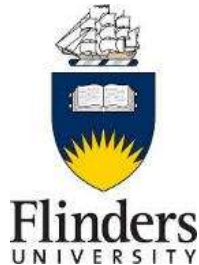# Socio-ecological assessment of the ecosystems, industries and communities of Spencer Gulf:

Potential indicators, findings and recommendations

Tim Ward

April 2019

Potential social, economic and ecological indicators for integrated ecosystem assessment of Spencer Gulf

Jason E. Tanner, Fred Bailleul, Simon Bryars, Mark Doubell, Nicole Foster, Sam Gaylard, Bronwyn M. Gillanders, Simon Goldsworthy, Charlie Huveneers, Charles James, Alice R. Jones, Jacob Maher, Melissa Nursey-Bray, Paul van Ruth and Tim M. Ward

Goyder Institute for Water Research
Technical Report Series No. 19/32

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The Goyder Institute for Water Research is a partnership between the South Australian Government through the Department for Environment and Water and the following organisations:

A socio-ecological assessment of the ecosystems, industries and communities of Spencer Gulf was co-funded by:

The primary organisations that undertook the socio-ecological assessment of the ecosystems, industries and communities of Spencer Gulf were:

Reports

Tanner, J.E., Bailleul, F., Bryars, S., Doubell, M., Foster, N., Gaylard, S., Gillanders, B.M., Goldsworthy, S., Huveneers, C., James, C., Jones, A.R., Maher, J., Nursey-Bray, M. ,van Ruth, P. and Ward, T.M. (2019) Potential social, economic and ecological indicators for integrated ecosystem assessment of Spencer Gulf. Goyder Institute for Water Research Technical Report Series No. 19/32, Adelaide, South Australia.

http://www.goyderinstitute.org/publications/technical-reports/

Socio-ecological assessment of the industries, communities and ecosystems of Spencer Gulf

- Collate existing data-sets
- Develop potential social, ecological and economic indicators
- Assess status of the Spencer Gulf
- Identify key knowledge gaps and other data limitations
- Recommend next steps

Marine industries of SA and Spencer Gulf

South East Coast
Gulf St Vincent and Kangaroo Island
Spencer Gulf
West Coast

0   500   1,000   1,500
$million

- Commercial fishing
- Recreational Fishing
- Offshore oil and gas exploration
- Shipbuilding and boatbuilding
- Aquaculture
- Marine Tourism
- Water transport
- Marina operation and marine equipment retailing
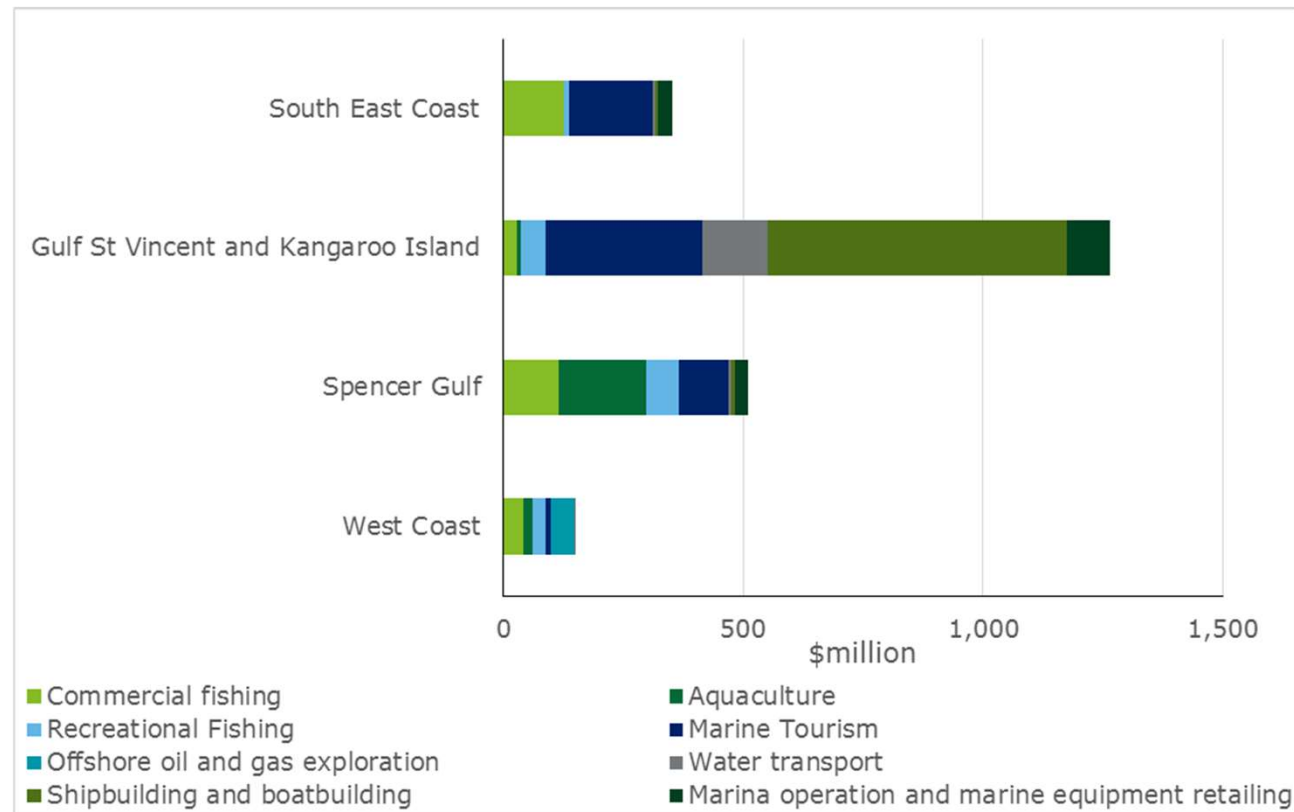
Deloitte Access Economics (2017)

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INDICATOR CATEGORIES

- Climate indices (DMI, NINO3.4, SAM)

- Weather patterns (rainfall, air temperature)

- Oceanographic (SLH, SST)

- Communities (human, social, financial, physical and natural capital)

- Marine Industries (aquaculture, fishing and tourism)

- Shipping (number of movements, volume of exports)

- Fisheries (status, catch, value)

- Aquaculture (production, value)

- Ecotourism (shark cage diving)

- Ecological assets (cuttlefish, ASL, fur seals, seagrass)

- Pollution (nutrients WWTP and finfish aquaculture

- Habitat degradation (prawn trawling)

- Conservation (marine parks)

CLIMATE INDICATORS

IOD(DMI) Increasing trend since 1900, fewer and smaller negative values, 2019 sixth highest value on record. Reflected in low rainfall in 2019.

