

ICES-PICES Working Group on Small Pelagic Fish

Brief Summary of kick-off meeting and next steps



The kick-off meeting of the ICES-PICES WGSPF took place in Copenhagen, Denmark from Monday March 9th to Wednesday March 11th. It was attended by 31 scientists (11 via WebEx) from 17 nations.

Target species were defined as Engraulid and Clupeid fishes (anchovies, sardines, sprats, herrings). The group also defined three Task Forces, each different (inter-related) Activities. Within each activity, group members will collaborate on a specific topic. Thus we have three levels: Task Force – Activity – Topic. The topics are designed and championed by group members. Each topic should use a comparative approach across systems and/or species. The list needs to be built (BOTTOM-UP!)

During a brainstorming session, members expressed interest in specific activities and topics and proposed members potentially interested. Names in bold were proposed as Activity leaders. Each activity needs two leaders, one from the western and one from the eastern hemisphere).

This list is far from complete and we would like all members to:

- 1) include their names and confirm interest in specific Activities.
- 2) contact other members and propose a Topic (or Topics) of collaboration. There is no limit to the size / type of collaboration but tangible products (review paper (methods / topic), research paper based on new data analyses, proposal for topic session at PICES or ICES meeting) are needed to galvanize the group. A presentation on our SharePoint lists all topics contributed by members.

It was decided that members not participating in any activity (or topic) will be removed from working group. New members will be added as necessary (ICES – Chair appointed members) based on interest / expertise. So, please express your interest in an activity and propose a topic / analysis, etc.

- 3) Please try to join a brief WebEx meeting scheduled for early next week: Tuesday 24th 08:00 (CET Europe), Tuesday 24th 16:00 JST, which is 23:00 Monday 23rd PTZ. It is short notice but the chairs will be available to answer questions. A second video conference will be two weeks later on April 7th.

Please email questions to the co-chairs.

Akinori Takasuka (atakasuka@mail.ecc.u-tokyo.ac.jp), Ignacio Catalan (ignacio@imedea.uib-csic.es), Myron Peck (myron.peck@uni-hamburg.de), Ryan Rykaczewski (ryan.rykaczewski@noaa.gov)

Task Force: Ecological Process Knowledge (EPK)

Activity 1: Critical review, evaluation and testing of hypotheses (1 topic)

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|--|--|----------------------|
| Rebecca Asch, Arnaud Bertrand, Ignacio Catalan, Fei Chai, Susana Garrido, Salvador Lluch-Cota, Andres Ospina, Myron Peck , Ryan | Carl van der Lingen, Dimitri Gueterez, Xabier Irigoien, Dominique Robert | |

| | | |
|--|--|--|
| Rykaczewski, Stelios Somarakis, Akinori Takasuka | | |
|--|--|--|

Literature review with a potential modeling approach. Hypotheses not only include those relating to recruitment but also those relating to role in ecosystem.

Activity 2: Life cycle closures (IBMs for ELHS) – bottlenecks and gaps in knowledge (various Topics)
Second lead needed

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|--|---|----------------------|
| Arnaud Bertrand , Ignacio Catalan, Susana Garrido, Martin Huret, Ana Machado, Matthias Kloppmann, Richard Nash, Andres Ospina, Myron Peck | Patricia Ayon, Noelle Bowlin, Tim Brochier, Sachihiko Itoh, Tian Yongjun, | |

Idea 1: Macro-ecological comparison of transport dynamics among regions and species Comparison of model representation of advection, impact of advective drift of eggs and larvae, sensitivity of this inferred impact on DVM (or other behavior), consequence of temperature change on drifting eggs and larvae, retention and connectivity issues, interannual variability... Review of existing work, or new coordinated Lagrangian runs?

Idea 2: Comparison of strategies that permit closure of the life history of species in each region. Are there commonalities among regions? E.g., can similar rules be applied to species that result in realistic onshore/offshore and latitudinal migration?

Notes: Include review on tagging studies, otolith microchemistry approaches, stable isotopes, etc. relevant for understanding life-stage specific distributions? ICES WGIPEM has some shared interest on this activity.

Activity 3: Drivers of spatial distribution and phenology (habitats)

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|---|----------------------|
| Rebecca Asch , Arnaud Bertrand, Ignacio Catalan, Susana Garrido, Martin Huret, Susana Garrido, Francis Juanes, Stefan Koenigstein, Giannina Passuni, Hui Zhang | Mariana Giannoulaki, Robert, Xabier Irigoien, Haruka Nishikawa, Chris Rooper,, Ana Sebates, | |

Idea 1: Look at stocks that are distributed across environmental gradients (e.g., temperature, photoperiod) and consider which drivers influence phenological characteristics across regions? This could be examined using a data-based approach and from a bioenergetics model approach. Do these end up producing the same results?

