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Stable carbon and oxygen isotope ratios of winter flounder otoliths assess connectivity between juvenile and adult habitats

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Winter flounder populations (Pseudopleuronectes americanus) have significantly declined in recent years along the Rhode Island, USA coastline. The reasons for this decline are not completely clear; however, habitat loss may be a factor. Therefore, knowledge of connectivity between juvenile nearshore habitats and the adult offshore populations may be important for improved management of this fishery. This study was undertaken to determine if stable carbon (δ^{13}C) and oxygen (δ^{18}O) isotope ratios in otoliths could be used to differentiate the locations that serve as important juvenile habitats for winter flounder.

It is generally believed that winter flounder spawn during late winter in nearshore areas, and juvenile fish reside in shallow-water habitats along the coastline during their first summer. Once young-of–the-year flounder undergo metamorphosis and settle, they remain in close proximity to that site until fall. Adult fish move offshore during the late winter and spring, and then return to their natal estuaries during the fall and winter to spawn.

Juvenile flounder were collected yearly over a three-year period from 18 juvenile habitats with a wide range of salinities. Several years later adult flounder of the same cohorts were obtained from similar inshore locations and also from the offshore fishery. Sagital otoliths were removed from the adult flounder and the core of the otolith representing the juvenile period was obtained using a Micromill drilling system. These juvenile otolith cores from adult fish and whole sagittal otoliths from juvenile flounder were analyzed for δ^{13}C and δ^{18}O using continuous-flow isotope ratio mass spectrometry.

Results from these analyses show significant differences in δ^{13}C and δ^{18}O signatures among water bodies (bay, coastal ponds and an estuarine river). Preliminary analysis indicates that the isotope ratios of the juvenile cores from adult flounder and whole otoliths from juvenile fish collected at the same locations were similar. Isotope data for juvenile cores from adult flounder obtained from the offshore fishery indicate that many of these flounder spent their first year in high salinity areas and not in estuarine systems.