

The ecosystem of the Peel-Harvey Estuary



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The Peel-Harvey Estuary



- **Study area:**
Peel Inlet, Harvey Estuary, entrance channels,

total area ~130 km², depth < 2.5 m
- **1970s/80s:**
 - eutrophication
 - extensive growth of macrophytes in Peel Inlet
 - algal blooms in the Harvey Estuary

→ fish kills
- **Management Action Plan:**
 - reduction of nutrient input
 - artificial entrance channel



1994 Dawesville Channel

Today:

- less algal blooms
- change in species composition and abundance, for example: macrophytes, fish and benthic invertebrates
- still eutrophic
- canal development

Research question:

How has the Dawesville Channel affected the ecosystem of the Peel-Harvey Estuary?



Ecopath

= quantitative ecosystem modelling technique that provides a snapshot of the biomass fluxes between the functional groups of an ecosystem

Here: comparison of two Ecopath models:

1970s – 1990s

‘pre DC’

1994

Dawesville Channel

1996 – 2007

‘post DC’



Structure of the Ecopath models

Functional groups (32 + detritus):

Dolphins, birds (2), sharks, fish (9), invertebrates (7), primary producers (5),

Target species:

blue swimmer crab (*Portunus pelagicus*, adult + juvenile)

Mugil cephalus, *Aldrichetta forsteri*, *Arripis georgianus*, whiting

Parameter input: Biomass (B), mortality or production per biomass (P/B), consumption (Q/B), dietary information, catch

Data pedigree: (ranges from 0 to 1 for high quality local data)

0.709
'pre DC'

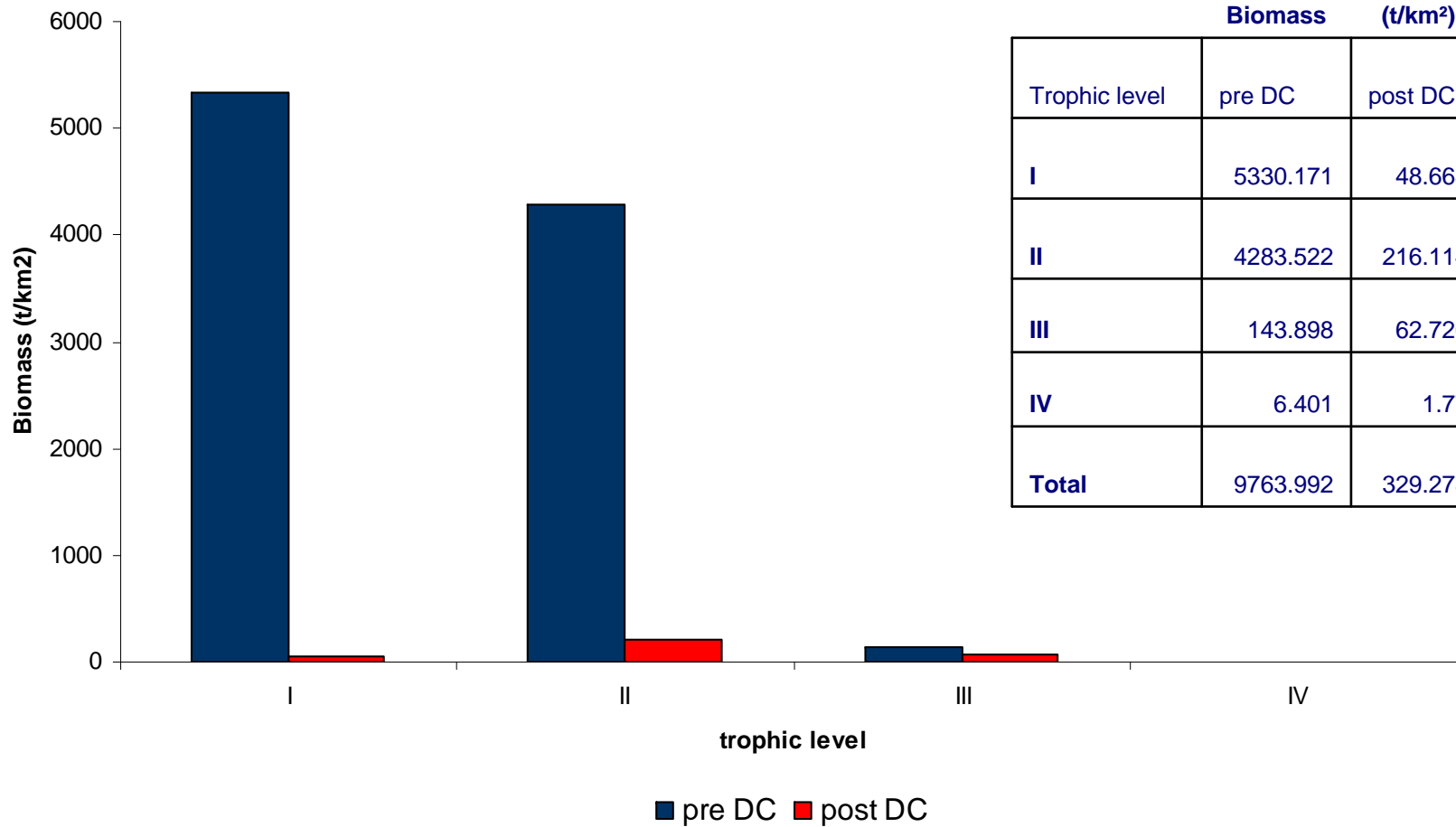
0.687
'post DC'

