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Threespine stickleback as a successful species in the Anthropocene

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Abstract

Anthropogenic effects lead to fast environmental changes, which challenge the adaptive capacities of biological species and therefore alter their relative completeness. This results in the growth of some species and the decline of others. Small fish threespine stickleback Gasterosteus aculeatus, which has a negligible commercial significance, notably expanded its range during the last decades (Svalbard, Northern Land, Caspian Sea, upper and midstream of rivers entering the Black Sea) and drastically increased its abundance within the current range (Baltic and White Seas, Lake Constance). In the Baltic Sea, the increase of stickleback abundance is likely associated with eutrophication, which improves their feeding conditions and, via positive feedback mechanisms, facilitates further growth of the population. In the Arctic White Sea, the growth of stickleback is primarily related to increased temperature. In lake Constance stickleback actively prey on juvenile whitefish which is their food competitor. Thus, in different ecosystems, different factors resulted in an increase of the same species, which is unlikely due to chance and thus requires a special analysis. Stickleback has a number of characteristics allowing them to quickly occupy changing ecological niches: (i) small size and quick maturation; (ii) exceptional euryhalinity; (iii) high phenotypic plasticity with respect to feeding and habitats; (iv) ability for quick genetic adaptations; (v) armor structures effectively protecting fish from predators ; (vi) complex behavior, in particular protection of offspring by males and cannibalism; (vii) high tolerance to chemical pollution. These characteristics may provide stickleback competitive advantages in comparison with other species and contribute to a recent increase of stickleback abundance and distribution range under quick and unpredictable human-induced environmental changes. As this trend is forecasted to progress, one may expect further growth of threespine stickleback abundance and range. The study was supported by RSF grant 19-14-00092.

Keywords

threespine stickleback, Baltic Sea, population growth, White Sea