ENSO(NINO3.4): Increasing trend since 19870. Neutral trend in annual values since El Niño episode of 2015-16. 2019: Neutral. Associated with moderate upwelling.

SAM: Increasing trend since the 1950s. Only negative annual value over the last decade was 2019. Associated with weaker westerly winds off SA.

Indian Ocean Dipole Trend
Annual: Trend 0.07 decade^{-1}
$r^2 = 0.3$, $p = 0$
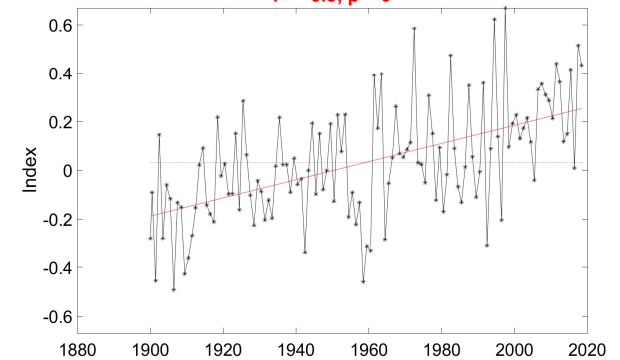
Nino3.4 Trend
Annual: Trend 0.04 decade^{-1}
$r^2 = 0.024$, $p = 0.056$
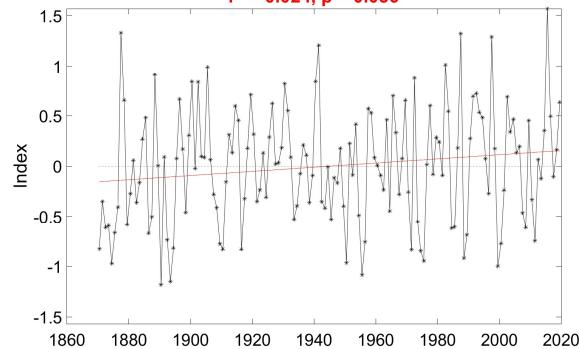
Southern Annular Mode Trend
Annual: Trend 0.38 decade^{-1}
$r^2 = 0.26$, $p = 0$

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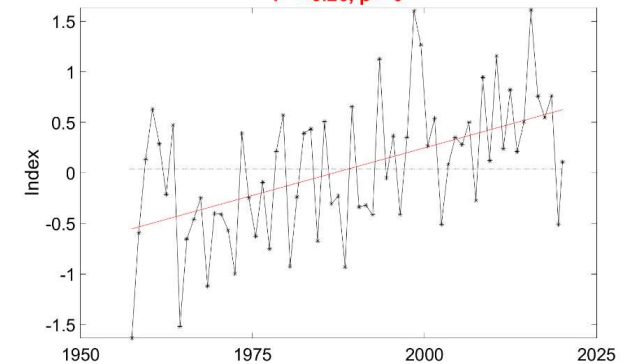
OCEANOGRAPHIC INDICATORS

- Mean Sea Level Height (SLH) at ports around gulf has increased at 1.98 to 2.82 cm.decade^{-1} .

- Sea Surface Temperature (SST) has increased by ~0.7 ^{o}C.decade^{-1} throughout gulf.

Port Lincoln Trend

Annual: Trend 4.17 decade^{-1}
r^2 = 0.44, p = 0
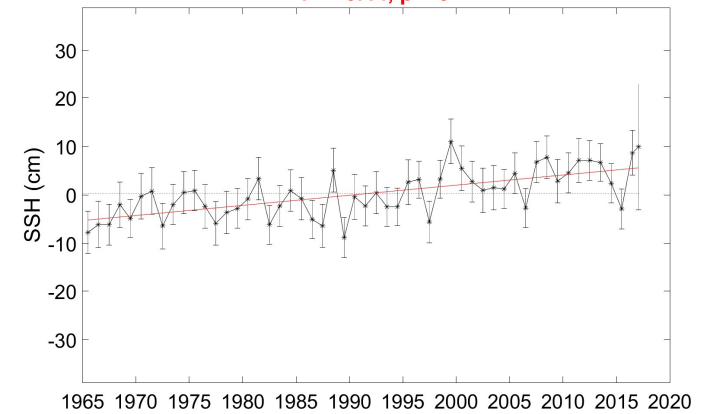
Northern Spencer Gulf Trend

Annual: Trend 1.02 decade^{-1}
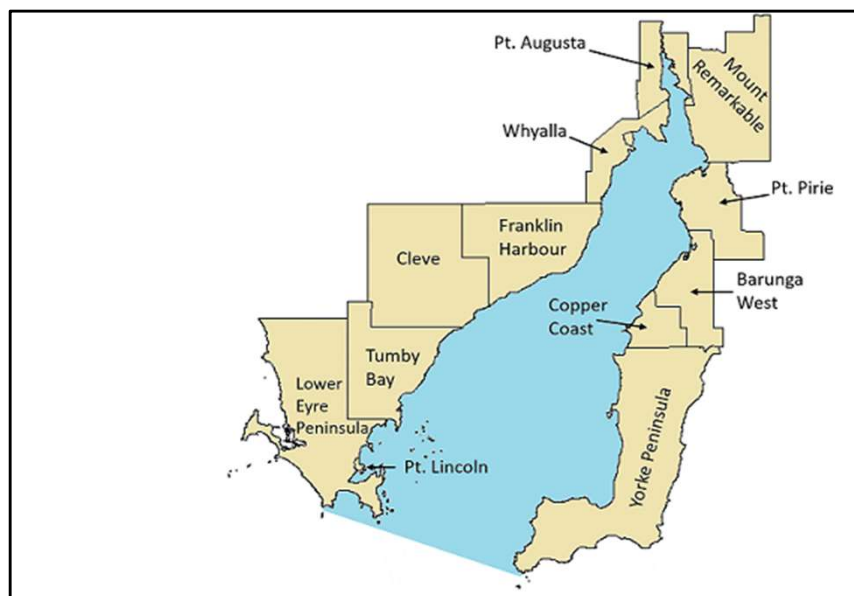**r^2 = 0.33, p = 0.024**
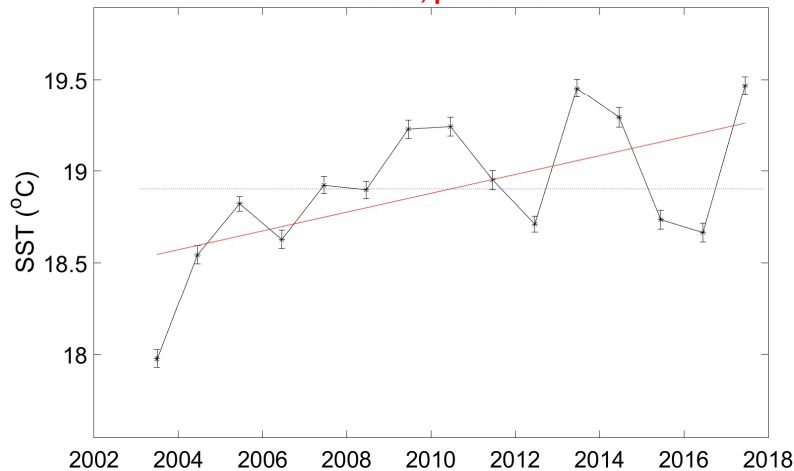
Southern Spencer Gulf Trend