Results: System statistics

Parameter	pre DC	post DC	unit	% change
Sum of all consumption	343230	6666.184	t/km ² /year	-98.06
Sum of all exports	845528.1	8347.508	t/km ² /year	-99.01
Sum of all respiratory flows	158153.5	2505.444	t/km ² /year	-98.42
Sum of all flows into detritus	931801.1	10187.82	t/km ² /year	-98.91
Total system throughput	2278713	27707	t/km ² /year	-98.78
Sum of all production	1325791	13758	t/km ² /year	-98.96
Mean trophic level of the catch	2.91	3.14		7.90
Total primary production/total respiration	7.65	4.362		-42.96
Net system production	1051180	8422.467	t/km ² /year	-99.20
Total primary production/total biomass	123.85	33.178		-73.21
Total biomass/total throughput	0.004	0.012		200.00
Total biomass (excluding detritus)	9764.31	329.376	t/km ²	-96.63
Total catches	8.54	3.84	t/km ²	-55.01

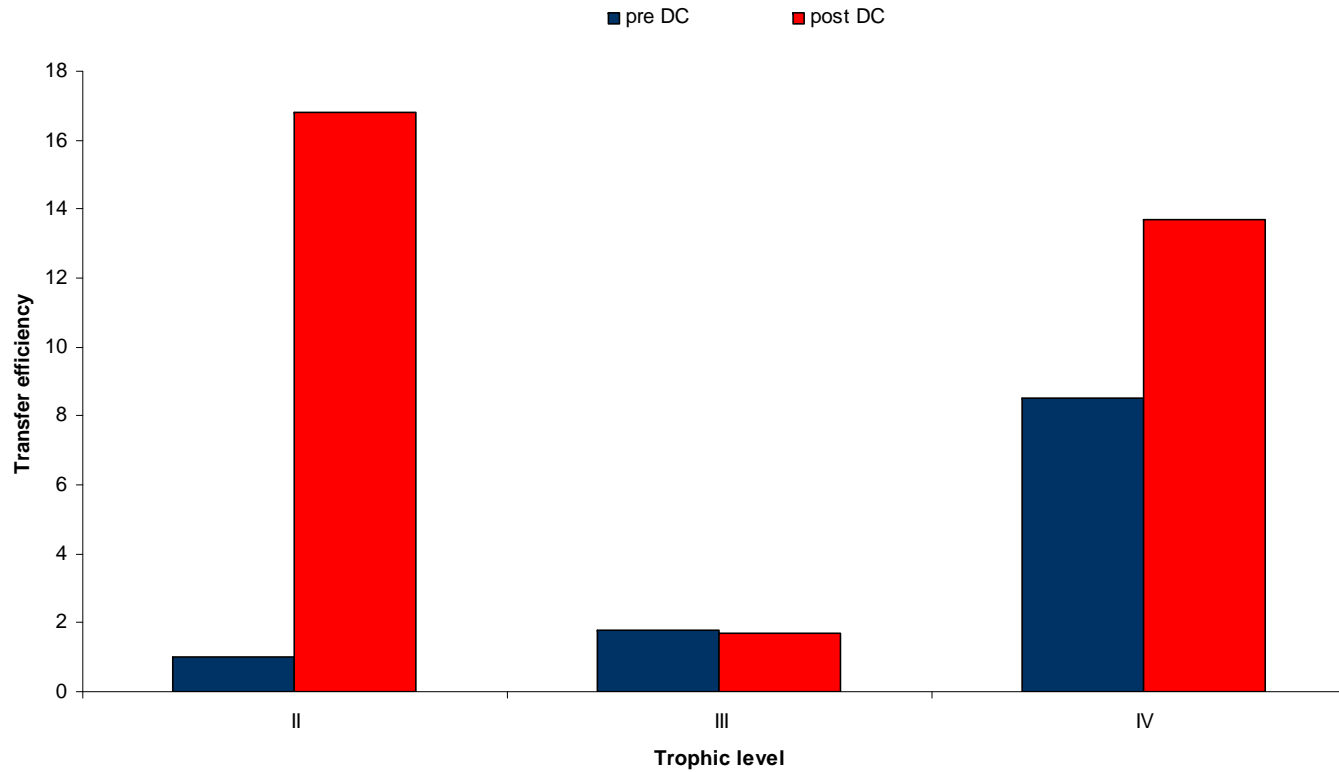
Results: Biomass – 4 trophic levels

Biomass per trophic level



Biomass (t/km ²)			
Trophic level	pre DC	post DC	% change
I	5330.171	48.668	-99.0869
II	4283.522	216.114	-94.9548
III	143.898	62.726	-56.4094
IV	6.401	1.77	-72.3481
Total	9763.992	329.278	-96.6276

