

Ref. SCICOM

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

3–5 April 2017

Plymouth, UK

ICES
International Council for the Exploration of the Sea

CIEM
Conseil International pour l'Exploration de la Mer

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Recommended format for purposes of citation:

ICES. 2017. Interim Report of the Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC), 3–5 April 2017, Plymouth, UK. ICES CM 2017/SSGEPD:04. 12 pp. https://doi.org/10.17895/ices.pub.8472

# Contents

## Executive summary

The Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC) had its annual meeting in Plymouth, United Kingdom, 3–5 April 2017, which was attended by fourteen scientists and more than forty students from four different countries.

The meeting started with an open-day event, during which the work done by WGSPEC and more in general the activities and opportunities provided by ICES were presented to students and early career scientists from Plymouth and from other UK and international universities. Attendees were engaged in a series of discussions around some key questions/problems raised by the talks on fish-related issues and on a recommendation received by the joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBird).

The following two days were dedicated to discuss the progress done on ToR a) and ToR b). In particular for the ToR a): the work needed to complete the two manuscripts to be submitted at the special issue of Deep Sea Research was discussed in light of the feedback received during the annual meeting in Victoria, Canada, and elsewhere. For the ToR b): preliminary comparison and analysis of the data of anchovy eggs and larvae collected in the Bay of Biscay, Catalan Sea and Ligurian Sea were shown and discussed.

# 1 Administrative details

**Working Group name**

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

**Year of Appointment**

2016

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

**2**

**Chair(s)**

Priscilla Licandro, UK

Athanassios Tsikliras, Greece

**Meeting venue**

Plymouth, United Kingdom

**Meeting dates**

3–5 April 2017

# 2 Terms of Reference

| ToR | Description | Background | Science Plan topics addressed | Duration | Expected Deliverables |
|---|---|---|---|---|---|
| a | Global comparison of climate variability impact on small pelagics | Support action for SICCME | 1, 2, 3, 4 | 1.5 years | Review paper submitted by May 2017 |
| 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, 2, 3, 4 | 1.5 years | Review paper on environemntal 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 | | 1, 2, 3, 4 | 1.5 years | 1 presentation given at the meeting in March 2017 |

| | |
|---|---|
| | on Drivers of Pelagic Fish Resources |

# 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 Progress report on ToRs and Work Plan

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

In a recent publication (Alheit *et al.*, 2014), WGSPEC demonstrated the impact of the Atlantic Multidecadal Oscillation (AMO) on the dynamics of small pelagic fish in northeast Atlantic and Mediterranean ecosystems.

Further investigations suggest that the AMO would affect also marine ecosystems in other regions such as the northwest and the southeast Atlantic, impacting small pelagics as well as other biotic components.

Shifts in the NAO/AMO phases could be associated with significant changes in thermal preferences of fish communities in some Atlantic and Mediterranean regions, increasingly characterized by relatively warmer-water species.

The effect of the Atlantic Multidecadal Oscillation (AMO) and North Atlantic Oscillation (NAO) signals across the Mediterranean Sea sub-regions (western, central and eastern) were examined using various catch ratios for the period 1970–2013. Small (European sardine *Sardina pilchardus*, European anchovy *Engraulis encrasicolus*, round sardinella *Sardinella aurita* and European sprat *Sprattus sprattus*) and medium (Atlantic mackerel *Scomber scombrus*, Atlantic chub mackerel *Scomber japonicus*, Atlantic horse mackerel *Trachurus trachurus*, Mediterranean horse mackerel *Trachurus mediterraneus*) pelagic fishes were included in the analysis.

We also tested the effect of AMO and NAO on small and medium pelagic fishes using the mean temperature of the pelagic catch (MTpC) method for the same period. The time of the pelagic fish community response to the AMO and NAO, as revealed by the MTpC and catch ratios, varies among the Mediterranean sub-regions. The pelagic fishes of the central and eastern Mediterranean are those that respond most to AMO variability, whereas those of the central and western Mediterranean also respond to the NAO. The effect of the NAO in the eastern Mediterranean was not significant.

More details about the results and conclusions of the work done on ToRa can be found in the abstracts presented by WGSPEC at the PICES/ICES Symposium (see ToRc, below), for which corresponding manuscripts will be submitted to the Special Issue of the symposium proceedings, to be published in Deep Sea Research II in early 2018.