Annual: Trend 0.89 decade^{-1}
r^2 = 0.26, p = 0.052
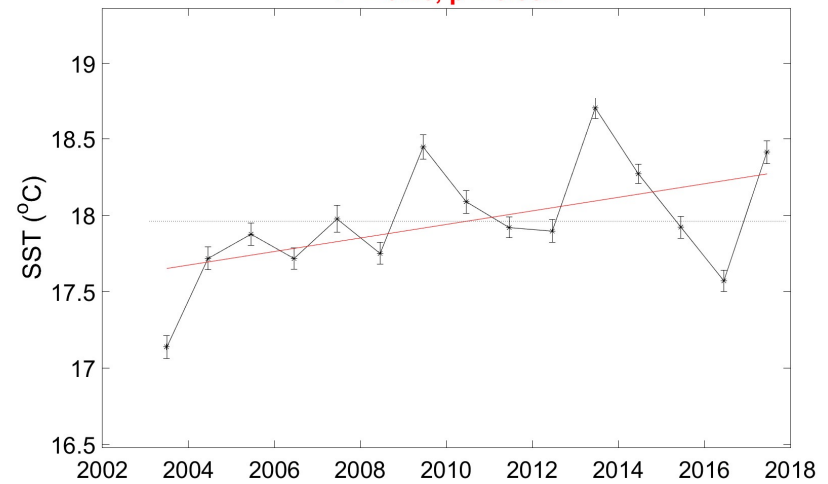
SOCIO-ECONOMIC INDICATORS

Employment

- Agriculture and mining are the most major employers in most LGAs.

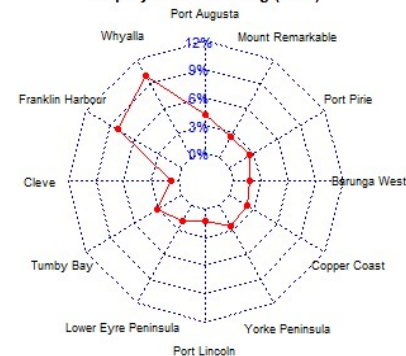- Aquaculture and fishing are important in Franklin Harbour, Lower Eyre Peninsula and Port Lincoln.
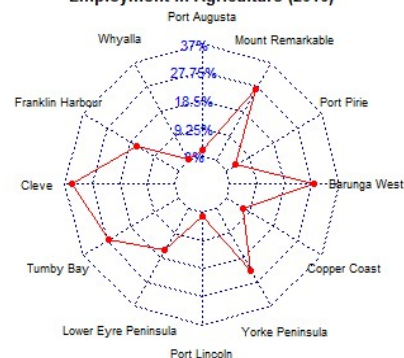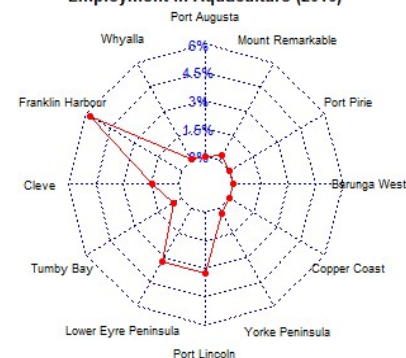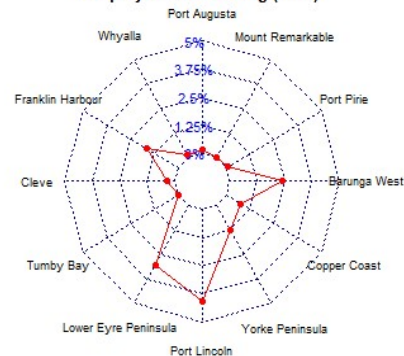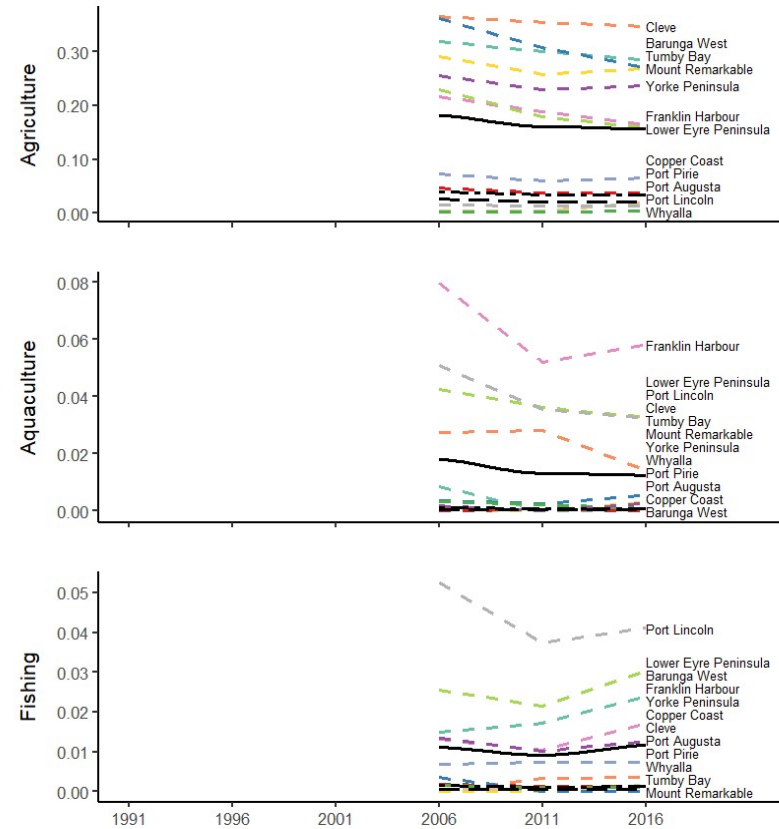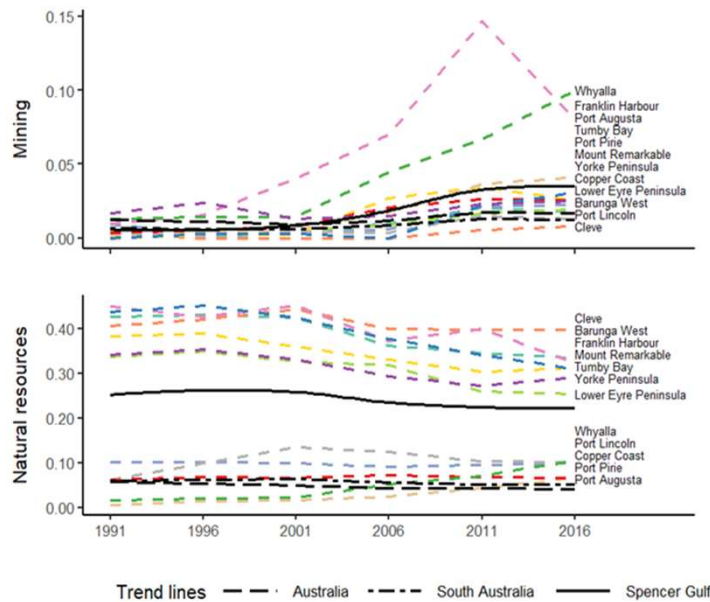
SOCIO-ECONOMIC INDICATORS