Idea 2: VAST is an r-package that describes spatial distribution and relies on empirical relationships with environmental conditions. That might be useful for the short term, but it might be biased in the long term.

Idea 3: Another suggestion is to explore the drivers of spatial distribution and consider if key drivers are density dependent or mesoscale/submesoscale conditions (e.g., oxygen).

Idea 4: What are behavioral cues that drive migration? (Stefan's suggestion)

Activity 4: Food-web dynamics (links to prey, predators and competitors) (need second, eastern hemisphere lead)

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|--|----------------------|
| Matt Baker, Susana Garrido , Francis Juanes, Stefan Koenigstein, Giannina Passuni, Ryan Rykaczewski, Hui Zhang | Marta Coll, Jason Everett, Shinichiro Nakayama, Patrick Polte, Iain Suthers, Jorge Tam, Hui Zhang, Carl van der Lingen | |

Idea 1: One suggestion here is that something like testing the wasp-waist idea could be assessed here in collaboration with Activity 1. What is the changing role of SPF in food webs?

Idea 2: Diet samples of predators can offer some information of natural mortality of SPF, but they can also offer some information on SPF themselves (abundances, distributions, is it the fast or slow growers that get eaten?).

Idea 3: How do changes in the biomass and composition (species composition, size distributions) of zooplankton affect SPF? Oftentimes the focus is on adults, but what about the larvae?

Idea 4: Can we take a broader look at changes in the flow of energy and organic matter (i.e., trophic transfer efficiencies) through SPF-dominated food webs.

Idea 5: Is intraguild predation a significant factor in SPF population dynamics? What is the spatial scale of these interactions? What is the spatial and temporal overlap between predators and prey (potential tools include MARSS, ARIMAS; joint models)?

Activity 5: Internal and external drivers of growth, reproduction and survival (climate, fishing...)

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|--|--|----------------------|
| Rebecca Asch, Matt Baker, Ignacio Catalan, Fei Chai, Arild Folkvord, Martin Huret , Isaac Kaplan, Martin Pastoors, Susana Garrido, Salvador Lluch-Cota, Jana Menegassi, Richard Nash, Andres Ospina, Gonçalo Silva, Stelios Somarakis, Akinori Takasuka, Jeroen | Jennifer Boldt, June Ferraz Dias, Cecilie Hansen, Shinichiro Nakayama, Haruka Nishikawa, Motomitsu Takahashi | |

| | | |
|------------------------------------|--|--|
| Van der Kooij, Carl van der Lingen | | |
|------------------------------------|--|--|

Compare traits (e.g., growth, fecundity as represented in a DEB model) across populations of SPF (e.g., different herring stocks, sardine, anchovy, etc. for which the DEB models exist) using forcing from coupled physical-biogeochemical models: how much is explained by the environment?

Requirements: size and weight at age data for complete life cycle, physical-biogeochemical outputs from regional hindcasts or observations.

**Task Force: Translating process knowledge (TPK)
Inputs and outputs to management structures and policy advice) (AKM)**

Activity 6: Survey design / monitoring (knowledge from fishers), citizen science

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|--|--|----------------------|
| Benoit Berges, Matthias Kloppmann, Richard Nash, Martin Pastoors, Jeroen Van der Kooij | Mariana Giannoulaki, Chris Rooper, Yongjun Tian, | |

Build on the session (larval fish conference) on time series of larval abundance and distribution as used in assessment. What are the identified shortcomings and how can they be overcome? What can these surveys be utilized for (feedback from other activity groups)? What information can be gathered by the industry? Consider spatial distributions, species composition, various life stages, new genetic techniques, acoustic approaches, etc.

- Larval surveys
- Acoustic surveys
- Trawl surveys
- Industry initiatives
- Tissue collections
- Timing of surveys
- Data gaps
- Image analysis/photos/videos
- Diet studies: Predators as samplers of SPF. Which ones get eaten? Citizen science.
- What we have (practically) and what we actually want
- Gear types (combining methodologies: trawl, egg/larvae, adult, juvenile, acoustic, aerial)
- Issues of data availability (national restrictions and collaborations)
- Seagoing observers
- What is the sensitivity of survey results to migration patterns? How can surveys assess migration patterns? This includes seasonal as well as finer-scale distributions.

Rebecca made a suggestion that underutilized time series be incorporated somewhere into the "monitoring" aspect of this activity (Tony Koslow's efforts?)

Activity 7: Improving short-term forecasts and/or long-term projections (need eastern Hemisphere lead)

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|-----------------------|----------------------|
| Rebecca Asch , Benoit Berges, Fei Chai, Dimitri Gutierrez, Martin Huret, Stefan Koenigstein, Fabien Moullec, Myron Peck, Ryan Rykaczewski, Laura Wise, | Gonçalo Silva | |

How can we incorporate the stochastic aspects of SPF in our projections at various scales? What are the relative skills of mechanistic vs empirical approaches at different time scales? What physical-SPF relationships are robust such that they can offer insight to distribution and productivity of the fish stocks? Can predictions of these physical conditions at seasonal-to-interannual timescales then be applied to make some prediction of SPF characteristics?