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

WGSPEC made good progress assembling the datasets of anchovy eggs and larvae from different Atlantic and Mediterranean regions. Preliminary comparisons showed one order of magnitude difference in eggs concentration between the Bay of Biscay and the North-western Mediterranean, as well as a wide temperature range characterising anchovy spawning seasons across regions.

A detailed analysis of spatio-temporal variability of anchovy eggs/larvae and their habitat was carried out in the eastern Ligurian Sea, with the aim of providing a first synthesis of recruitment variability in the anchovy from that region where data are available during more than two decades.

In agreement with what previously reported in other Mediterranean regions, results show a positive correlation between areas of high plankton productivity and abundance of anchovy eggs/larvae, which in the eastern Ligurian Sea tend to be more concentrated in shallow waters near to the rivers mouths. Further work is on-going to verify, on a more extended dataset, whether recruitment has shown similar patterns of variability across regions.

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

The members of WGSPEC prepared 2 abstracts that were presented at the PICES/ICES Symposium in Victoria, Canada, 6–11 March 2017.

1) **Ocean-atmosphere interactions related to the AMO caused simultaneous 'regime shift'-like changes in ecosystems of eastern North Atlantic and Mediterranean in the mid-1990s**

Jürgen Alheit[1], Joachim Groeger[2], Priscilla Licandro[3,4], Ian H. McQuinn[5], Thomas Pohlmann[6], Athanassios C. Tsikliras[7]

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[7] School of Biology, Aristotle University, Thessaloniki, Greece

Northeast Atlantic marine ecosystems such as the Bay of Biscay, Celtic Sea, English Channel, Subpolar Gyre region, Icelandic waters and the North Sea as well as the Mediterranean show concomitant 'regime shift'-like changes around the mid-1990s, which

involved all biota of the pelagic system: phytoplankton, zooplankton, pelagic fish assemblages, demersal fish assemblages and top predators. These shifts were caused by complex ocean-atmosphere interactions initiating large-scale changes in the strength and direction of the current system that move water masses around the North Atlantic and involved the North Atlantic Oscillation (NAO), the Atlantic Meridional Overturning Circulation (AMOC), and the subpolar gyre (SPG). The contractions and expansions of the SPG most likely played a key role in the coupled atmosphere-ocean system of the North Atlantic. Fluctuations in the AMO seem to be a driver for these complex processes and small pelagic fish population trends were the sentinels of these mid-1990s changes.

## 2 ) Synchronization of the mean temperature of the pelagic catch (MTpC) with the North Atlantic climate variability

**Athanassios C. Tsikliras[1], Priscilla Licandro[2,3], Joachim P. Gröger[4] and Jürgen Alheit[5]**

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The aim of the present work was to investigate whether the pelagic fish communities of NE Atlantic and the Mediterranean respond to the climate variability of the North Atlantic. The mean temperature of the pelagic catch method (MTpC) that is based on the median temperature preference of each species weighted by its catch, was used. The annual landings of the fish species of the Bay of Biscay, Celtic Sea, West of Scotland, Faroe Plateau and Iceland sub-regions were extracted from ICES and that of the western, central and eastern Mediterranean from GFCM (1950-2010). North Atlantic Oscillation (NAO) and Atlantic Multidecadal Oscillation (AMO) index values were extracted from NOAA. MTpC increased in Celtic Sea, West of Scotland and Faroe Plateau and declined in Bay of Biscay and Iceland. The rate of MTpC increase was 1.05 $^{o}$C, 0.92 $^{o}$C and 0.72 $^{o}$C per decade in Celtic Sea, West of Scotland and Faroe Plateau, respectively. MTpC was positively correlated with AMO in Celtic Sea and West of Scotland and negatively correlated in the Bay of Biscay and Iceland; no correlation emerged in Faroe Plateau. A positive relationship of MTpC with NAO emerged for Celtic Sea and a negative for Iceland. The rate of MTpC increase was 0.29 $^{o}$C, 0.29 $^{o}$C, and 0.25 $^{o}$C per decade in the western, central and eastern Mediterranean, respectively. MTpC was positively correlated to AMO in all three sub-regions, was negatively correlated to NAO in the western and central, and was not related to NAO in the eastern Mediterranean.