Results: Transfer efficiencies



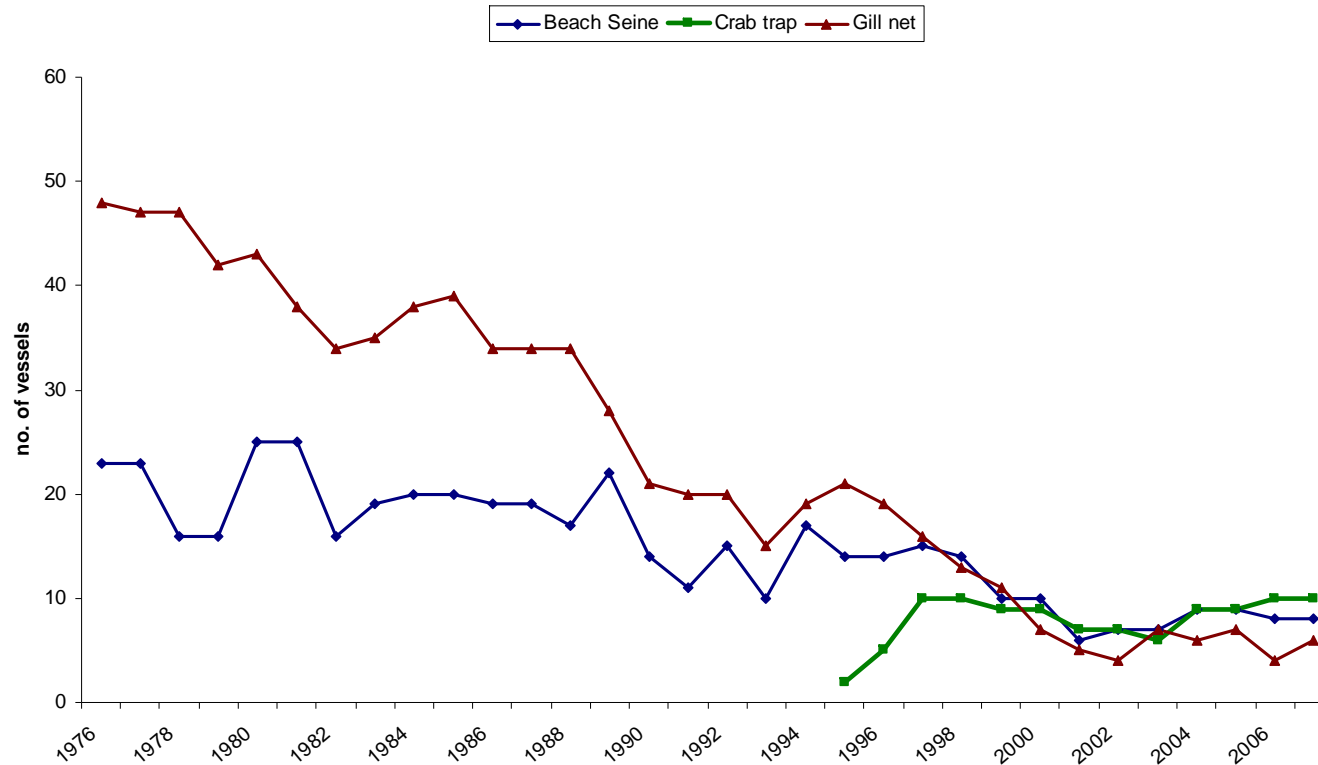
Overall transfer efficiency:

'pre DC': 2.5%

'post DC': 7.3%

Model calibration for Ecosim (= temporal dynamics) :

→ development in commercial fishery:

