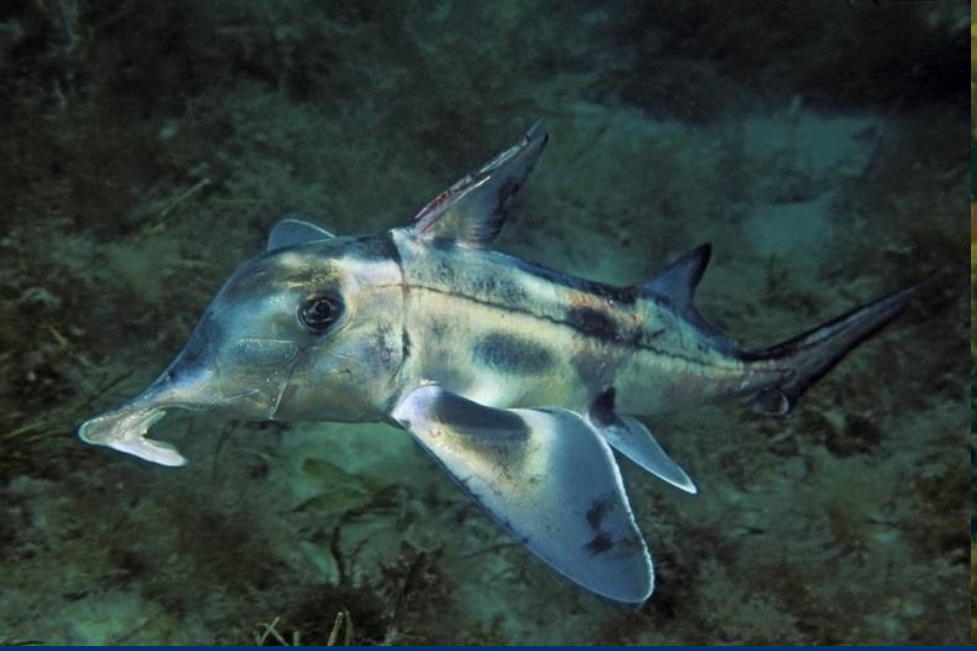

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Melbourne Water
Enhancing Life and Liveability

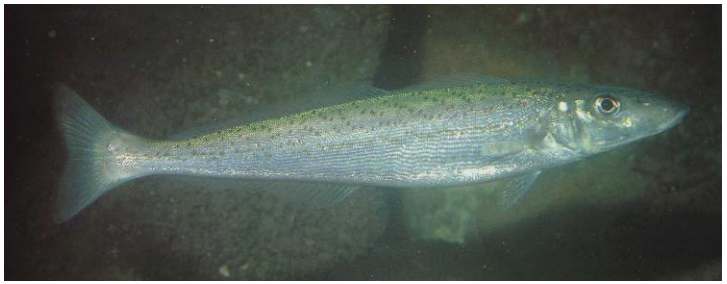
Fish – environmental drivers and habitats

Greg Jenkins

Research Studies

- Three major studies since the Western Port review 2011

1. Fish – habitat relationships in Western Port
2. Status of the recreational fishery in relation to biodiversity values
   - Phase 1: Analyse recreational fishing data to understand fish biodiversity and habitats
   - Phase 2: Formal assessment of Western Port fishery
3. Investigating the drivers of long-term change in fish populations



Enhancing Life and Liveability

1. Fish – habitat relationships

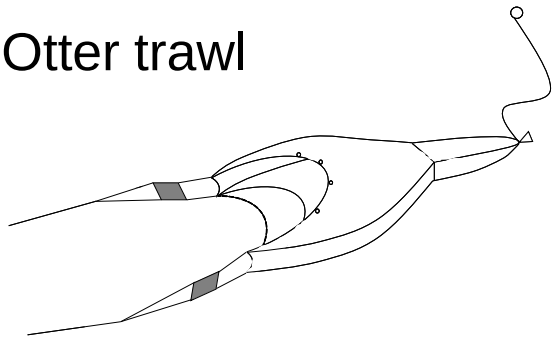
Background

- Fish assemblages only well studied in *Zostera* seagrass.
- Can species use alternative habitats if *Zostera* lost?
- Is there a need for protection of specific habitats to support fish populations?