# 5 Other activities and outcomes of the WG in this delivery period

### Daily event at the 2017 WGSPEC meeting: Introducing ICES to a new generation of scientists

A daily event was organized at the beginning of the annual meeting of the WGSPEC to engage the next generation of marine scientists in current activities, which are relevant for the fisheries and for the marine science community in the North Atlantic and adjacent seas.

More than forty students and early career scientists from Plymouth and other UK and international universities were introduced to ICES and to other international organizations, such as OSPAR and PICES, highlighting opportunities for training, funding and collaborative exchanges.

The program included a series of talks addressing some of the key questions/problems relevant for the international fishery community (see detailed agenda in Annex 2).

A debate involving invited speakers, students and attendees highlighted the interest of the young generation towards a better understanding of natural and human-induced fluctuations in fish stocks.

The attendees agreed that the meeting provided a unique opportunity to bring together the fisheries science community in the southwest England, where the fisheries resources form such an important component of the local/regional economy.

The importance of maintaining long-term surveillance of fish stocks, such as that ensured by the MBA in the English Channel, was also discussed in light of the potential financial cuts that could prevent the continuation of this historical time series of demersal and pelagic fish.

The meeting featured at the News page of the University of Plymouth and in the ICES Newsletter with an article entitled "International fisheries science working group opens its doors to Plymouth students" (contains a link) by Mr Andrew Merrington, Senior Media & Communications Officer.

**Figure 1. Students and scientists attending the daily event at the 2017 WGSPEC meeting.**

### Discussion on Recommendation received by the joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBird)

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 (Edwards *et al.*, 2011) 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 (Edwards *et al.*, 2011).

### List of references

Alheit, J., Licandro, P., Coombs, S., Garcia, A., Giráldez, A., Garcia Santamaría, M.T., Slotte, A. & Tsikliras, A.C. (2014). Atlantic Multidecadal Oscillation (AMO) modulates dynamics of small Pelagic fishes and ecosystem regime shifts in the eastern North and Central Atlantic. J. Mar. Syst., 131: 21-35.

Edwards, M., Helaouet, P., Halliday. N., Beaugrand, G., Fox, C., Johns, D.G., Licandro, P., Lynam, C., Pitois, S., Stevens, D., Coombs, S & Fonseca, L. 2011. Fish Larvae Atlas of the NE Atlantic. Results from the Continuous Plankton Recorder survey 1948-2005. Sir Alister Hardy Foundation for Ocean Science. 22p. Plymouth, U.K. ISBN No: 978-0-9566301-2-7

## Annex 1: List of participants

| Participant | Affiliation | Email |
|---|---|---|
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* Connected via teleconference

## Annex 2: Agenda

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

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

If you are interested to attend the event please contact:

- Dr. Benjamin Ciotti: benjamin.ciotti@plymouth.ac.uk

- Dr. Priscilla Licandro: priscilla.licandro@outlook.com

**AGENDA**

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)

[Recommendation: 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.

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 in vertical shifts in the abundance of small pelagic fish, which would help to explain the population trends of seabirds.]

Tuesday, 4th April 2017

*Term of Reference (ToR) A: Global comparison of climate variability impact on small pelagics*

[coffee breaks at mid-morning and mid-afternoon]

09:00-12:30 Revision of results obtained at the 2016 WGSPEC meeting in Koblenz and new results obtained after the annual meeting (J. Alheit & P. Licandro)

14:00-17:00 Discussion/conclusions on ToR A and timeline for publication (Thomas Pohlmann, University of Hamburg; J. Alheit)

Wednesday, 5th April 2017

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

[coffee break at mid-morning and mid-afternoon]

09:00-10:30 Presentation of preliminary results (T. Pilgrem)

10:30-14:00 Discussion, preliminary conclusions and way forward (P. Licandro)

14:00-16:00 Discussion on comments received on paper on Mediterranean pelagic fish populations and large scale climatic oscillations (A. Tsikliras)

16:00 – 17:30 Discussion on draft of WGSPEC 2017 report, dates and venue of WGSPEC 2018 meeting, AOB, Closure (P. Licandro, A. Tsikliras)