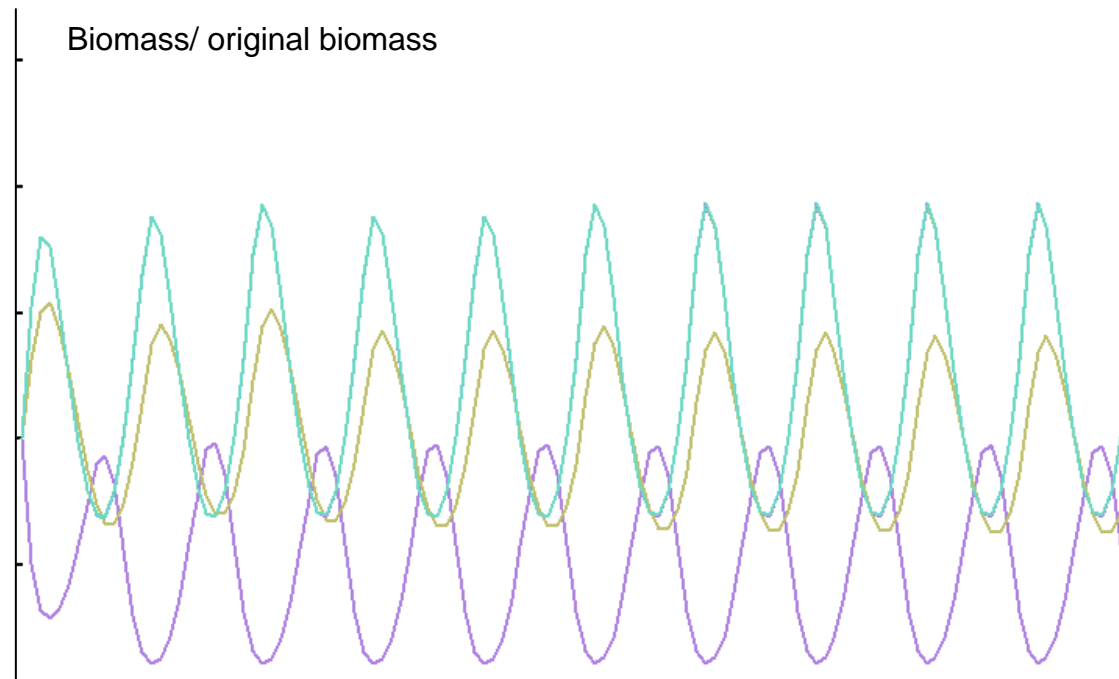


Commercial CPUE data → do not reflect change in biomasses in the estuary

→ No data set available to tune the model

→ Ecosim scenarios without model calibration

Model calibration for Ecosim (= temporal dynamics) :