1. Fish – habitat relationships

Sampling

Mini Otter trawl



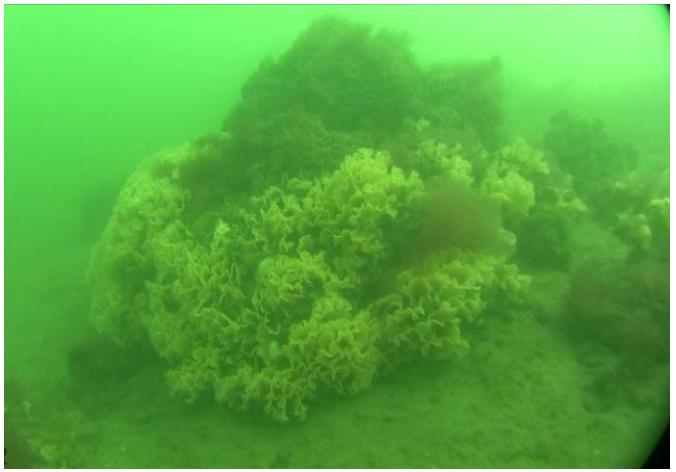
Stereo underwater video

1. Fish – habitat relationships

Habitats

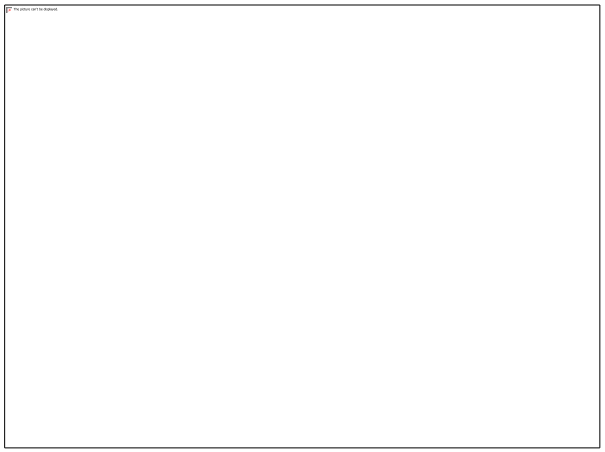
Zostera

Amphibolis



Bryozoan (“Coral”)

Caulerpa



Rhodoliths

Reef-algae

1. Fish – habitat relationships

Conclusions

- *Amphibolis* and *Caulerpa* had diverse and abundant fish assemblages comparable to *Zostera*
- The assemblage of fish in *Caulerpa* was more similar to that in *Zostera*
- *Caulerpa*, and to a lesser extent *Amphibolis*, may act as a refuge habitat in the case of *Zostera* loss
- Exception is syngnathids (pipefish and seahorses)
- The nursery value of these habitats may be lower due to greater depth (both species) and exposure (*Amphibolis*)
- Weedy seadragons specific to *Amphibolis* beds

