Investigating fish communities as an index of estuarine condition

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Context / Aims

Fish communities exhibit predictable responses to ecosystem degradation/stress, and thus may be used as sensitive indicators of the ecological condition of these systems. Biotic indices, based on fish and other biological communities, are now used world wide to quantify the ecological health of rivers, lakes, estuaries and many other environments.

A Fish Community Index for the Swan Canning estuary was developed by Murdoch University over five years (2007-2012) in collaboration with the Swan River Trust, the Department of Water and the Department of Fisheries. The index was developed from a 30 year dataset is the first of its kind for assessing estuarine health in Australia and has been subjected to extensive testing, validation and review to provide a robust and sensitive tool for monitoring and reporting.

The Fish Community Index complements traditional water quality testing as a measure of the condition of the system and since 2012 has been part of regular monitoring and reporting on the waterway. An report on fish communities in the Swan Canning Riverpark is released to the public annually.

The aim of this project is to undertake the evaluation of the fish communities in the Swan Canning Riverpark for the purposes of applying the fish assemblage based index of estuarine condition and reporting. The project extends monitoring until 2017.

Photo: Seine netting for fish communities

Project progress and approach

This project is in progress with an annual report on fish communites recently completed.

The Fish Community Index combines signals from numerous characteristics of the fish community (e.g. the numbers, diversity and identities of different species, and the relative proportions of species with different feeding and habitat requirements). The resulting index score (0-100) quantifies the ecological health of the Swan Canning Estuary and results are reported as a conceptually simple letter grade (A, very good – E, very poor).

Fish communities were sampled over the summer and autumn of 2016 and 2017. Six nearshore and six offshore sites in each of four management zones of the Swan Canning estuary were sampled using a seine net and multimesh gill net (Figure 1). Collected fish are identified, counted and returned to the water alive. Species abundances in each sample are used to calculate values for core metrics used to calculate the nearshore and offshore fish community index. In turn these are used to calculate and overall index score for each zone.

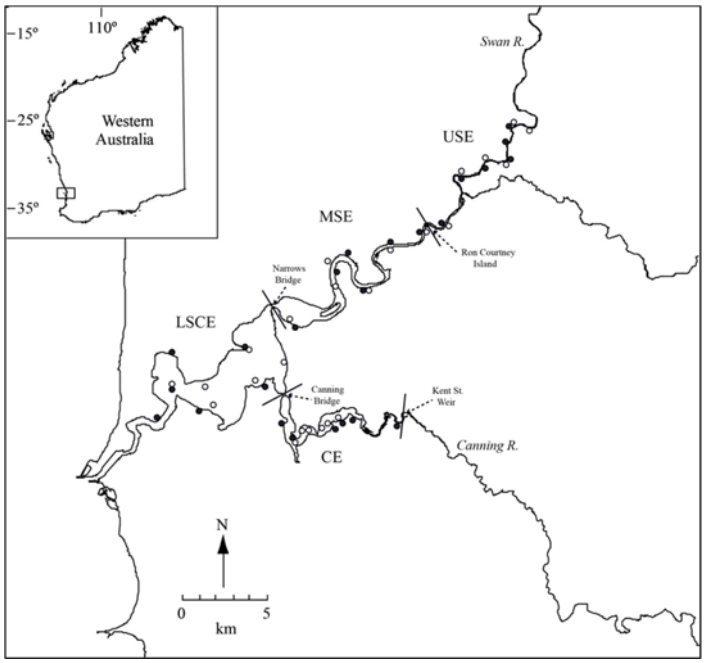

Figure 1: Locations of nearshore (black circles) and offshore (open circles) sampling sites . LSCE, Lower Swan Canning Estuary; CE, Canning Estuary; MSE, Middle Swan Estuary; USE, Upper Swan Estuary.

Outcomes to date and implications for management

In 2017, the shallow nearshore areas were assessed as being fair to good, while offshore waters of the system were assessed as fair (Figure 2). These results are slightly poorer for 2017 compared with 2016 and reflect the impact of the flood event of February 2017 with associated salinity changes and hypoxia through autumn. Fewer species were caught in 2017 as conditions were less favourable for a large number of the marine-associated and estuarine species.

The ecological consequences of flooding were most evident in the offshore waters of the Middle Swan Estuary, where condition score dropped significantly, from good (B) in summer to poor (D) in autumn.

Across the estuary as a whole, the ecological condition based on fish communities has been assessed as generally good to fair in nearshore and offshore waters since 2008 and 2011, respectively (Figure 2).

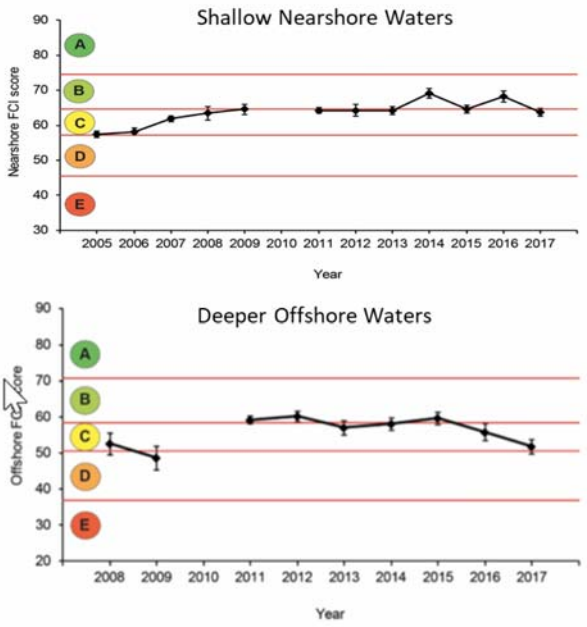

Figure 2: Trend plot over recent years of the average (± standard error) Fish Community Index (FCI) scores for nearshore and offshore waters across the whole Swan Canning Estuary. Condition grades are A, very good; B, good; C, fair; D, poor; E, very poor) Red lines denote boundaries between condition grades.

Future activity within the next 12-18 months

Further monitoring and reporting will occur in 2018.

Key project communications

Hallett, C.S. (2017). Assessment of the condition of the Swan Canning Estuary in 2017, based on the Fish Community Index of estuarine condition. Final report to the Department of Biodiversity, Conservation and Attractions. Murdoch University, Western Australia, 35 pp.

Hallett, C.S. (2014). Quantile-based grading improves the effectiveness of a multimetric index as a tool for communicating estuarine condition. *Ecological Indicators* 39: 84-87.

Hallett, C.S., Valesini, F.J. (2012). Validation of the Fish Community Index of Estuarine Condition and development of a monitoring regime for the Swan Canning Riverpark. Final Report to the Swan River Trust. Murdoch University.

Hallett, C.S., Valesini, F.J., Clarke, K.R., Hesp, S.A., Hoeksema, S.D. (2012). Development and validation of a fish-based, multimetric index for assessing the ecological health of Western Australian estuaries. *Estuarine, Coastal and Shelf Science* 104-105: 102-113.

Hallett, C.S., Valesini, F.J., Clarke, K.R., Hoeksema, S.D. (2016). Effects of a harmful algal bloom on the community ecology, movements and spatial distributions of fishes in a microtidal estuary. *Hydrobiologia* 763: 267-284.