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Abstract

A Comparison of Olfactory Sensitivity in Seawater- and Freshwater-Adapted Bass, *Dicentrarchus labrax* †

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Abstract: Fish rely heavily on olfaction for many aspects of their lives including foraging, defense, migration, and reproduction. Olfactory receptor neurons in the olfactory epithelium are in direct contact with the water, and are, therefore, exposed to changes in water chemistry. The European seabass, *Dicentrarchus labrax*, uses estuaries as feeding grounds and migrates between seawater and brackish water; but some can be found in 100% freshwater. However, little is known about how the olfactory system adjusts to waters of such different ionic composition and whether this affects its function and ability to discriminate between odorants. The aim of this study was, therefore, to compare olfactory sensitivity in seabass adapted to either seawater (SW) or freshwater (5 ppt; FW), to odorants conveyed at different salinities, using multi-unit recording from the olfactory nerve. In SW-adapted fish, olfactory sensitivity to amino acids (AA) was consistently higher when AA were presented in seawater (SW-AA) than when presented in freshwater (FW-AA), whereas in FW-adapted fish, olfactory sensitivity to FW-AA was either equal or slightly lower to SW-AA. SW-adapted fish responded to decreases in external [Ca^{2+}] and to increases in external [Na^{+}]. FW-adapted fish responded to increases of both ions. In SW-adapted fish, Ca^{2+}-free artificial seawater (ASW) completely inhibited olfactory responses to amino acids, whereas Na^{+}-free ASW had no effect. However, in FW-adapted fish, lack of either ion in the water had no effect. Taken together, these results suggest that, as a primarily marine species, the olfactory system of the seabass is more sensitive in seawater; however, it can still function in freshwater, albeit with reduced sensitivity. Furthermore, in seawater, the olfactory transduction process is likely mediated by influx of external Ca^{2+}, but not Na^{+}. In FW-adapted fish, the transduction process relies on neither external Ca^{2+} nor Na^{+}, suggesting that the process of hyperosmoregulatory ability to adjust to life in ion-poor water. Further work is needed to clarify how changes in salinity affect olfactory sensitivity, and the mechanisms by which euryhaline species are able to adapt to such changes when moving between media of different ionic composition and variable pH.

Keywords: olfaction; salinity; odorants; calcium; sodium; amino acids

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