2. Recreational Fishery and Biodiversity

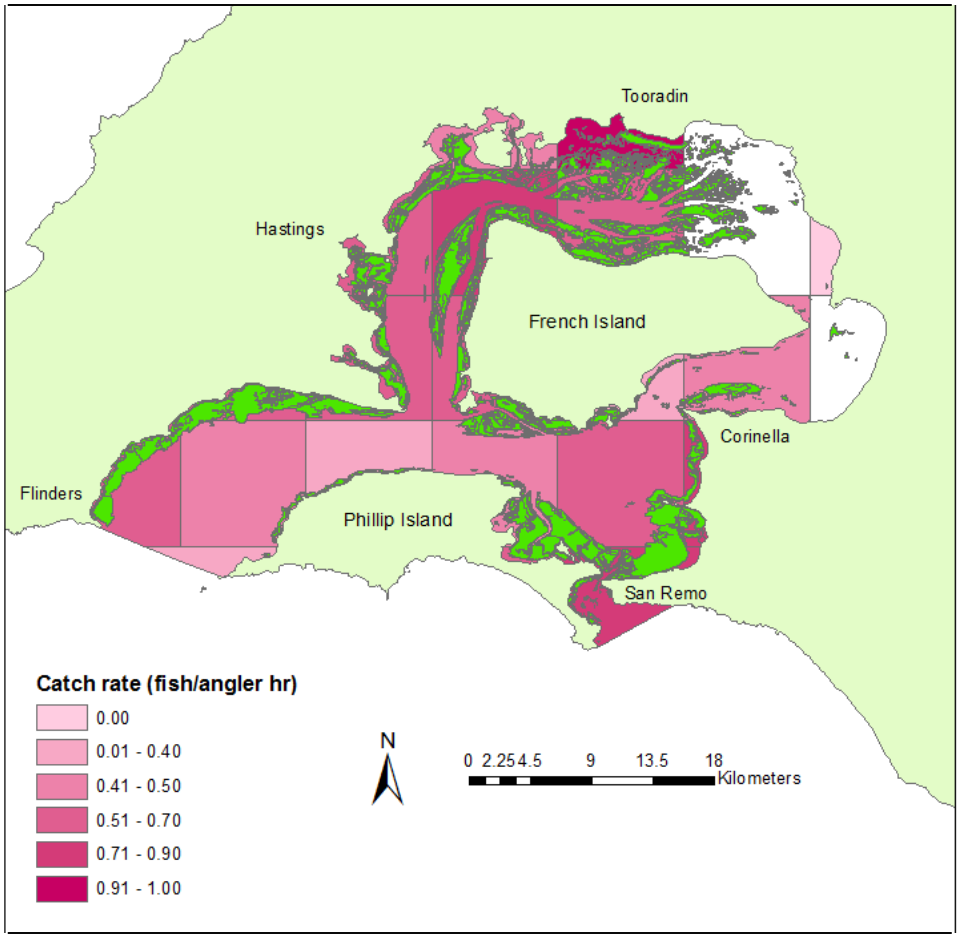
Phase 1 - Background

- Second largest recreational fishery in Victoria
- Analysed > 13,000 boat ramp interviews conducted from 1998 to 2013
- Information on catch, size, location depth and habitat
- Aim was to increase knowledge of fish biodiversity and habitat relationships
- Results related to:
  - Habitat distribution
  - Catchment inputs
  - Human activities
  - Marine National Parks

