

The effects of a single freshwater release into the Kromme Estuary.

4: Larval fish response

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Abstract

In total 17 families comprising more than 29 species of larval teleost fishes were recorded in the Kromme Estuary during the study period. Dominant species included *Atherina breviceps*, *Caffrogobius gilchristi*, *Diplodus sargus capensis*, *Gilchristella aestuaria*, *Glossogobius callidus*, *Rhabdosargus holubi* and *Rhabdosargus globiceps*. The larval fish catch in the estuary indicated a marine dominance with a relatively high species diversity. The introduction of a regulated freshwater pulse of $2 \times 10^6 \text{ m}^3$ into the estuary from the Mpopu Dam was monitored. Pre- and post-release collections of fish larvae were made on a weekly basis for a two-month period between October and December 1998. The regulated freshwater release into the estuary resulted in no significant changes to the fish family composition, species diversity or estuarine association of the larval fish assemblage. No significant increase in total larval fish abundance or recruitment response by estuarine-dependent species was recorded. A limited breeding response by estuarine-resident fish species such as *Caffrogobius gilchristi*, *Gilchristella aestuaria* and *Glossogobius callidus* was documented. The increases in larval abundance of estuarine-resident species were mainly attributed to spawning events in the Geelhoutboom Tributary. This tributary received freshwater inflow from rainfall, which coincided with the dam release. It appears that the tributary serves to supplement the Kromme Estuary ichthyoplankton with large numbers of larvae belonging to estuarine-resident species. Physical conditions in the estuary returned to marine dominance within two weeks of the freshwater release. It is concluded that the riverine pulse and salinity gradient induced by the release of freshwater was too short-lived and too weak to result in a cueing effect on larval fish in the marine environment. A larger amount of freshwater would be required to produce a positive response by the larvae of estuarine-associated marine species.

Introduction

It has been well documented both in the northern and southern hemispheres that estuaries are important nursery areas for the juveniles of many species of estuarine and marine fish (Day et al., 1981; Dando, 1984; Wallace et al., 1984). This is the direct result of these species being represented in estuaries predominantly by juveniles. Although some species of fish do enter estuarine nursery areas as juveniles, others enter as larvae (Beckley, 1985; Whitfield, 1989; Gaughan et al., 1990; Strydom, 1998). It therefore seems probable that the nursery function of estuaries begins not only at the juvenile phase in the development of estuarine-dependent marine fish but starts at the postflexion larval stage in the development of some of these species. This postflexion larval stage may be very short in duration until the larva transforms into a juvenile fish but during this time the postflexion larva is already making use of the estuary as a nursery area.

The postflexion larvae (older larvae) of estuarine-dependent marine fish recruit into food-rich, sheltered estuarine nurseries from marine breeding grounds. The recruitment of postflexion marine larval fish into estuarine nurseries is also accompanied by the recruitment of postflexion larvae of certain estuarine resident species whose preflexion larvae undergo an obligatory marine phase (Whitfield, 1989). These larvae later return to the estuary as postflexion larvae or early juveniles. Estuaries are also important nursery areas for the larvae of estuarine resident species whose life cycles are completed within the estuarine environment. The larvae of the estuarine round-herring have been recorded utilising optimal tidal stream movement in order to maintain their position within the

estuarine nursery environment (Melville-Smith et al., 1981). In assessing the role that estuaries play in the reproductive strategies and early life histories of estuarine-associated species, it becomes imperative to understand the importance of cues in attracting recruitment size larval fish into estuaries. Freshwater input into estuaries has been identified as a probable cue in facilitating recruitment of larval fish into these systems (Boehlert and Mundy, 1988; Whitfield, 1994a).

River flow influences the salinity, turbidity and biochemical properties of estuarine waters. Fish possess a highly developed sense of smell (Stabell, 1992) and estuarine water flowing into the marine environment may serve as a cue in guiding estuarine-dependent larval fish species into these nursery habitats. River flow also brings nutrients and organic material into estuarine systems. Nutrient input, via riverine base flow, has been shown to increase primary and secondary production in estuaries (Hilmer and Bate, 1991; Schlacher and Wooldridge, 1996), thus benefiting estuarine fish stocks. Whitfield (1994a) found a positive correlation between estuarine-dependent larval and juvenile marine fish abundance and river flow into estuaries.

Poor catchment management and freshwater deprivation have had serious impacts on many South African estuaries through their effect on biotic diversity as well as essential ecological processes (Whitfield and Wooldridge, 1994). Reddering (1988) emphasised the fact that reduced river discharge due to excessive freshwater abstraction has a profound effect on the biological behaviour of estuaries. The Kromme Estuary, on the warm temperate coast of South Africa, is a typical example of a freshwater-starved estuary (Jerling and Wooldridge, 1994). Impoundments within the catchment have substantially reduced freshwater inflow into the estuary and, as a result, there is an absence of a typical longitudinal salinity gradient with hypersaline conditions in the upper reaches being regularly recorded (Heymans and Baird, 1995). Almost the entire

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