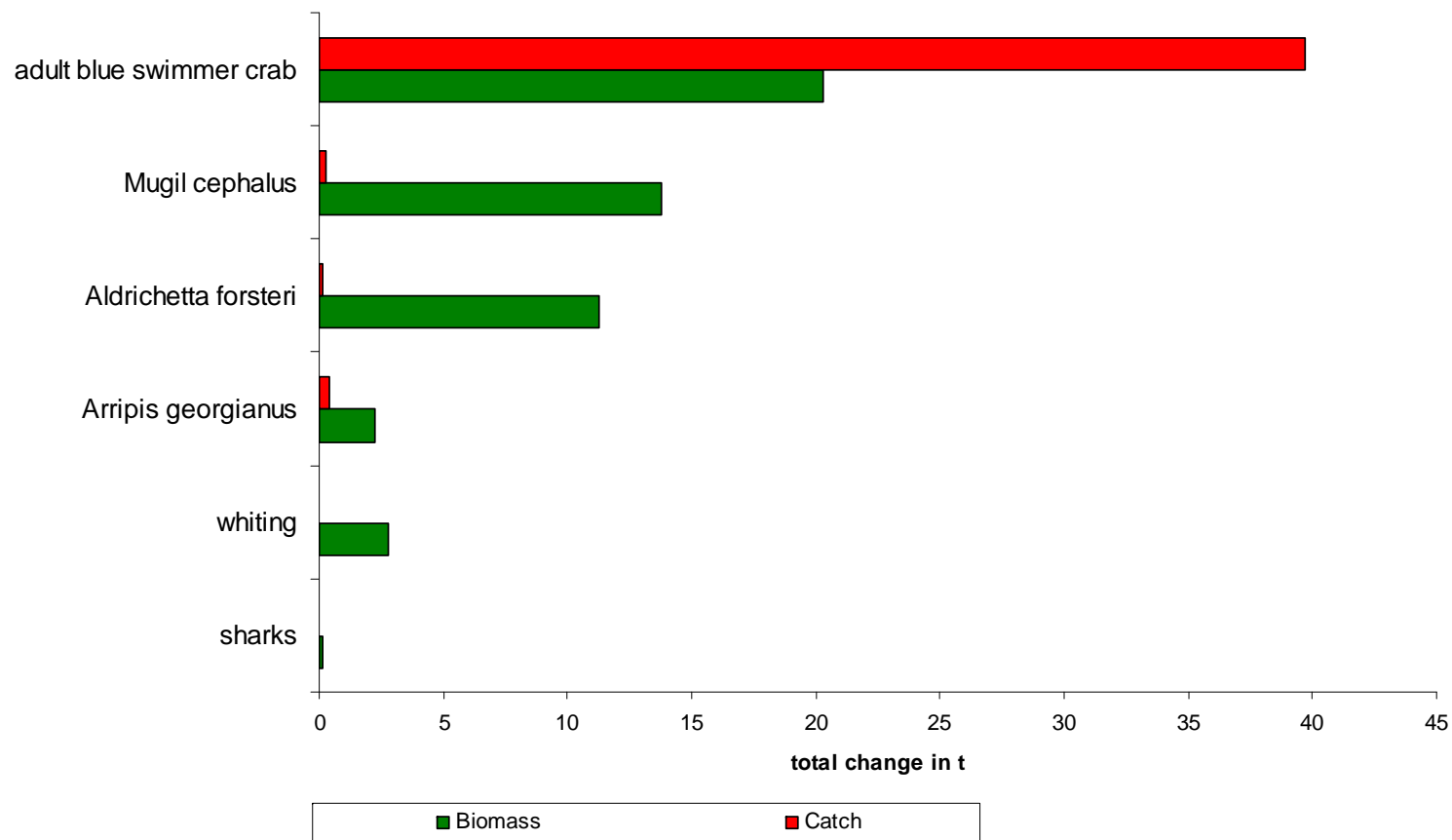


purple: microscopic algae, green: macrophytes, yellow: seagrass

Forcing functions: temperature and rainfall

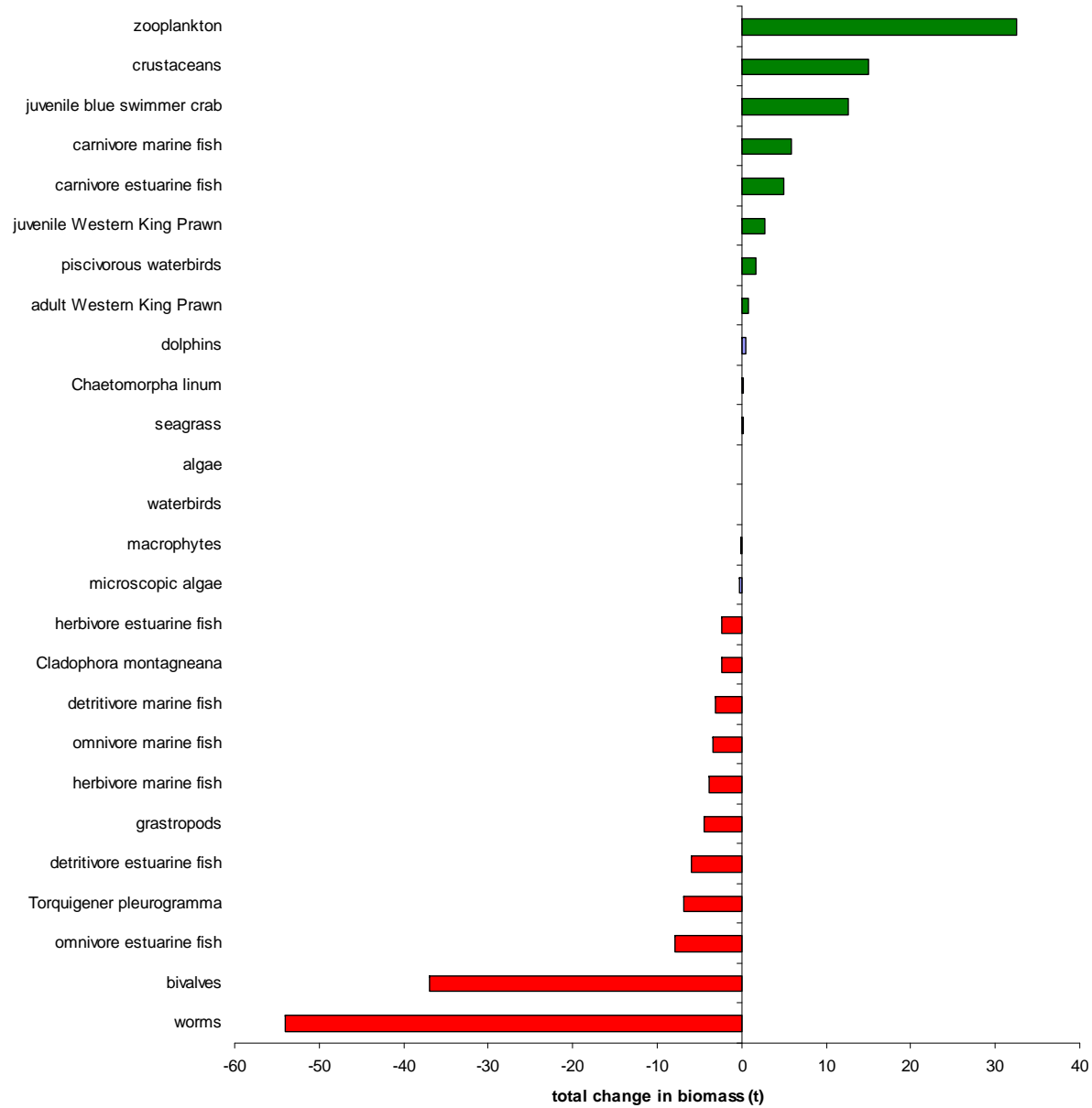
Ecosim scenarios: decrease in recreational fishing by 25% over 20 years

Target species:



