Activity 8: Short-term forecasts and long-term projections

Leaders: Stefan Koenigstein (Germany), Robert Wildermuth (USA)

Background

Small pelagic forage fish (SPF) are at the nexus of marine ecosystems between environmental drivers, lower trophic level productivity, and higher trophic predators, and are targeted by large fisheries operations. They show high spatiotemporal and demographic variation, and are responsive to climate fluctuations and climate change trends in the coming century. For these reasons, understanding and modeling SFP dynamics is complex and challenges ecosystem-based fisheries management.

Activity 8 will explore methods and mechanisms to a) forecast short-term forage fish dynamics and processes (*e.g*., recruitment) at operational management scales, and b) project mid- and long-term changes (*e.g*., decadal-scale fluctuations, distribution shifts and biomass trends under climate change) in regional hindcasts and regionally downscaled future climate projections. This research exchanges ideas and understanding across multiple systems (*e.g*., Canary Current, California Current, Humboldt Current and Kuroshio Current) to explore drivers and integrated models. This Activity is a continuation of Activity 7, *Improving short-term forecasts and/or long-term projections*, from the initial phase of the WG during the 2020–2024 term.

Objectives of the activity for 2024–2028 [with links to WG's ToR]

- Understand fluctuations and ecosystem linkages of forage fish (*ToR 2*)
- Conduct comparative analyses of forage fish (*ToR 1*)
- Identify research gaps and advance forecasting capacities (*ToR 3*)
- Project climate change impacts (*ToR 5*)
- Contribute sessions and/or workshops to the 2026 ICES/PICES/FAO symposium on forage fish (*ToR 6*).

Description of tasks

- **Advance incorporation of environmental and ecological drivers into forage fish population dynamic models.** Models and quantitative studies to provide the grounds for improvement of models used for stock forecasting, assessment, and long-term projections, conducted in collaboration with and using results of WGSPF Activities 1–4.
- **Conduct intercomparison of similar models** across regions and species, for commonly applied models such as larval dispersal models, bioenergetic models, population (stock assessment) models, adult IBMs, food-web models. Technical interchange on, for example, software packages and analyses used, and comparison of most relevant processes and drivers in models.
- **Advance ensemble comparisons** of hindcasts and projections of different model types, for one region or SPF stock (*e.g*., individual-based *vs*. population *vs*. food-web *vs*. end-to-end models). Includes advancing analyses of driving mechanisms behind model dynamics, and comparable output parameters across different model structures (*e.g*., recruitment *vs*. productivity, predation *vs*. natural mortality, consumption *vs*. trophic flow). Interchange with FishMIP regarding comparison of future fisheries projections under SSP/OSP scenarios among different regional models which include forage fish.
- **Explore good practice in coupling of models**, including model validation, performance evaluation, and characterization of uncertainties. Innovation and exchange on technical challenges and communication of results in applied areas, *e.g*., linking larval dispersal into population models, energy budgets with individual-based models, and integration of climate-ocean-ecosystem dynamic models.

- **Identify key areas of uncertainty** and knowledge gaps, guiding observations and experiments aimed at improving future modeling efforts. Identify key processes that have a disproportionate impact on model output *(e.g.*, by sensitivity analyses).
- **Novel applications of models in adaptive management (short-term forecasts) and supporting fisheries adaptation (long-term projections)**. Identify advances needed in forage fish models, and suggest novel management applications for recent advances. In collaboration with WGSPF Activity 9.

Deliverables and anticipated timeline

Deliverable/objective	Timeline
Finalize and submit a review paper on *"Challenges and advances in modeling forage fish"*	October 2025
Convene, together with Activity 9, topic session and/or workshops at the 2026 Symposium (SPF-2026) on advancing models for management applications	May 2026
Convene workshop(s) on innovations in integrated ecosystem modeling at ICES, PICES, and/or ECCWO 6 science conferences	2027

Membership

Name	Institution	Email
Stefan Koenigstein	Leibniz ZMT, Germany	stefan.koenigstein@leibniz-zmt.de
Robert Wildermuth	NOAA_SWFSC, USA	robert.wildermuth@noaa.gov
Ryan Rykaczewski	NOAA-PIFSC, USA	ryan.rykaczewski@noaa.gov
Martin Huret	IFREMER, France	Martin.Huret@ifremer.fr
Susana Garrido	IPMA, Portugal	susana.garrido@ipma.pt
Leire Ibaibarriaga	AZTI, Spain	libaibarriaga@azti.es
Alfonso Perez	IEO-CSIC, Spain	alfonso.perez@ieo.csic.es
Valerio Bartolino	SLU, Sweden	valerio.bartolino@slu.se
Isabel Riveiro	IEO-CSIC, Spain	isabel.riveiro@ieo.csic.es
Laure Pecquerie	IRD, France	laure.pecquerie@ird.fr
Vladimir Radchenko	VNIRO (TINRO), Russia	vladimir.radchenko@tinro.vniro.ru
Criscely Luján	IMARPE, Peru	criscelylujan@gmail.com
Dongwha Sohn	PNU, Korea	dongwhasohn@gmail.com
Stefanie Haase	Thünen, Germany	stefanie.haase@thuenen.de
Naiara Rodríguez-Ezpeleta	AZTI, Spain	nrodriguez@azti.es
Laura Wise	IPMA, Portugal	lwise@ipma.pt
Chris Rooper	Fisheries and Oceans, Canada	Chris.Rooper@dfo-mpo.gc.ca
Fernando Ramos	IEO CSIC, Spain	fernando.ramos@ieo.csic.es
Dorota Szalaj	IPMA, Portugal	dorota.szalaj@ipma.pt
Matthew Baker	NPRB, USA	Matthew.Baker@nprb.org
Mariana Hill	GEOMAR, Germany	mhill-cruz@geomar.de
Jorge Flores-Valiente	IMARPE, Peru	jorgefloresvaliente@gmail.com
Timothee Brochier	IRD, France	timothee.brochier@ird.fr
Margarita Rincón-Hidalgo	IEO-CSIC, Spain	Margarita.Rincon-Hidalgo@ec.europa.eu
Ana Teles-Machado	University of Lisboa, Portugal	ammachado@fc.ul.pt
Andres Ospina-Alvarez	UIB, CSIC	andres.ospina@csic.es
Isaac Kaplan	NOAA-NWFSC, USA	isaac.kaplan@noaa.gov
Carryn de Moor	UCT, South Africa	carryn.demoor@uct.ac.za