Making short-term forecasts of relatively “normal” conditions might not be so important. But perhaps making forecasts of extreme events (or at least the ecosystem responses to extreme events) can be more valuable.

Activity 8: Improvements to management (knowledge to fishers, indicators, stock assessments, Management Strategy Evaluation) – need leaders and more ideas

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|--|--|----------------------|
| Benoit Berges, Arnaud Bertrand, Cecelie Hansen, Isaac Kaplan, Salvador Lluch-Cota, Fabien Moullec, Martin Pastoors, Laura Wise | Erich Diaz, Mariana Giannoulaki, Richard Nash, Carl van der Lingen | |

What methods are applied to assess stocks of small pelagics across the regions? Can we make use of new indicators (e.g., acoustic indicators from the fishing industry)? Not only for stock assessments, but perhaps also for ecosystem indicators (i.e., populations or ecosystem conditions that are non-target—industry might be interested in helping with this)?

How can we assess stocks in data-poor regions and/or stocks? (Susana, Stelios) This might overlap with wkDLSSLS?

Can we test adaptive management strategies across regions (Isaac’s suggestion)? Peru has a unique strategy. What if it were applied elsewhere? (IMARPE: Erich Diaz) What do we have (practically), and what we actually want? What is necessary to provide timely information to managers, industry, the certification process? (Salvador’s suggestion)

Task Force: Social ecological approaches (SEA)

Activity 9: Networks, vulnerability and opportunities of dependent human communities. *Need eastern hemisphere lead and more ideas.*

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|---|----------------------|
| Fabien Moullec, Andres Ospina, Myron Peck Wise | Tarub Bahri, Lotta Kluger, Patricia Majluf, Cristina Pita | |

Vulnerability assessment (that include SPF) have been / are being conducted for national and regional climate adaptation planning. Most often, these use the same mode ($V = \text{exposure} \times \text{sensitivity} \times \text{adaptive capacity}$). This activity will compare outputs of these CVA including approaches used to understand the adaptive capacity of human communities dependent on SPF resources – as well as to compare the adaptation options identified in different regions / communities (e.g. FutureSeas – vulnerability and social-economic issues, GFCM climate vulnerability assessments conducted in three Mediterranean regions, EU project work examining climate vulnerability of fishing fleets. Other examples needed from PICES and other regions – Elliott Hazen? In Brazil: Maria Gasalla). There are economists involved in the group - need to view their slides / interests.

Activity 10: Quantifying trade-offs in goods and services (end-to-end models) *Need lead and people / ideas.*

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|-----------------------|----------------------|
| Cecilie Hansen, Isaac Kaplan, Stefan Koenigstein, Andres Ospina, Myron Peck | | |

Compare approaches to assess exposure, sensitivity and adaptive capacity. Isaac suggests that there are e2e approaches in several regions that might permit this comparison.

Activity 11: Bioeconomic modelling (including stakeholder engagement) *Need leads, need many more confirmed participants, and ideas.*

| Expressed Interest (lead) | Proposed (to confirm) | New Members (to add) |
|---|---|----------------------|
| Cecilie Hansen, Isaac Kaplan, Stefan Koenigstein, Andres Ospina, Myron Peck | Eneko Bachiller, Alan Haynie, Salvador Lluch-Cota, Francesc Maynou Renato Rosa, Stephen Stohs, Olivier Thebaud, Rudi Voss | |

What is the industry response to different temporal scales of variability? Can this be modeled?

How can the revenue of the industry be maximized for highly variable resources? How does this map out around the globe?

A concrete suggestion here was that specific questions posed to the ICES WGECON. The group meets in June (jointly with the social-economic group). Questions/requests can also be posed to SHID.

Timeline for WGSPF group activities

24th March 2020 – Attempt to get confirmations regarding members and their associations with activities.

End of March 2020 – Have leaders of these activities identified. It would be great to have an Atlantic and Pacific co-leader for each of the activities.

End of March 2020 – Co-chairs will develop the scientific steering committee for the symposium (with consideration of the regional, disciplinary, and gender balance).

April 2020 – Leaders of activities who would like to reach out to other WG with relevant expertise need to do so before those groups have their spring workshops.

Mid-May 2020 – Leaders of the activities will work with their groups to propose theme sessions for the symposium.

Mid-May 2020 – Co-chairs will be working to confirm the location, venue, and dates of the symposium. The Mediterranean region is the target. Barcelona is still an option. The tentative time period is still December 2021. The symposium can also be delayed until Spring 2022.

