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Poster

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Responses of fish-based, estuarine health indices to algal bloom events of differing severity

1. Background / aims

We recently developed fish-based, multimetric indices (see references) for assessing the health of shallow nearshore and deeper offshore waters of the Swan-Canning Estuary, Western Australia (Fig. 1).

Here, we examine index responses to two blooms of the harmful dinoflagellate, *Karlodinium veneticum*, which have affected this system in the last decade.

These blooms differed in their extent and severity, enabling us to assess the sensitivity of the indices to ecological perturbations of differing intensities.

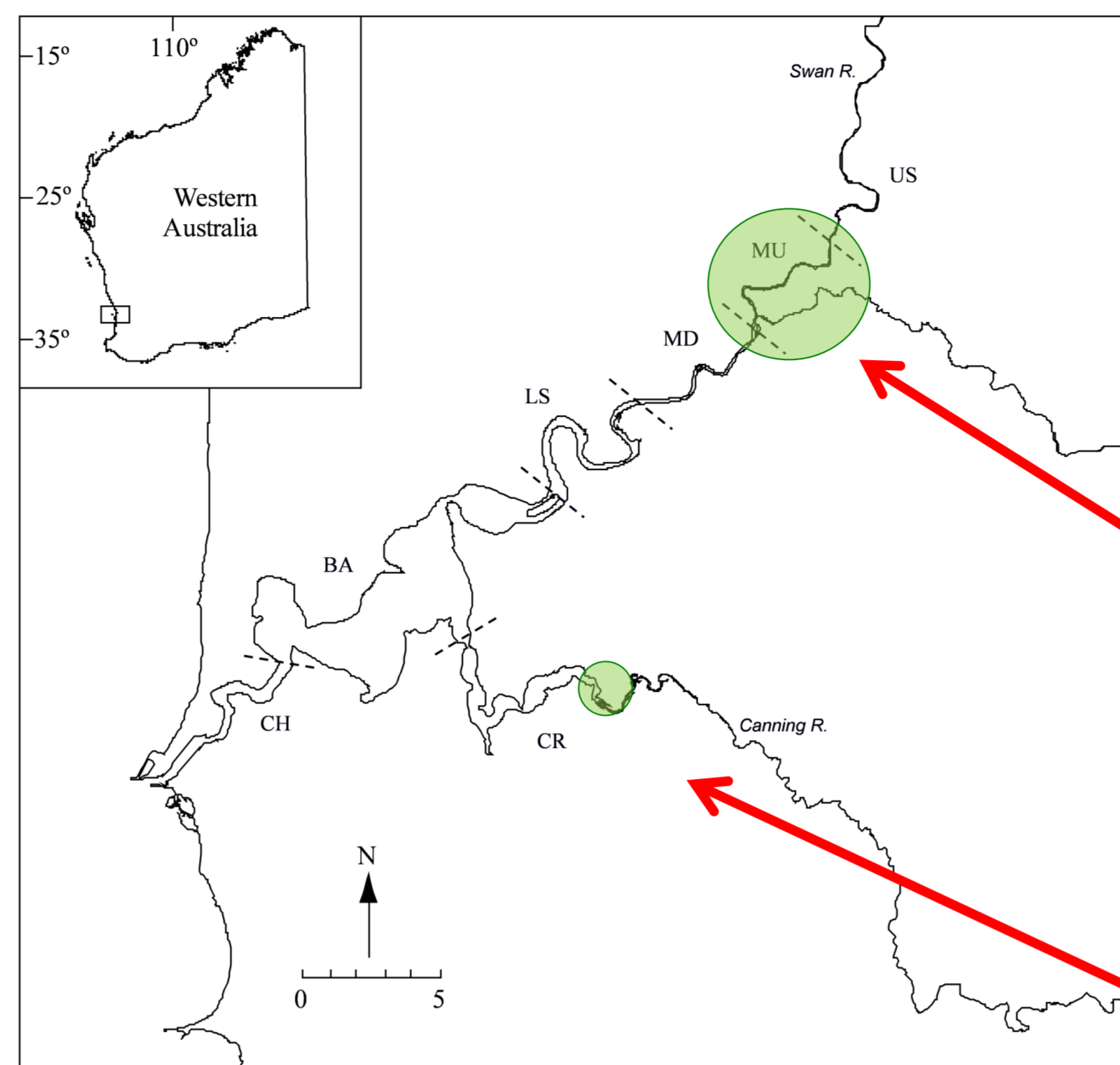


Fig. 1 (above): Map of the Swan-Canning Estuary and its regions

Fig. 2 (below): Fish kills caused by algal blooms (Frances D'Souza, DoW)



2. Methods

