

# INCORPORATING SPATIAL STRUCTURE: REFINING FISHERIES MANAGEMENT

## WHEN BIOLOGY AND MANAGEMENT DON'T ALIGN

Pacific herring spend most of their time in large schools in the open ocean and return in early spring, spreading themselves among individual bays, inlets, and estuaries to spawn. These individual sub-stocks are largely independent and vary in abundance, productivity, and so forth. Harvest rules are usually based on the status of the whole population, across multiple sub-stocks, without accounting for this spatial structure, as information about individual sub-stocks is rarely available. This mismatch in scale between biology and management can have consequences for the effectiveness of management rules and sustainability of herring populations.

## MODELING SPATIAL STRUCTURE FOR PACIFIC HERRING

The Ocean Modeling Forum developed multiple stock assessment models, based on Pacific herring in British Columbia, and asked how estimates of herring abundance are affected by getting the spatial structure of the population wrong. Several hypothetical approaches to the sub-stocks were tested, including ignoring them, grouping them in different combinations, and identifying each independently.

The results showed that models that ignore the sub-stock spatial structure perform the worst, highlighting the need to include spatial structure in stock assessment models as well as evaluations of alternative management strategies.



## RECOMMENDATIONS

Developing spatially-structured models is critically important for assessing herring abundance, particularly when there is a reasonable likelihood of identifying sub-stocks. To reduce error, improve estimation, and reduce overall management risk, stock assessment models should include spatial structure.

Punt, A. E., et al. 2018. When are estimates of spawning stock biomass for small pelagic fishes improved by taking spatial structure into account? *Fisheries Research* 206: 65–78.