Employment

- Employment in natural resource industries in Spencer Gulf is higher than state or national averages.

- Most employed in agriculture and mining.

SOCIO-ECONOMIC INDICATORS

Employment

- Unemployment levels vary among LGAs.

- Average unemployment, part-time employment and proportion of women employed levels and trends for Spencer Gulf are generally similar to the rest of South Australia.

- Unemployment has generally decreased since 1991, and part-time employment has increased.
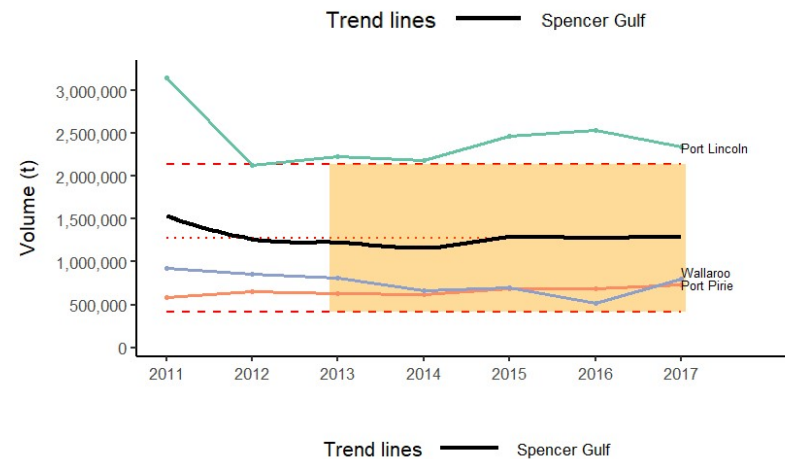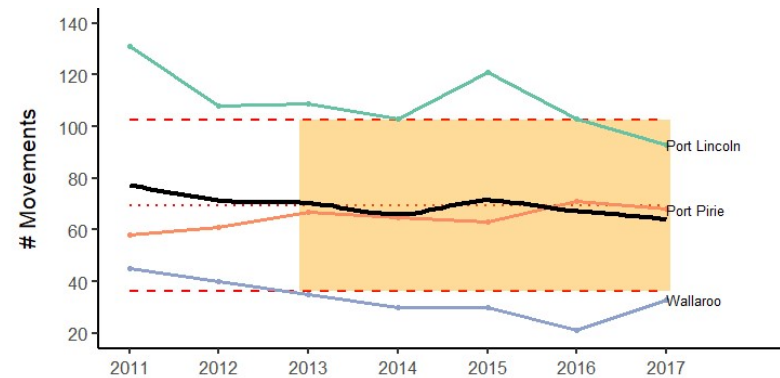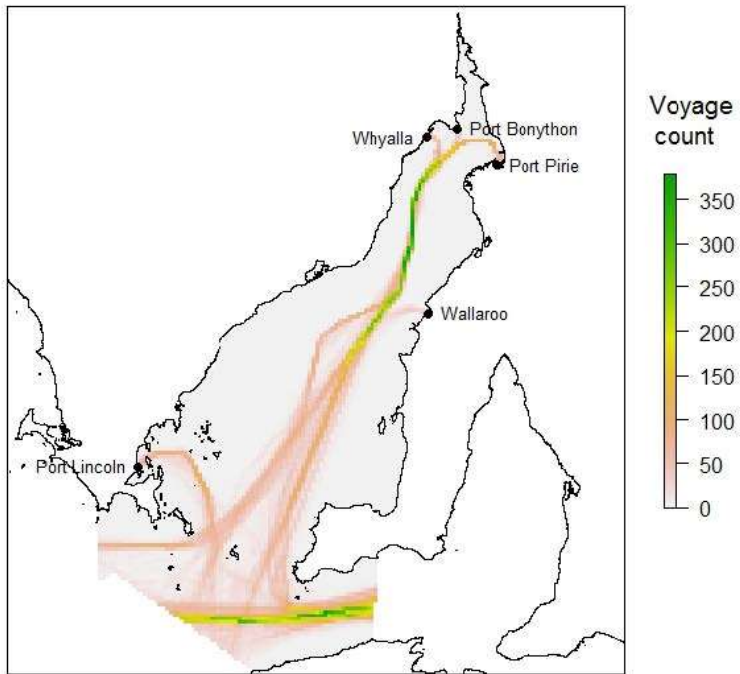
Other indicators