We examined patterns in index scores from samples collected before, during and after two blooms:

March 2004 – severe bloom

- affected >5km of the middle-upstream (MU) region of the Swan River
- lasted for >3 weeks
- resulted in a fish kill (est. 1000's of fish)

May 2011 – mild bloom

- persisted over <2km of the Canning Estuary
- lasted for <1 week
- did not result in a fish kill

Mild bloom (2011)

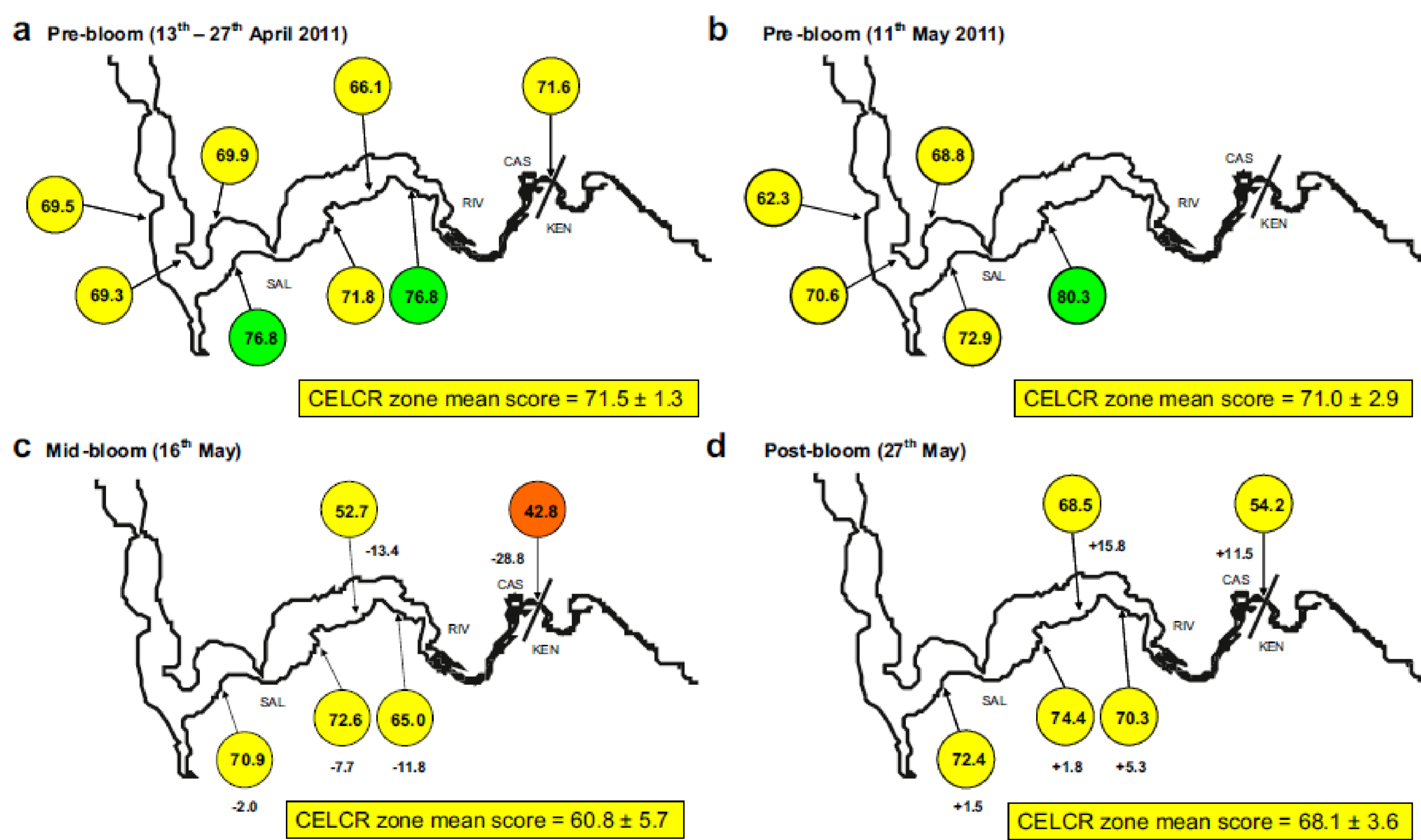
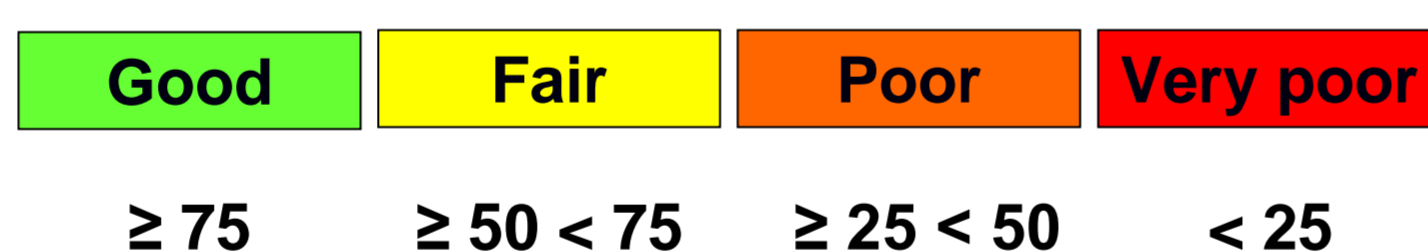


