Stock Identification of Yellowtail Flounder off New England

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Summary - A review of the information available on stock identity of yellowtail flounder is provided for the 2022-2024 research track assessment of New England yellowtail flounder stocks. The scientific basis for current assessment and management units was reviewed by the 36th Northeast Regional Stock Assessment Workshop and the 3rd Groundfish Assessment Review Meeting. In summary, the available information supports the continued assessment of three spatial units: 1) Cape Cod-Gulf of Maine, 2) Georges Bank, and 3) Southern New England-Mid Atlantic. Simulation testing suggests that assessing current management units as separate stocks is generally robust to uncertainty in location of stock boundaries and movement among stocks. Recommendations are provided for updating analyses in the research track process and longer-term research to fill information gaps (e.g., advanced analysis of genetics).

Previous Peer Reviews

Previous reviews of yellowtail flounder stock identity define separate stocks off the Scotian Shelf, southern New England, on Georges Bank, and off Cape Cod (Scott 1954, Royce et al. 1959, Lux 1963, Canada 1983, USA 1983, Neilson et al. 1986, Begg et al. 1999a). However, there was some disagreement among reviews on stocks of yellowtail flounder in the Mid Atlantic Bight and the northern Gulf of Maine. Although most reviews included the Mid Atlantic Bight in the southern New England stock area, the Mid Atlantic was identified as a separate stock in the US case for an international boundary (USA, 1983). Royce et al. (1959) also defined a separate stock of yellowtail on the scattered shoals of the northern Gulf of Maine.

The 36th Northeast Regional Stock Assessment Workshop (NEFSC 2003) reviewed geographic patterns of abundance, geographic variation, and movement to support the conclusion that yellowtail flounder should be managed as three stocks: 1) Cape Cod-Gulf of Maine, 2) Georges Bank, and 3) southern New England-Mid Atlantic. Information on genetic variation is uncertain, because an unpublished analysis of allozymes found some differences among Browns Bank, Georges Bank and the Mid-Atlantic Bight (Doggett et al. 1973), but another unpublished analysis of random amplified polymorphic DNA indicated 90–95% genetic homogeneity among all management areas from the Scotian Shelf to the Mid Atlantic Bight (Kuzirian & Chickarmane 2004). There were divergent patterns of yellowtail flounder abundance and biomass over time in the southern New England-Mid Atlantic area (Brown et al. 1987, Cadrin 2010). Geographic patterns in growth and maturity indicate that Cape Cod-Gulf of Maine yellowtail flounder form a separate phenotypic stock (Begg et al. 1999a, Scott 1954, Lux & Nichy 1969, Pitt 1974, Neilson et al. 1986, Cadrin 2010).

Peer review of the 36th SAW recommended further investigation to evaluate the degree of mixing between the Georges Bank and Cape Cod stocks of yellowtail flounder (NEFSC 2003), which was addressed by a large-scale tagging project (Alade 2008, Wood & Cadrin 2013). Tagging data indicate 96% residence in the Cape Cod–Gulf of Maine stock, 98% residence on Georges Bank, and 26% residence in the southern New England–Mid-Atlantic stock area, but most movement from southern New England

was observed for yellowtail flounder released on Nantucket Shoals, near the boundary with adjacent stock areas. The 3rd Groundfish Assessment Review Meeting reviewed the tagging study and concluded that tagging data and analyses support the current stock definitions and boundaries (NEFSC 2008). Uncertainty in the boundary of the Georges Bank stock and the southern New England–Mid-Atlantic stock was confirmed by tagging data.

Evaluating Performance of Current Assessment Units

Considering the uncertainty in location of stock boundaries and movement among stock areas, the robustness of assessing each yellowtail flounder management unit as a separate stock was tested. An age-based, tag-integrated, metapopulation model of the three New England yellowtail flounder stocks was developed by Goethel et al. (2015a). The metapopulation model estimated movement among stock areas by fitting to the fishery and survey data used for yellowtail flounder assessments as well as the tagging data. The metapopulation model provided similar estimates of stock size and fishing mortality as the three independent closed-stock models, except for estimates of the dominant 1987 yearclass from the southern New England-Mid Atlantic stock that had partial movement to the other two stocks (Cadrin et al. 2019).

Operating models were conditioned on the results of the tag-integrated metapopulation model to generate pseudodata for single-stock and metapopulation estimation models (Goethel et al. 2015b). Performance of alternative estimation models was evaluated by comparing estimated parameter values to the 'true' values from operating models. Simulation results confirmed that closed-stock estimation models generally estimated stock size and mortality trends well, except for the simulated 1987 yearclass (Cadrin et al. 2019).

Discussion

The available information supports the continued assessment of three spatial units:

1. Cape Cod-Gulf of Maine,
2. Georges Bank, and
3. Southern New England-Mid Atlantic.

Since the SAW36 and GARM III reviews, there has been no new analyses of geographic variation in genetics or life history traits. Patterns in survey trends in the last two decades are consistent with previous inferences of a separate harvest stock in southern New England–Mid-Atlantic where survey catches remained extremely low, in contrast to moderate increases in survey catches on Georges Bank in the 2000s then low catches in the 2010s, and relatively high survey catches in the Cape Cod-Gulf of Maine area (NEFSC 2022).

Tagging information indicates high residence in the Georges Bank and Cape Cod-Gulf of Maine stock areas and confirms uncertainty in location of Georges Bank and southern New England–Mid-Atlantic boundary. However, sensitivity analyses and simulation testing suggest that separate stock assessments of the current spatial units perform well in the context of observed movement rates among stocks.

Previous analyses can be updated in the 2022-2024 research track process. For example, spatial distributions of fishery and survey catches should be updated to explore recent changes. Analyses of size and maturity at age can be updated to confirm phenotypic differences of the Cape Cod-Gulf of Maine

stock. Analyses of survey catch by stratum can be updated to confirm different stock trends among stocks. In the longer-term geographic variation should be investigated using more advanced genetic methods.

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