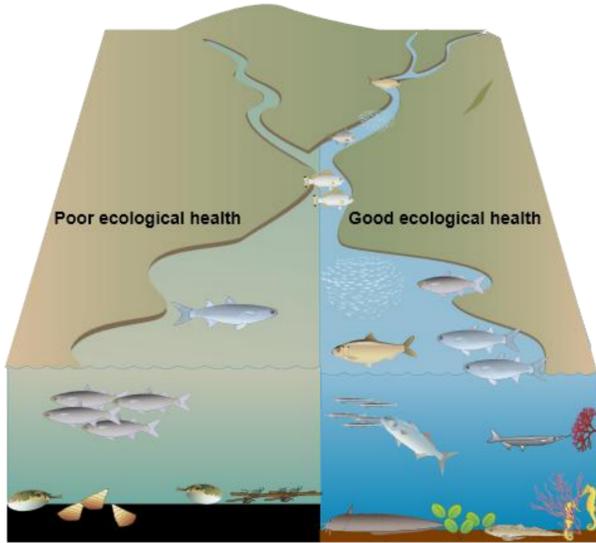


The Fish Community Index (FCI):

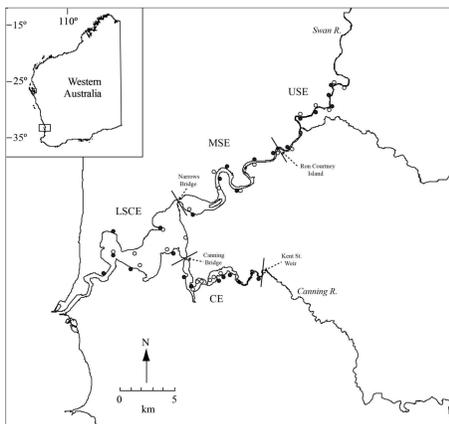
A simple and robust tool for monitoring and reporting estuarine health

1. Background and rationale



- In degraded estuaries, fish species with specific habitat, feeding or other environmental requirements will be less abundant and diverse, whilst a few generalist species become more abundant, leading to a decrease in the number and diversity of species overall.
- Multimetric FCI integrates metrics of fish community structure and function; quantifies condition against historical reference conditions.

2. Annual monitoring regime



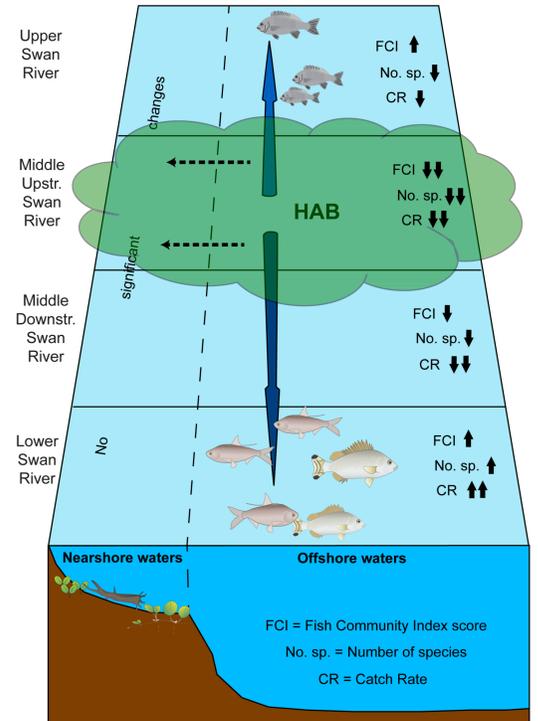
- 4 estuarine zones (Lower Swan Canning Estuary, Canning Estuary, Middle Swan Estuary, Upper Swan Estuary).
- 6 nearshore and 6 offshore sites per zone.
- Seine netting (nearshore) and gill netting (offshore).
- Fish community sampled in both Summer and Autumn at each site.