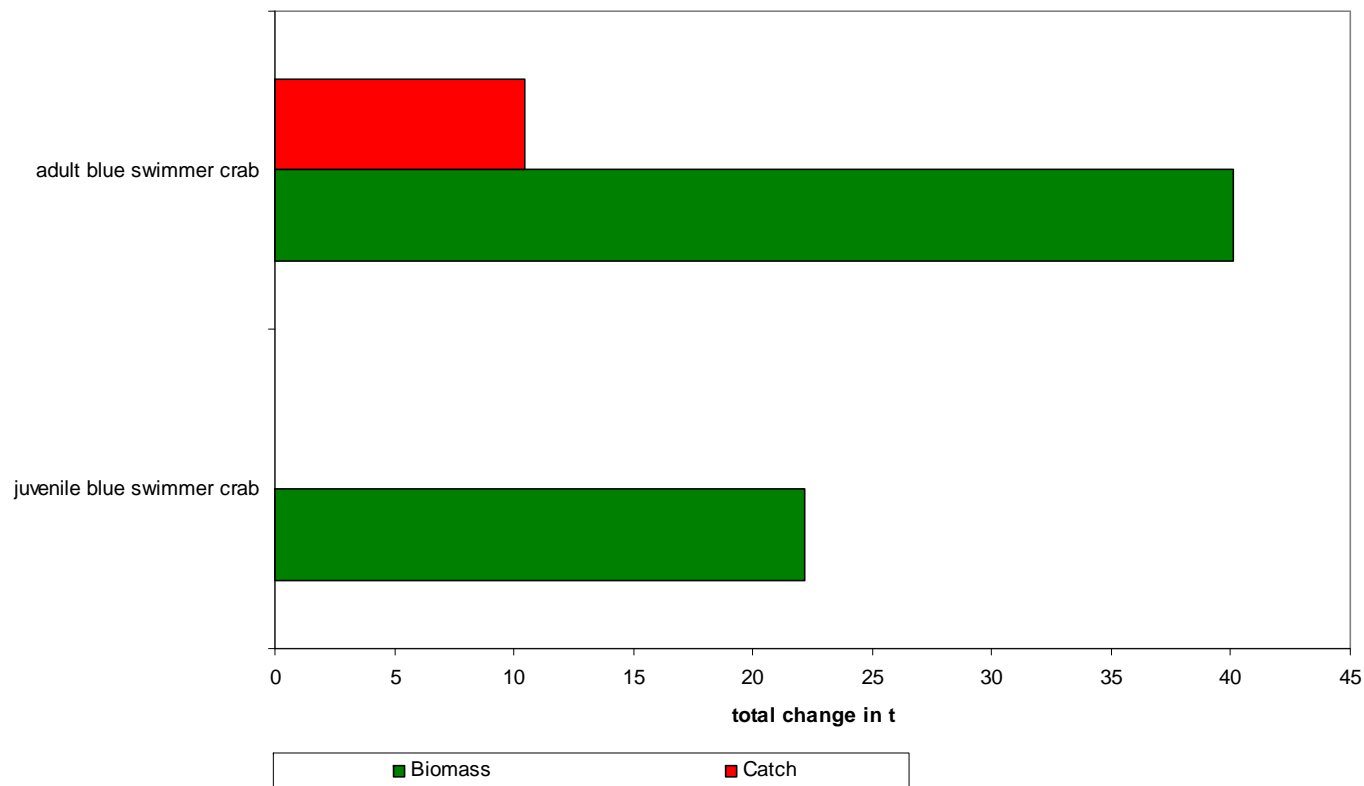
Ecosim scenarios: decrease in recreational fishing by 25%

Non-target species:



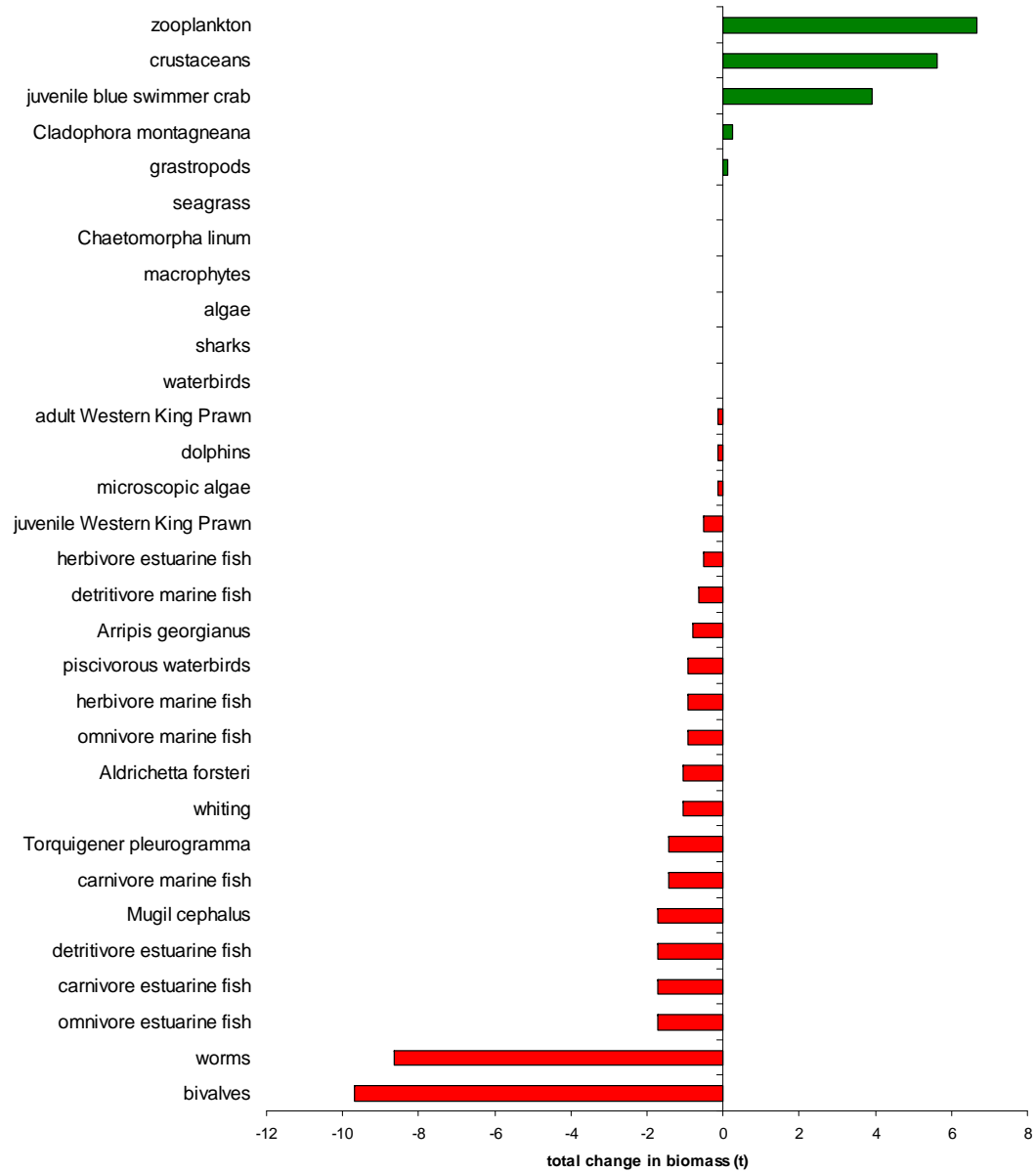
Ecosim scenario: decrease in commercial (crab trap) fishing by 50% over 20 years