Other notes

Topic (need to address ToR 4)

Ecosystem-based monitoring of SPF populations. Perhaps a useful product is a review paper on successes and challenges in providing in situ data relevant for exploring drivers of change in SPF populations and creating effectively management (e.g. harvest control rules) of SPF. The topic requires integration of different observing networks (from physics / oceanographic features, prey and predators of SPF). Use of novel technologies (genetic analyses revealing stock structure/complexity) would be covered. Are spatial-temporal data good enough to adequately depict changes in distribution and abundance – compare across regions to show effectiveness of survey designs (e.g. higher-resolution sampling across regions – could be explored using models). Explore opportunities related to availability of real-time data and industry self-sampling. Link with ICES WGs exploring survey (re-) design: WGISUR (integrated surveys for the Ecosystem Approach) WGISDA Improving survey data for assessment and advice). Shared members with WGISDA).

Topic (ToR 1)

The generality of recruitment hypotheses in SPF. This work will re-visit and re-evaluate hypotheses on mechanisms behind recruitment strength in SPF (a formal synthesis and critique not creating new hypotheses). Hypotheses describing the factors influencing population dynamics of SPF are as old as the field of fisheries oceanography itself. Over the last century, the list of proposed hypotheses has grown steadily. (Ed Houde's "Emerging from Hjort's shadow" might be a well-known recent review of the state of the hypotheses, but among this WG, we might compile a list of SPF-specific hypotheses.) While we continue to propose new hypotheses (that may be developed for specific species and regions), we rarely have the guts to cross hypotheses off the list. Data available for a single species in an individual system may be insufficient to definitively reject a hypothesis. However, in WGSPF we have expertise from across the globe and multiple species that may offer opportunities to confront these hypotheses with novel data. Is it possible to make a list of hypotheses, identify which combination of key characteristics that each hypothesis addresses (i.e., growth, survival, reproduction, and/or spatial distribution), and then test those hypotheses for with SPF data from multiple regions? Can we apply similar observation- and model-based approaches to test these hypotheses across systems? What criteria will we use to "reject" hypotheses? If the hypothesis is valid for one region but not another, why is that so? We recognize that rejection of a hypothesis developed for a specific species, region, and time period is not meant to suggest that the proposed explanation is incorrect. The mechanisms driving variability can change over time and may differ from region to region. However, we see value in identifying which ideas can be applied to SPF across multiple regions. Some examples: optimal environmental window, wasp-waist, stable ocean, size-structured trophodynamics, match-mismatch, stage duration, member-vagrant, etc.

From Salvador Lluich-Cota: A pragmatic task would be to define the data needed (even if we do not fully understand the mechanisms) to objectively (dynamically, in near real-time) attribute SPF fluctuations to natural variability OR anthropogenic drivers (relevant for adaptive management and complementary strategies such as MSC certification); (probably for TF on global comparisons problems and solutions).

Topic (ToR 1)

Comparison of traits across populations and species – This is a broad topic and a lot can be done. In one example, organismal-level bioenergetics could be used as a common currency to examine life cycle strategies and trade-offs among traits of populations and species (e.g. growth versus reproduction, differences in phenology). Variability among parameters can be examined across populations and species both within and between regions (e.g. within region by different groups). Bioenergetics allows one to examine the capacity for phenotypic variable (plasticity) in traits to be explained solely by spatio-temporal environmental variability. After assessing the contribution of environmental variability, the unexplained part of phenotypic variability has somehow to be related to genetic adaptation. The contribution part of plasticity vs. adaptation has to be understood to correctly estimate the adaptive capacity of species or populations. Bioenergetics model simulations also allows investigating the trade-offs between traits (growth, reproduction) by quantifying the energy allocated to each vital rate. The variability in the energy allocation strategies across regions can also be interpreted based on the seasonal variability of the environment. In other words, life cycle strategies can be interpreted with regard to the environmental variability. This topic can include employing common-garden / comparative measurements to disentangle plastic/genetic responses.

A number of other topics could be compared across populations / species and regions: i) density-dependence, ii) responses to climate variability, iii) tipping points (regime shifts) and trophodynamics. Note also change of responses versus scales (individual versus population scales). Maintenance of life cycle processes and life cycle closures.

Topic (ToR 1)

A number of vulnerability assessment (that include SPF) have been / are being conducted for national and regional climate adaptation planning. Work can compare approaches used to understand the adaptive capacity of human communities dependent on SPF resources – as well as to compare the adaptation options identified in different regions / communities (e.g. FutureSeas – vulnerability and social-economic issues, GFCM climate vulnerability assessments conducted in three Mediterranean regions, EU project work examining climate vulnerability of fishing fleets – likely other examples are available in PICES regions – Elliott Hazen? In Brazil: Maria Gasalla). There are economists involved in the group - need to view their slides / interests.