3. Index calculation

- Values for component metrics are calculated for each sample, after allocating each fish species to its appropriate Habitat, Estuarine Use and Feeding Mode guilds^{1,2}.
 - Metric values then converted to metric scores (0–10) via comparison with the relevant (zone- and season-specific) reference condition values for each metric².
 - Metric scores are combined into a FCI score (0–100) for each sample (NB nearshore and offshore versions of the FCI).
 - FCI score is compared to thresholds to determine the ecological condition grade for the sample³.
- A very good, ● B good, ● C fair, ● D poor, ● E very poor
- Intermediate grades e.g. B/C (good/fair) or C/B (fair/good) awarded if the FCI score lies within one point of a grade threshold.

4. Index sensitivity to stressors

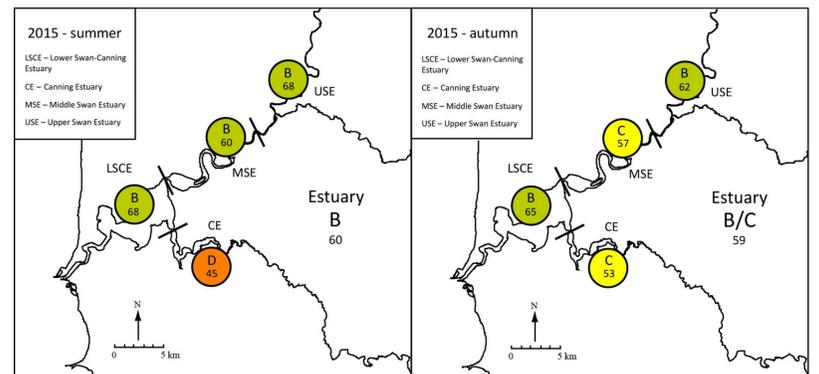
- FCI is a sensitive and robust tool for quantifying ecological health responses to local-scale environmental stressors and the subsequent recovery of the system.
- Exemplified by the ability of the FCI to track changes in estuarine condition caused by algal blooms during 2004, 2011 and 2012^{2,4}.
- During a dinoflagellate bloom in the Swan River during March 2004, the mean offshore FCI score for the region declined from 58 (C/B) to 17 (E).
- Offshore waters most affected. Fish moved upstream, downstream, and into nearshore waters from the offshore waters of the bloom-affected area.
- Recovery of FCI scores post-bloom highlights the resilience of estuarine fish communities to these ecological perturbations.



5. Reporting estuarine health

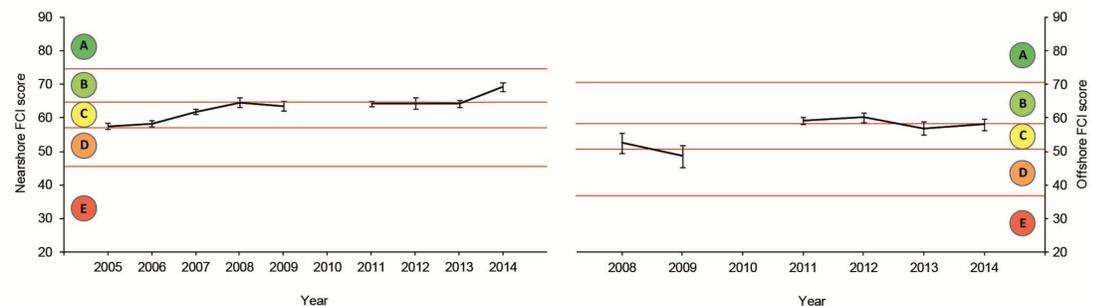
SPATIAL PATTERNS

- Condition of the estuary was generally fair (C) to good (B) over the period of 2012–2015.
- Canning Estuary zone in poorest condition.
- Offshore waters in poorer condition than nearshore waters⁴.



TEMPORAL TRENDS

- Evidence of an improvement in overall condition of the estuary since the mid- to late-2000s, following a period of frequent and severe algal blooms and fish kills in 2000–2008.



6. Summary

- FCI is sensitive to ecological stressors such as hypoxia and algal blooms. The established annual monitoring regime provides a robust basis for quantifying and reporting spatial and temporal changes in estuarine condition.
- Scores and condition grades are easily understood by the public and other stakeholders, and can be incorporated into future report cards.
- FCI monitoring outputs are publicised on the web (www.swanrivertrust.wa.gov.au) and inform the discussion around estuary health in the State parliament, media and wider community.

References

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- Hallett et al., 2012b. *ECSS* 104-105: 102-113
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