2. Recreational Fishery and Biodiversity

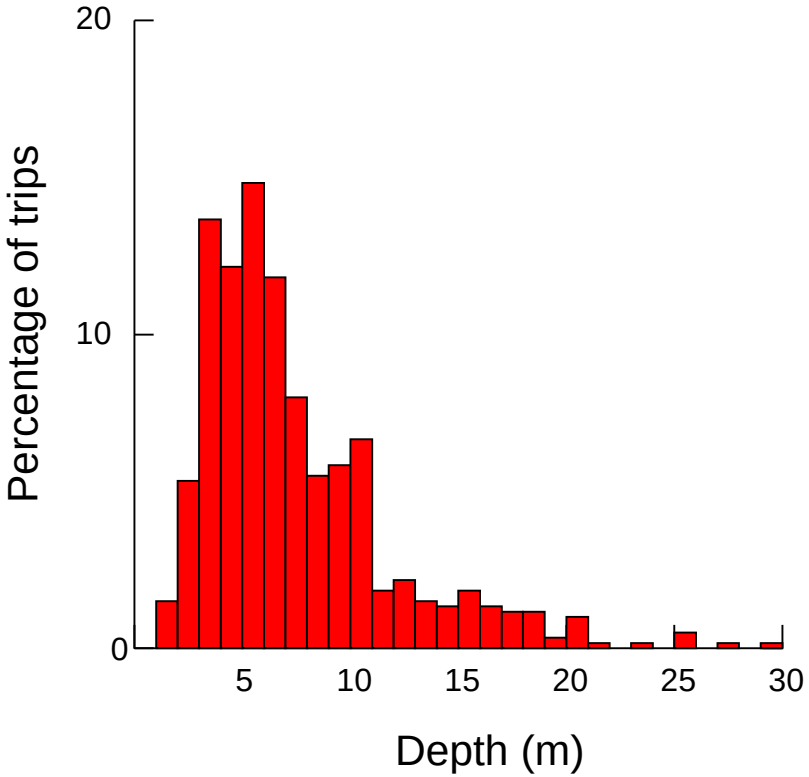
King George whiting

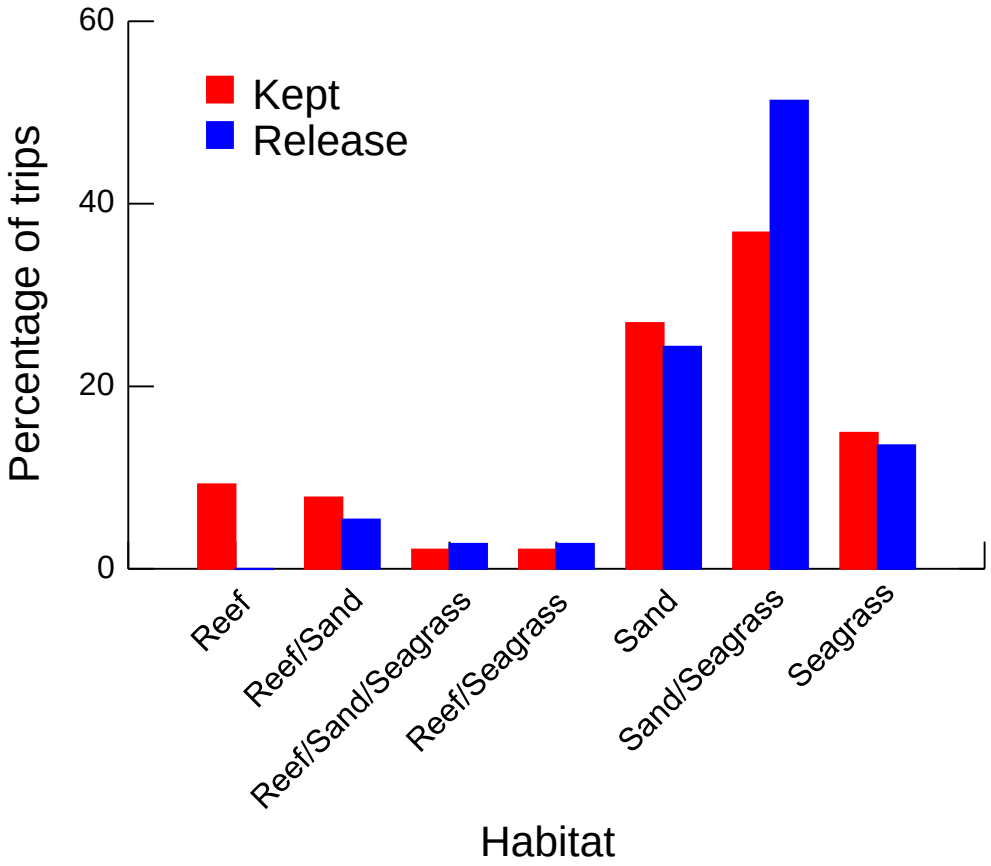
- Catch rates tend to match seagrass distribution
- Undersize fish more common in the SE



