Activity 5: Non-climatic and non-fisheries anthropogenic impacts

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Background

Human impact on marine ecosystems is continuously increasing and diversifying over time. Some of the most recent activities are related to a variety of construction and artificial hard substrata installations, such as ocean renewable energy platforms, establishment of liquified natural gas terminals and expanding harbor/marina construction. This raises the need for balancing the transition to sustainable energy sources with simultaneous preservation of marine ecosystems and safeguarding their sustainability. Rigorous environmental assessments are required to ensure that marine infrastructure is designed, deployed, operated and decommissioned in ways that minimize harm to marine life, highlighting the importance of informed decision-making in the face of rapid industrial growth in the marine realm. This relates to not only the individual single pressures and drivers that affect the system, but also to the cumulative impacts of the 'old' and 'new' stressors and habitat alterations that need to be considered both in assessments as well as in management decisions.

The limited understanding of cause-and-effect regarding different types and magnitudes of seascape modification, particularly in relation to role and relevance of small pelagic fishes (SPF), presents a significant challenge. Constructions and modifications introduce stressors, including underwater noise, suspended sediment, altered currents and many more, all of which can affect SPF behavior, physiology, reproduction, migrations, and habitat use. Understanding and assessing the vulnerability of SPF communities to these infrastructure-related stressors is crucial for informing sustainable management practices and minimizing ecological impact. This is relevant both in the context of ecosystem-based fisheries management (EBFM) but also ecosystem-based management (EBM). Many SPF species play a crucial role in marine food webs and are vital for both ecological balance and commercial fisheries. Seascape modifications, including the construction of ocean renewable energy installations, artificial reefs, and other marine infrastructures, can alter the physical and biological characteristics of marine environments. Due to the fragmented and variable evidence of their impacts on SPF, it is difficult to make conclusive statements with sufficient certainty. For instance, while some studies suggest that the presence of structures may provide shelter or enhance feeding opportunities, others indicate that these modifications could disrupt traditional migratory patterns, spawning grounds, and foraging behaviors. These multifaceted interactions make it difficult to disentangle the effects of seascape modifications from other environmental variables affecting SPF, such as temperature, salinity, oxygen, and prey availability. Consequently, there is a pressing need for more targeted research that examines the direct and indirect effects of these seascape modifications on SPF populations at relevant spatial and temporal scales.

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

- Synthesize information across species and oceans on cases of seascape modification effects;
- Develop a conceptual framework for assessing the vulnerability of SPF communities to non-climate and fishery-related stressors across regions and species;
- Contribute a session and a workshop to the 2026 ICES/PICES/FAO symposium on forage fish (*ToR 6*).

Description of tasks

This activity will focus on the following tasks:

- Convene a Topic Session on "New Approaches for Assessment of Human Impacts Beyond Fisheries" at the 2026 SPF symposium (SPF-2026) that welcomes contributions on a broad range of anthropogenic

stressors that can impact forage species, including eutrophication, chemical and microplastic pollution, disturbances to the sound scape, dredging, and offshore energy development.

- Organize a workshop on "Conceptualizing a Vulnerability Analysis for Anthropogenic Stressors on Small Pelagic Fish Communities" at SPF-2026 that will focus on the conceptual framework development for the vulnerability assessment to be developed within the activity. The aim is to synthesize knowledge of anthropogenic impacts across study systems and different species, particularly using trait-based approaches, so that we can better evaluate general patterns and provide more comprehensive advice when requested. Eventually, our study should provide a baseline for informed marine spatial planning and investigate cross-species and cross oceans similarities and differences in impact response.
- The workshop will provide a platform for expert scoring assessing the sensitivity and exposure of selected SPF to environmental modifications. Following the symposium, species traits and respective stressor lists will be collected and backed with literature where possible. Based on this, questionnaires will be developed to include expert rating where knowledge is limited, and the vulnerability analysis will then be performed. A vulnerability analysis framework will be collaboratively developed based on the following key elements:
    - *Exposure*: This refers to the degree to which SPF communities are exposed to anthropogenic stressors like underwater noise (from construction and operational activities of wind farms, shipping lanes, and LNG terminals), sediment suspension (turbidity from dredging and other activities), and changes in hydrodynamic conditions (due to alterations in current patterns caused by structures).
    - *Sensitivity*: The intrinsic biological traits that make SPF communities vulnerable to these stressors, such as their reliance on specific habitat types (*e.g.*, estuaries, shallow coastal waters), sensitive life stages (e.g., larvae or juvenile stages), and migration patterns that may be disrupted by noise and hydrodynamic changes. The sensitivity of different SPF species and life stages will vary based on their dependence on these areas and behaviors.
    - *Adaptive capacity*: This measures the ability of SPF species and ecosystems to adapt to or recover from the impacts of these stressors. It includes species mobility, behavioral plasticity (*e.g.*, shifting to alternative habitats), ecosystem resilience (*e.g.*, recovery of habitats affected by sedimentation or noise), genetic diversity, and life history traits.

Deliverables and anticipated timeline

Deliverable/objective	Timeline
Workshop (W1) on "Conceptualizing a Vulnerability Analysis for Anthropogenic Stressors on Small Pelagic Fish Communities" at SPF-2026	May 2026
Topic Session (S2) on "New Approaches for Assessment of Human Impacts Beyond Fisheries" at SPF-2026	May 2026
Manuscript on vulnerability of selected SPF	2027

Membership (*interest currently collected*)

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