- Range of other human, social, financial, physical and natural capital indicators presented in the report.
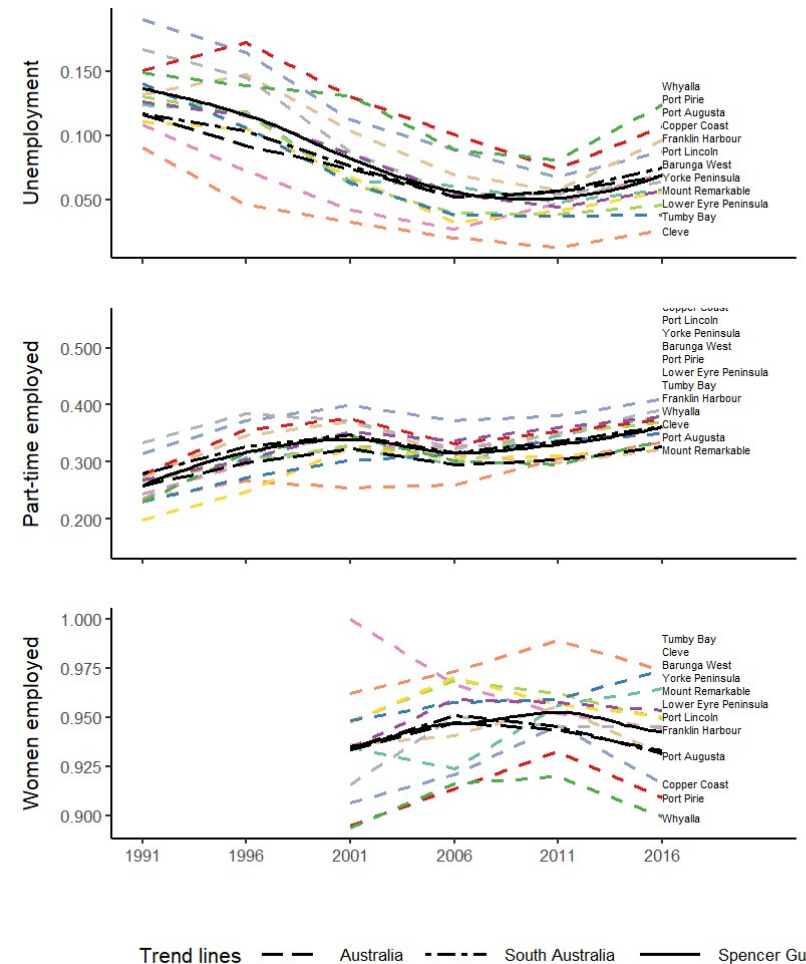
SOCIO-ECONOMIC INDICATORS

Shipping

- Ship movements and volume (exports and imports) were highest in 2011 and Port Lincoln.

SOCIO-ECONOMIC INDICATORS

Fisheries value

- Gross Value of Production (GVP) of major commercial fisheries in Spencer Gulf in 2018/19 was $80M.

- Prawn fishery was most valuable ($41 M), followed by sardine ($22M), Marine Scalefish Fishery ($7.4M), Abalone ($5.3M) and Blue Crabs ($4.1M).

- GVP fluctuated between $61M and $105M since 1998/90.

Stock Status

- **Sustainable:** Prawns, Sardine, Abalone, Blue Crabs, King George Whiting, Calamari

- **Recovering:** Garfish.

- **Depleted:** Snapper.

Fishery Value ($M)
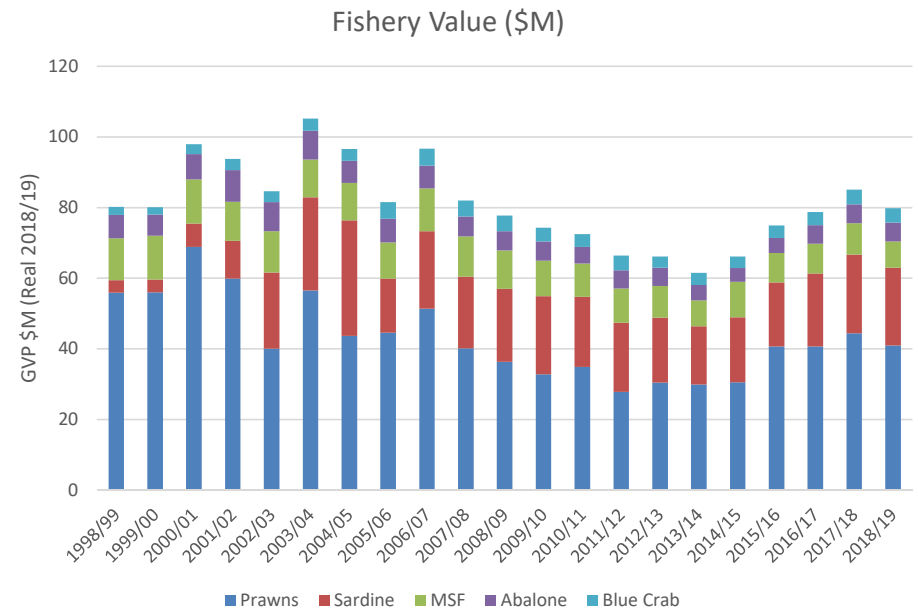
SOCIO-ECONOMIC INDICATORS

Aquaculture value

- Gross Value of Production (GVP) of aquaculture in Spencer Gulf in 2018/19 was $170M.

- Tuna industry was most valuable ($129 M), followed by Yellowtail Kingfish ($39M) and Mussels ($4M).

- GVP fluctuated between $153M and $172M since 2014/15.