2. Recreational Fishery and Biodiversity

King George whiting

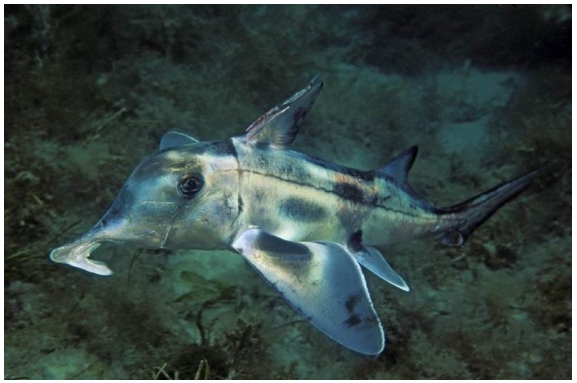




2. Recreational Fishery and Biodiversity

Phase 1 Conclusions

- Valuable tool for understanding biodiversity values
- Distributions of some species associated with seagrass (e.g. Whiting, Calamari, Garfish)
- Other species with deeper reef habitat (Snapper, Gummy Shark)
- Rhyll basin important for juveniles of a number of species
- Elephant fish increasingly restricted to Rhyll basin



2. Recreational Fishery and Biodiversity

Phase 2 – Background

- Fishery assessment undertaken in collaboration with Fisheries Victoria
- Stakeholder meeting at Hastings in August 2015 (recreational and commercial fishers, scientists, fishery and catchment managers, fishery compliance officers, conservation sector)
- Followed by publication of fishery assessment report
- Weight of evidence approach based on recreational fishery data
- trends in catch, effort, size, juvenile recruitment, and social indicators

2. Recreational Fishery and Biodiversity

Phase 2 – Conclusions

- King George whiting fishery improving trend
- Snapper and flathead stable
- Gummy shark fishery in good condition
- Elephant fish fishery in significant decline and contraction
- Fishing effort related to catch rates (more fishing when more fish!)
- 80% of anglers “very satisfied” or “somewhat satisfied”