Fig. 3: Responses of nearshore health index scores (circled) and health classifications (colours) to a relatively mild algal bloom in the Canning Estuary



3. Results

Severe bloom (2004)

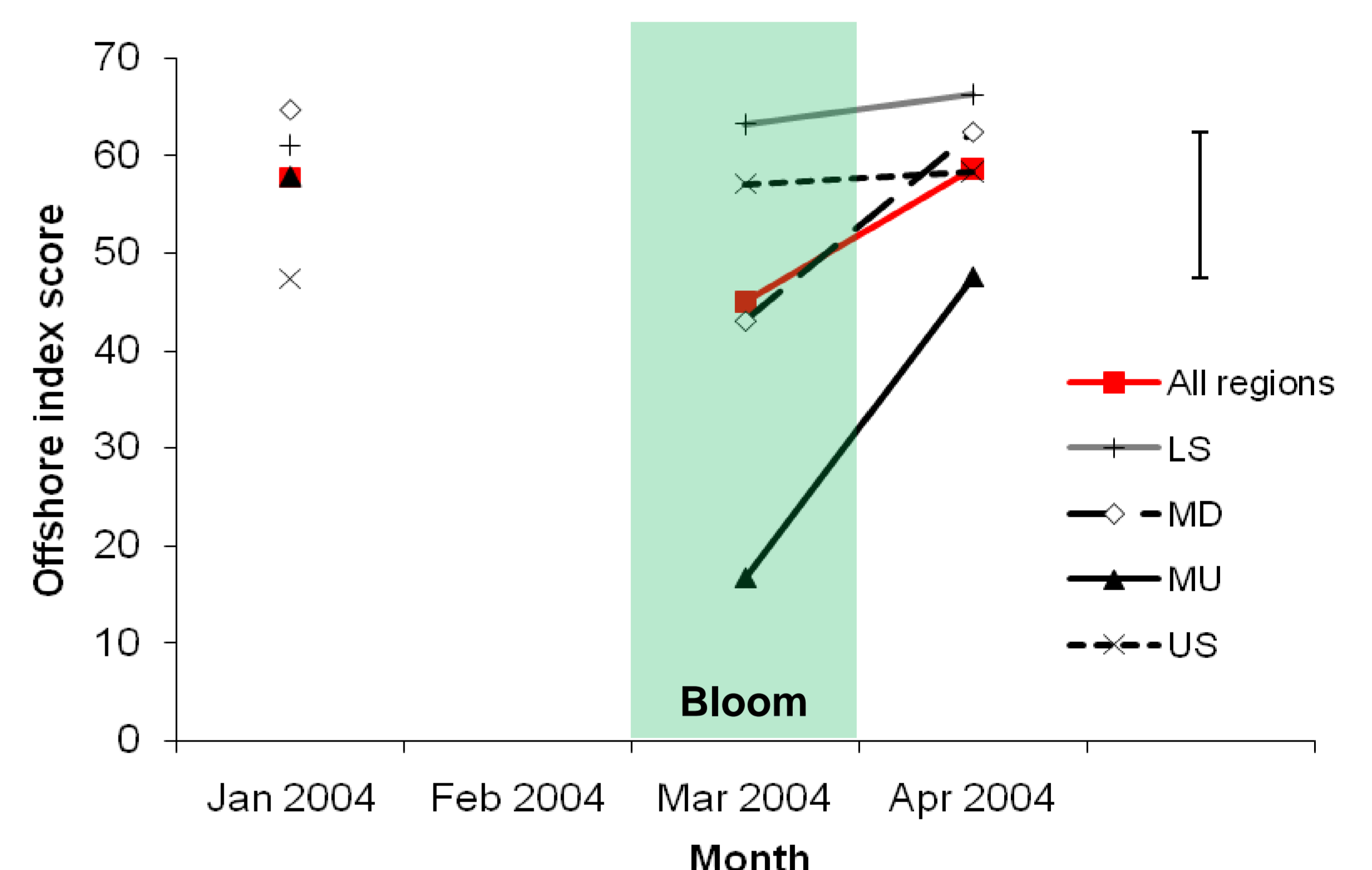


Fig. 4: Mean offshore health index scores recorded from the Lower (LS), Middle-Downstream (MD), Middle-Upstream (MU) and Upper (US) Swan River regions before, during and after a severe algal bloom

- **Pre-bloom:** health of CE zone consistently fair to good (mean score = 71); most sites scored between 66 and 72
- **Mid-bloom:** site scores fell by 2-29 points as fish moved away from bloom. Mean CE zone score had decreased by >10 points to 60.8
- **Post-bloom:** health of CE zone recovered and site scores had rebounded by 2-16 points. Mean CE zone score reached 68.1 as fish recolonised the zone

- **Mid-bloom:** health of deeper, offshore waters in the Swan River had become poor, most notably in the bloom-affected MU region (mean score = 17; v. poor)
- In contrast, offshore health of LS & US regions increased slightly during the bloom, as fish moved into these regions from bloom-affected MU & MD regions
- Nearshore index scores (not shown) responded similarly to the bloom, but showed smaller declines in health as some fish shifted to these areas
- **Post-bloom:** Index scores recovered towards pre-bloom levels

4. Conclusions

Nearshore index responses to the mild algal bloom confirmed its **sensitivity to local-scale environmental perturbation** and its ability to track the subsequent recovery of the system.

Consistency of nearshore scores prior to the May 2011 bloom confirms that the index is **consistent and robust** (i.e. not overly sensitive to natural, background variability).

We have demonstrated:

- the ability of certain fish species to evade severe bloom conditions
- the vital role of shallow-water, **nearshore habitats as refuges** during severe algal bloom events in this system.

References:

Hallett *et al.* (In press). *ECSS*, doi: 10.1016/j.ecss.2012.03.006
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