Target species:



Ecosim scenarios: decrease in commercial (crab trap) fishing by 50% over 20 years

Non-target species:





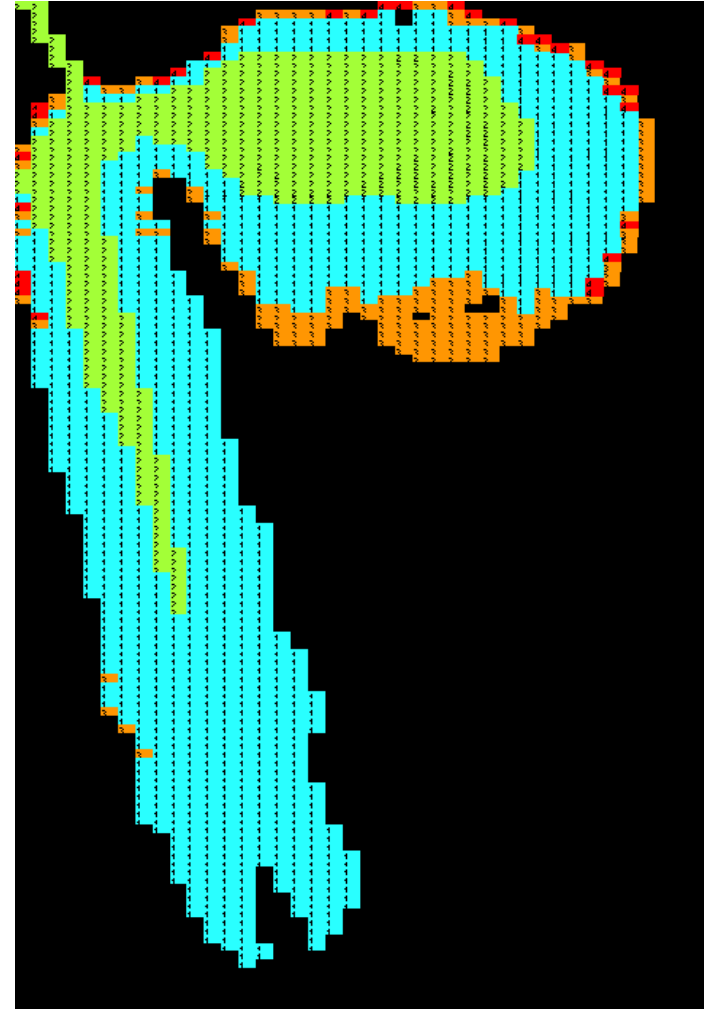
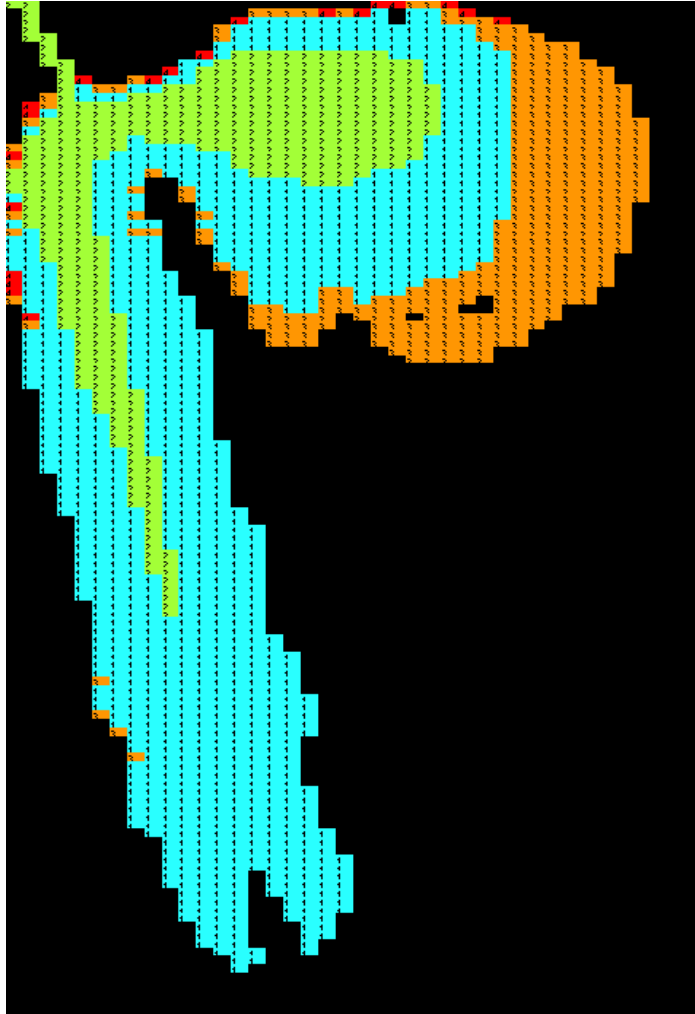
Conclusion:

- fishing pressure is expected to decrease:
 - political pressure on commercial fishermen
 - fishing licences and effect of petrol prices on recreational fishermen

But: increase in residential areas around the estuary

- How will habitat destruction affect the ecosystem of the Peel-Harvey Estuary?