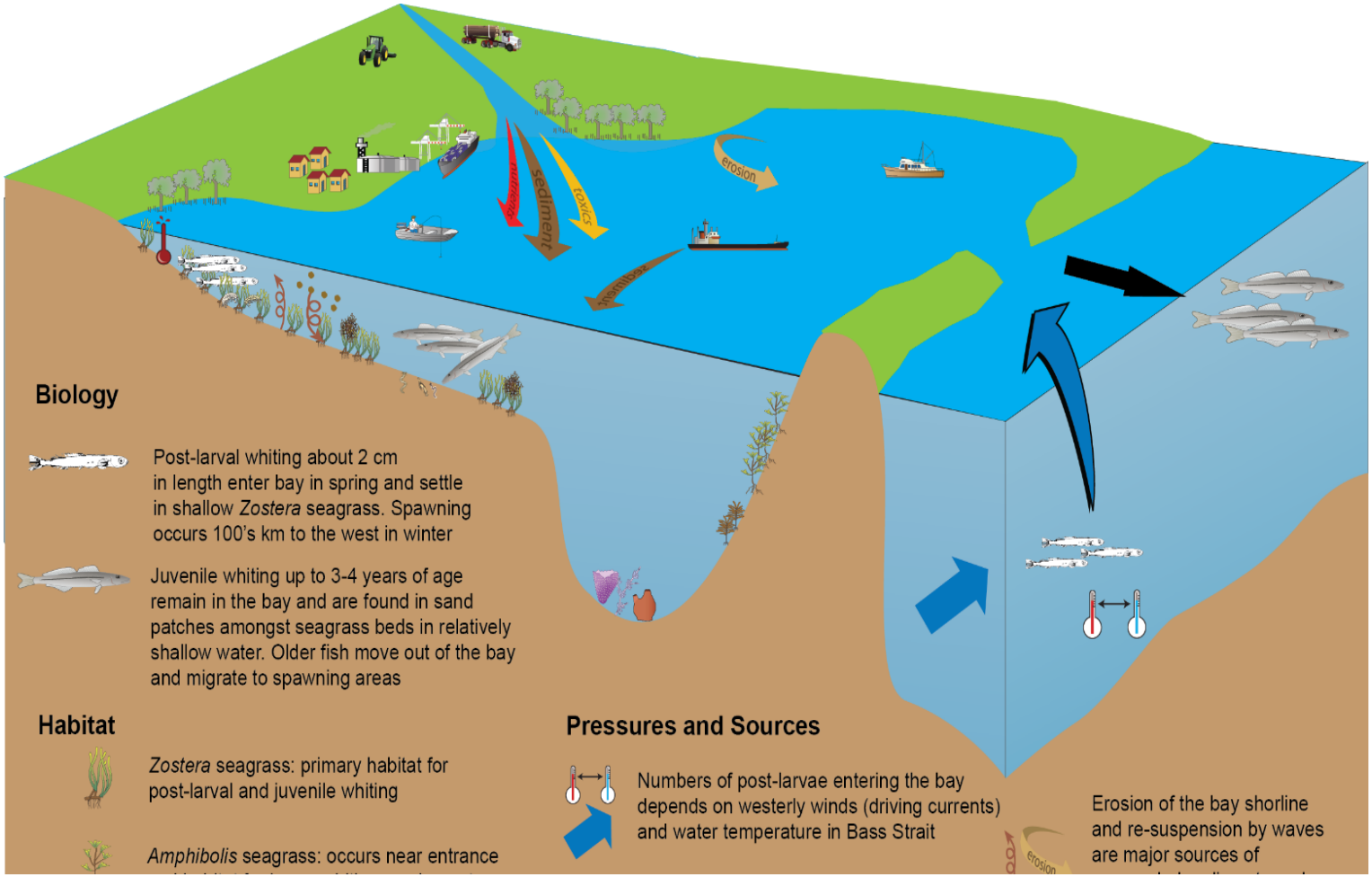
3. Drivers of long-term change

Backgound

- Investigated the drivers of long-term change in key fisheries using historical data to inform future management
- Conceptual models of the life history and environmental drivers of snapper, King George whiting and elephant fish
- Collated fisheries information, including catch records, juvenile recruitment indices and growth time series
- Historical data on a suite of environmental variables was also sourced
- Common trends across fish species were related to environmental variables as were change-points in the trends