Aquaculture GVP $M

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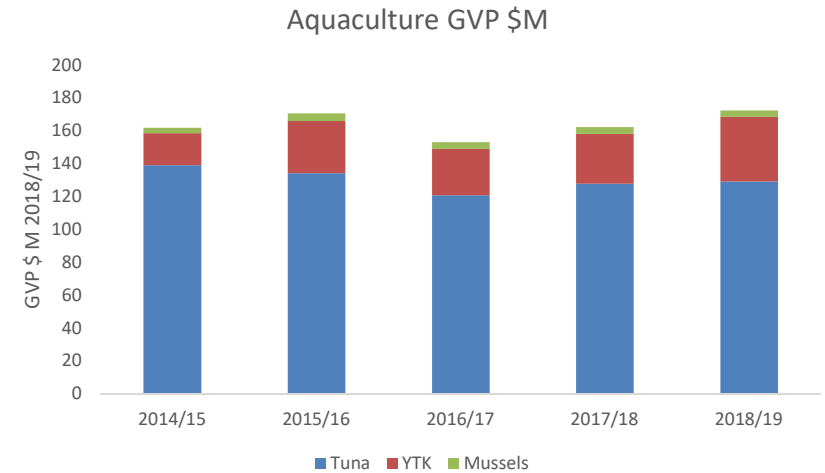
ECOLOGICAL INDICATORS

- **Cuttlefish**: abundance at Point Lowly has fluctuated over last decade: ~150,400 individuals in 2018. Monitoring sporadic.

- **Australian sea lion**: pup abundance declined from ~1,200 in 2006 to ~800 pups in 2015. No recent data.

- **Long-nosed fur seal**: pup abundance stable between 2005 and 2014 at ~10,000 pups. No recent data.

Cuttlefish abundance at Point Lowly

Long-nosed fur seal pup abundance in Spencer Gulf

Australian sea lion pup abundance in Spencer Gulf

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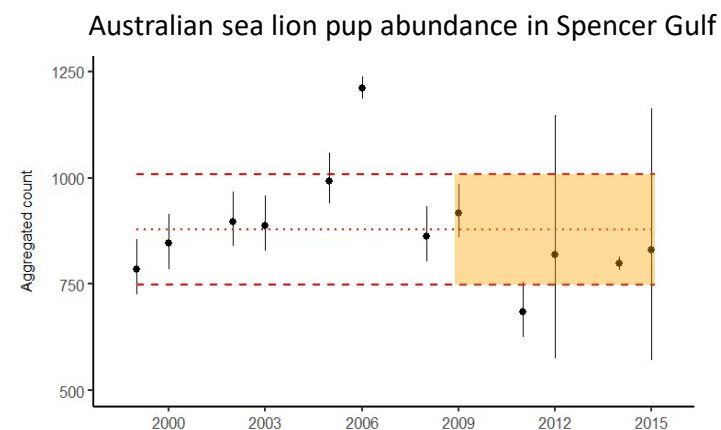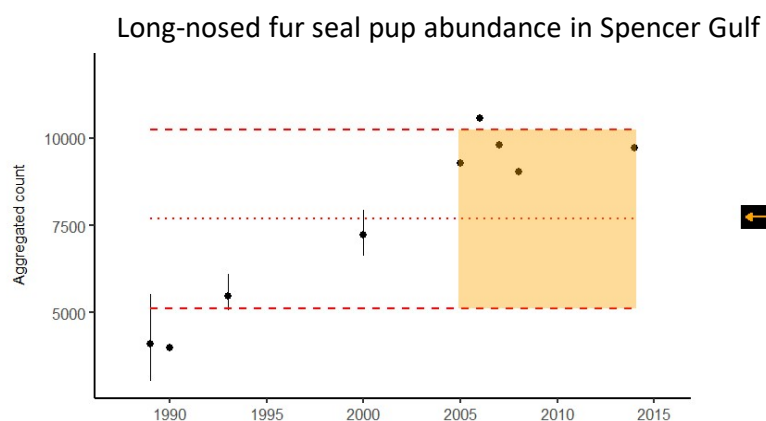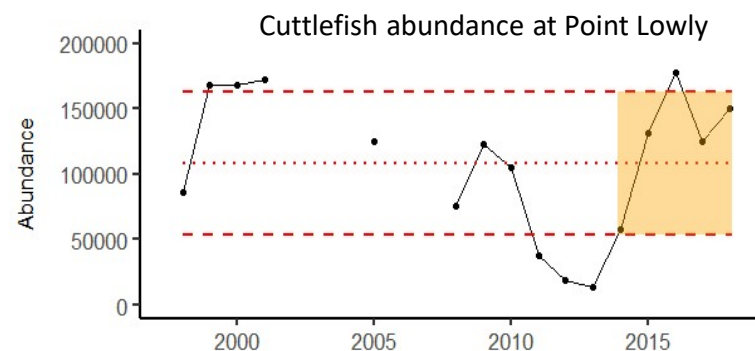
ECOLOGICAL INDICATORS