Ecospace (spatial dynamics): increasing urbanisation at the east coast of Peel Inlet

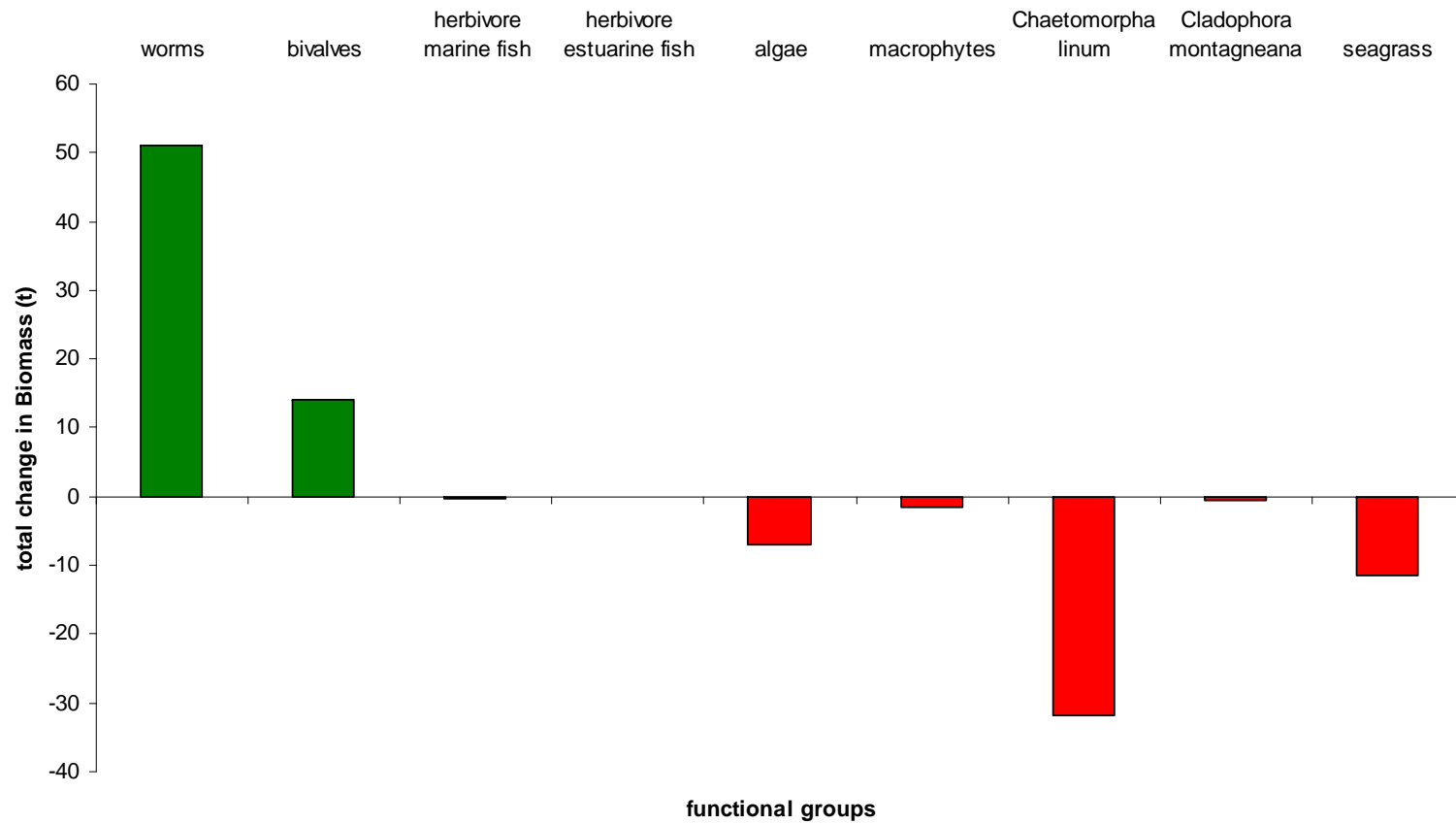


shallow mud, deeper sand, plant cover, rock

Results:

→ robust model (dispersal rates)

2.6% increase in catch (gill net, beach seine)





Conclusions

- Ecosystem has changed drastically since the opening of the Dawesville Channel
- Peel-Harvey Estuary can expect a decrease in fishing pressure, but faces new challenges through potential habitat destruction
- Identification of data gaps: detritus, food web, migration, long term data set (need for monitoring program)



Thank you!