3. Drivers of long-term change

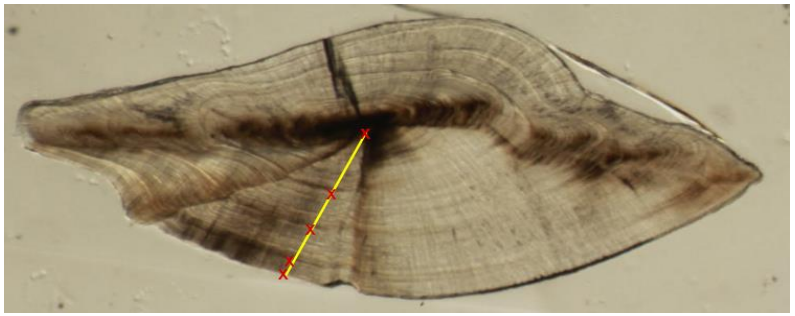
Conceptual models

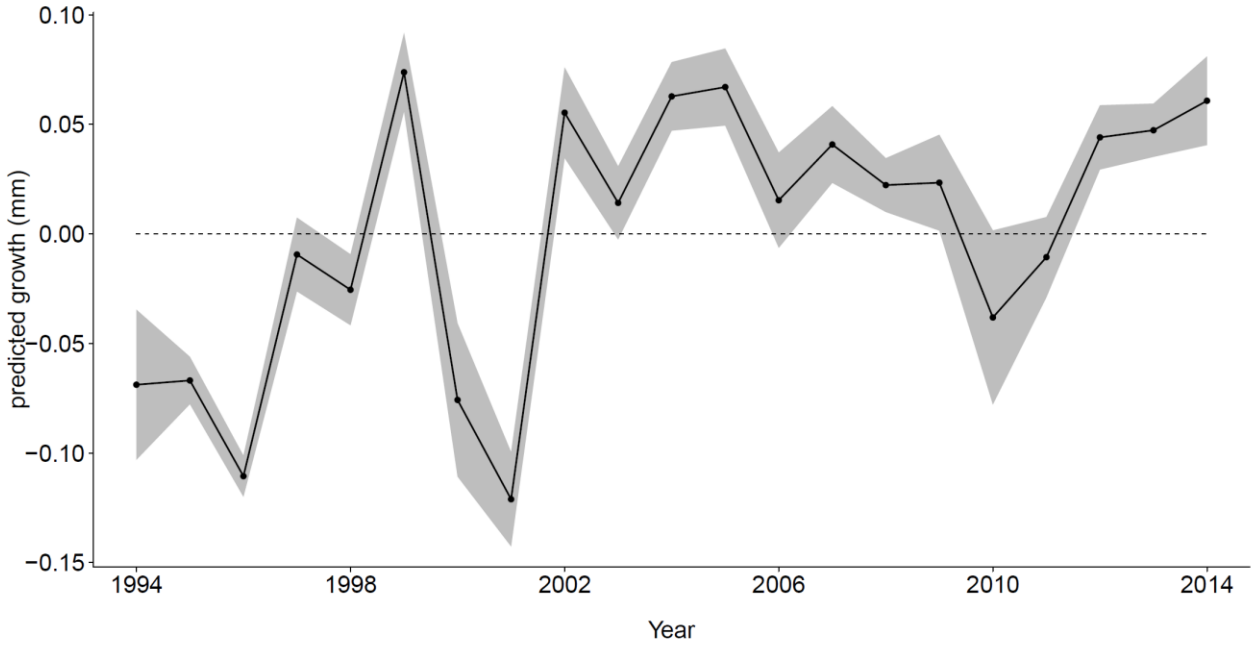


3. Drivers of long-term change

King George whiting growth

- Width of annual rings on otoliths (ear bones) indicates growth rates





3. Drivers of long-term change

Conclusions

- Three common trends fishery data identified with both local and regional environmental drivers
- Local drivers included a positive effect of nitrogen on whiting and elephant fish (likely to increase seagrass growth)
- Chlorophyll-*a* was a negative local driver indicating a negative effect of phytoplankton blooms
- The main regional driver was water temperature in Bass Strait that was positively related to King George whiting and snapper abundance
- Step changes (change points) in these trends were predominantly associated with El Niño and La Niña events,
- Step changes also associated with juvenile recruitment and cessation of commercial netting

Management Implications

- Strong need to conserve *Zostera*: alternative habitats available but small in area and may not serve “nursery” function
- Rhyll basin is important for fish but is strongly influenced by catchment inputs in NE
- Current fishery management regulations supported but need for further assessment of the broader elephant fish stock
- Some nitrogen beneficial for seagrass growth but too much may lead to negative effects of phytoplankton blooms
- Careful catchment management in relation to inputs is crucial to the health of Western Port

Future Research

- Fish eggs and larvae are the most vulnerable life stage, but there is a poor understanding of fish spawning in Western Port: fish egg and larval sampling is recommended
- The life history of elephant fish in Western Port is poorly understood, particularly the relationship between habitat and breeding / young stages
- Novel sampling techniques are required to understand the relationship between fish and deeper habitats (i.e. ‘coral’).
- Surveys of juvenile fish numbers (snapper, whiting) are currently carried out in Port Phillip Bay but could be extended to Western Port
- Research on drivers of long-term change could be enhanced by additional data, such as bird abundance, seagrass cover etc, giving greater insight for future management

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