**Seagrass:**
- Recent declines in cover in northern (of up to 58%) and southern (of up to 35%) gulf.
- Recovery (19%) near Whyalla steel plant.
- Mapping incomplete. Time-series limited to 2 or 3 sampling periods at a limited number of sites.
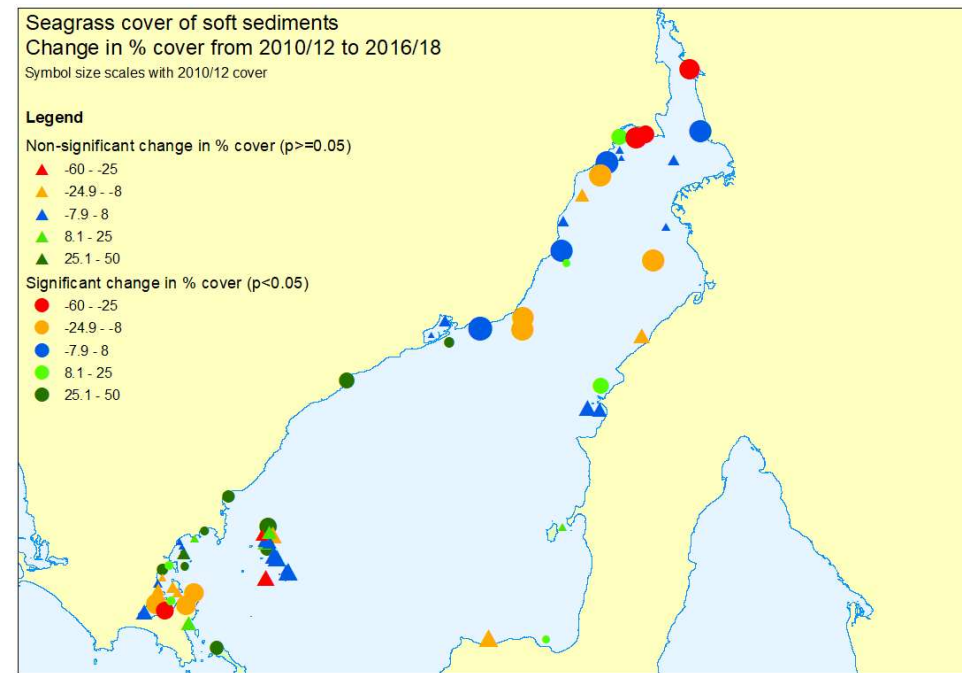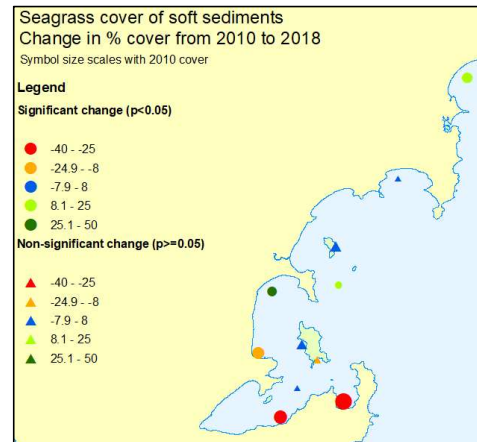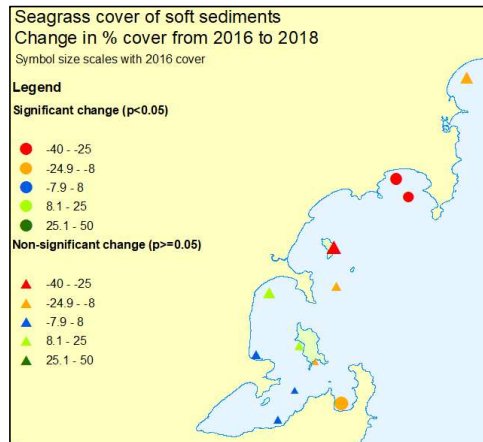
PRESSURE INDICATORS

Pollution

- Annual inputs of ammonia, total nitrogen and total phosphorus from WWTP have declined over the last 2 decades.
- Nutrients from Whyalla steelworks higher than WWTPs by a factor of 10.
- Largest anthropogenic input of nitrogen into gulf is from finfish aquaculture (1956 t in 2018). Complete time-series not available.

Total Nitrogen

Ammonia

Total Phosphorus

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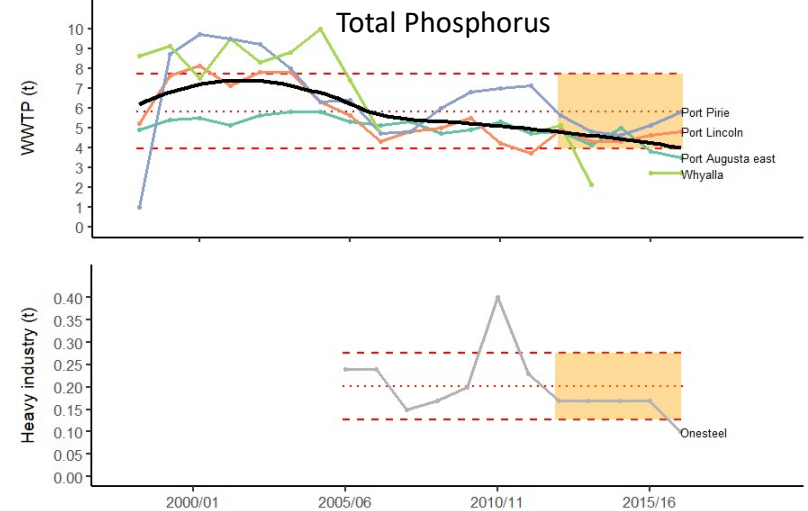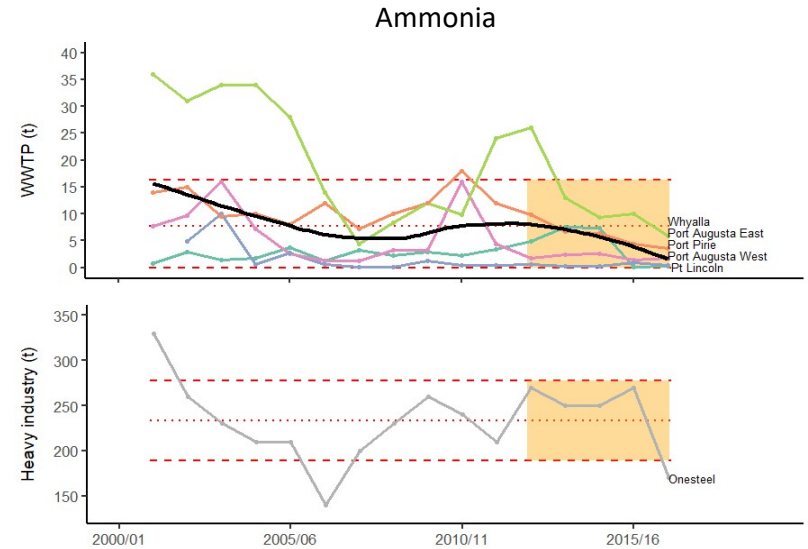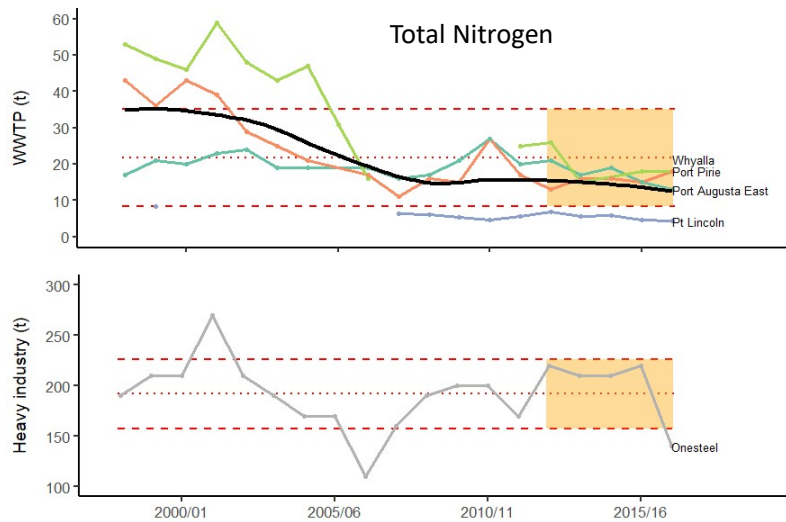
ECOSYSTEM INDICATORS

