

## Investigating fish communities as an index of estuarine condition

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### Background

Fish communities exhibit predictable responses to ecosystem degradation, 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 worldwide to quantify the ecological health of rivers, lakes, estuaries and many other environments.



Photo: Yellowtail grunter. (Jennifer Elliott – DBCA)

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, which 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 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.

Annually, the Department of Biodiversity, Conservation and Attractions commissions Murdoch University to undertake an evaluation of the fish communities in the Swan Canning Estuary for the purposes of applying the fish assemblage-based index and reporting on the estuarine condition.

The FCI combines signals from numerous characteristics of the fish community (e.g. abundance, diversity and species identity, 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 (very good) to E (very poor).

Fish communities were sampled over the summer and autumn of 2019. Six nearshore and six offshore sites in each of four management zones of the Swan Canning Estuary were sampled using a seine net and multi-mesh gill net (Figure 1). Collected fish were identified, counted and returned to the water alive. Species abundances in each sample were then used to calculate values for the core metrics that together make up the nearshore and offshore fish community index. In turn these are used to calculate an overall index score for each zone.

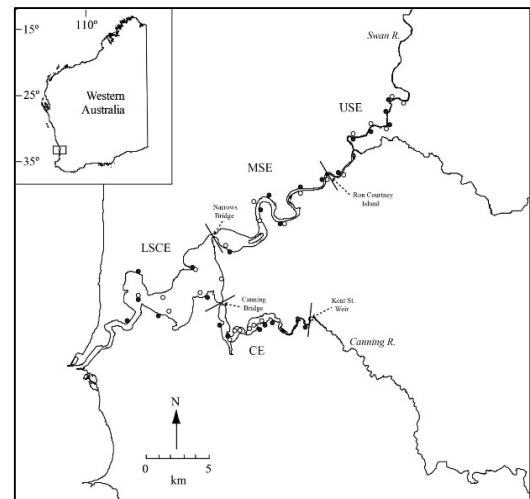


Figure 1: Locations of nearshore (black circles) and offshore (open circles) sampling sites.

LSCE: Lower Swan Canning Estuary;  
MSE: Middle Swan Estuary;  
USE: Upper Swan Estuary;  
CE: Canning Estuary.

## Findings

The nearshore waters of the estuary were in overall fair condition (C) during 2019, consistent with the trend in condition scores since 2011 (Figure 2). Average FCI scores for each nearshore zone showed them to be in broadly fair (C) condition in summer, with the exception of the USE, whose condition in summer was good (B). Hardyheads (*Atherinidae*) and gobies (*Gobiidae*) dominated catches from the nearshore waters of the estuary in 2019. As in previous years, the total number of species recorded in the nearshore waters of each zone declined in an upstream direction, from 23 species in the lower Swan Canning to 16 species in the Upper Swan. This is typical for the Swan Canning and similar estuaries in south-western Australia.

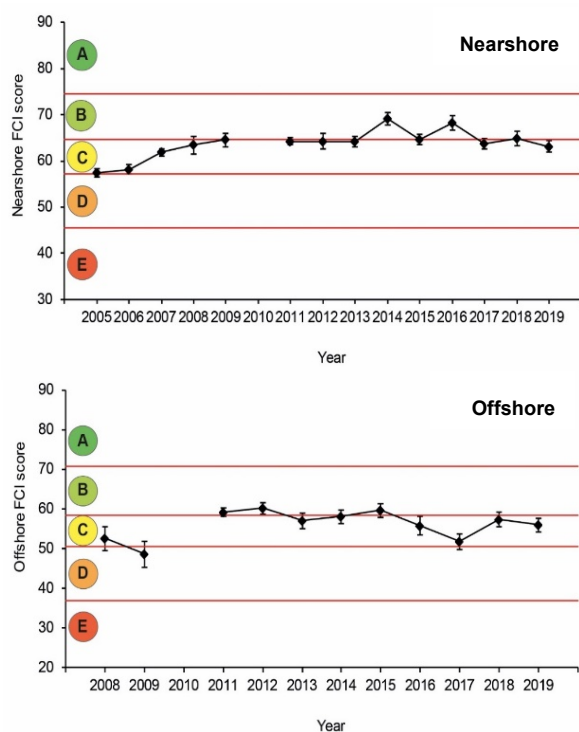


Figure 2: Trend plot over recent years of the average ( $\pm$  standard error) Fish Community Index (FCI) scores for nearshore and offshore waters across the whole Swan Canning Estuary.

Condition grades are A, very good; B, good; C, fair; D, poor; E, very poor

Red lines denote boundaries between condition grades.

Overall, the offshore waters of the estuary were also in fair (C) condition during 2019 (Figure 2). These results reflect the lack of any widespread hypoxia during this year's monitoring period. A decline in condition of the offshore waters of the middle Swan was observed between summer and autumn and may reflect the presence of dinoflagellate blooms at that time. Consistent with results observed since 2012, the Canning Estuary scored poorly relative to other zones in both seasons. Perth herring was among the dominant species in offshore waters from all four zones, comprising 46–90% of the total catches. Southern eagle rays were abundant in the lower Swan Canning (23% of the catch) and yellowtail grunter and black bream were common in the upper Swan (14–18%).

## Management Implications

In 2019 the ecological condition of the estuary (as a whole) was assessed as fair based on fish communities. These results are consistent with the relatively stable trend in condition since 2011.

The offshore waters of Canning Estuary exhibited the lowest scores of any zone in 2019. Since the start of regular fish community monitoring in 2012, the offshore waters of this zone have consistently scored poorly relative to those of the other zones across both seasons (receiving a D grade in 50% of monitored seasons), and some additional monitoring may be necessary moving forward to better understand the factors underlying this trend.

Monitoring and reporting will occur again in 2020.

## Further information

Hallett, C.S. (2019). Assessment of the condition of the Swan Canning Estuary in 2019, based on the Fish Community Index of estuarine condition. Final report to the Department of Biodiversity, Conservation and Attractions. Murdoch University, Western Australia, 34 pp.

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Hallett, C.S., Trayler, K.M., Valesini, F.J. (2019). The Fish Community Index: a practical management tool for monitoring and reporting estuarine ecological condition. *Integrated Environmental Assessment and Management* 15 (5): 726-738. doi:10.1002/ieam.4151