Ecosystem indicators:
- Ecopath with Ecosim model (1991-2010).
- Sardine fishery grew rapidly during this period.
- Two ecosystem indicators increased slightly (mean trophic level of catch, fishing in balance index).
- In general biodiversity measures were similar throughout the period.

Trophodynamic model

Gillanders *et al.* (2015)

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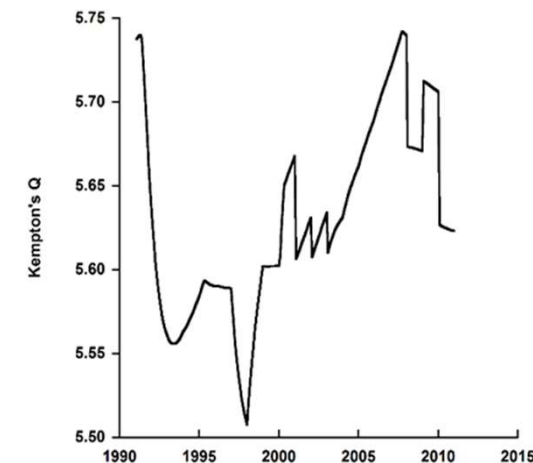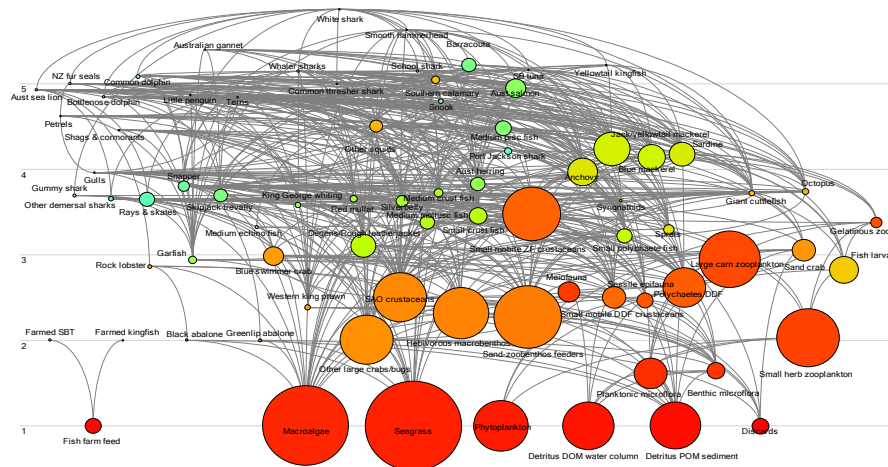
CONSERVATION INDICATORS

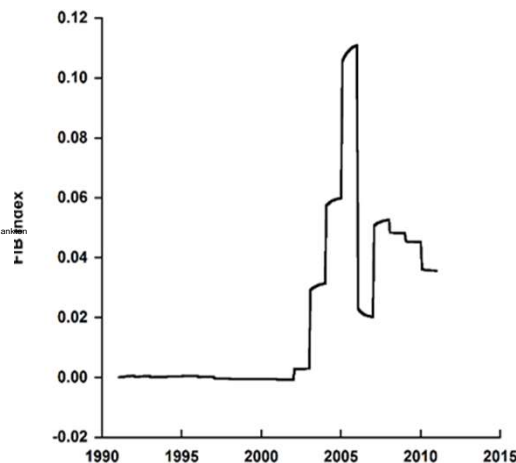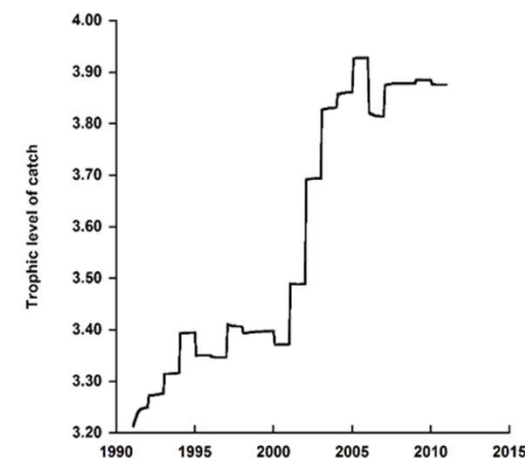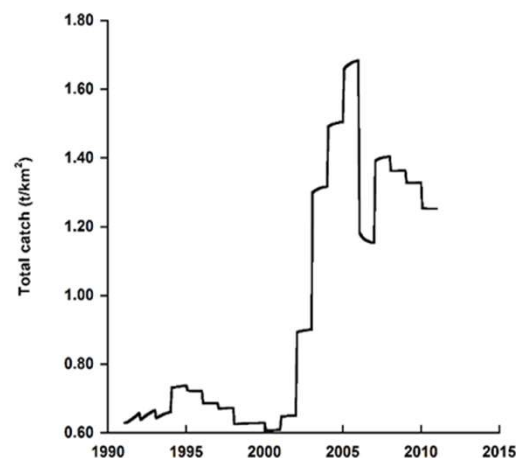**Marine Parks:**
- Marine parks implemented in November 2012. Sanctuary zones in October 2014. Seven marine parks partly or fully in Spencer Gulf.
- Monitored with baited remote underwater videos (BRUVs) and/or diver surveys. First surveys 2016/17. No time-series to assess change.
- Public perception surveys since 2011. Data from LGAs around Spencer Gulf shown below.

Are you in favour of marine parks to protect plants and animals in general?
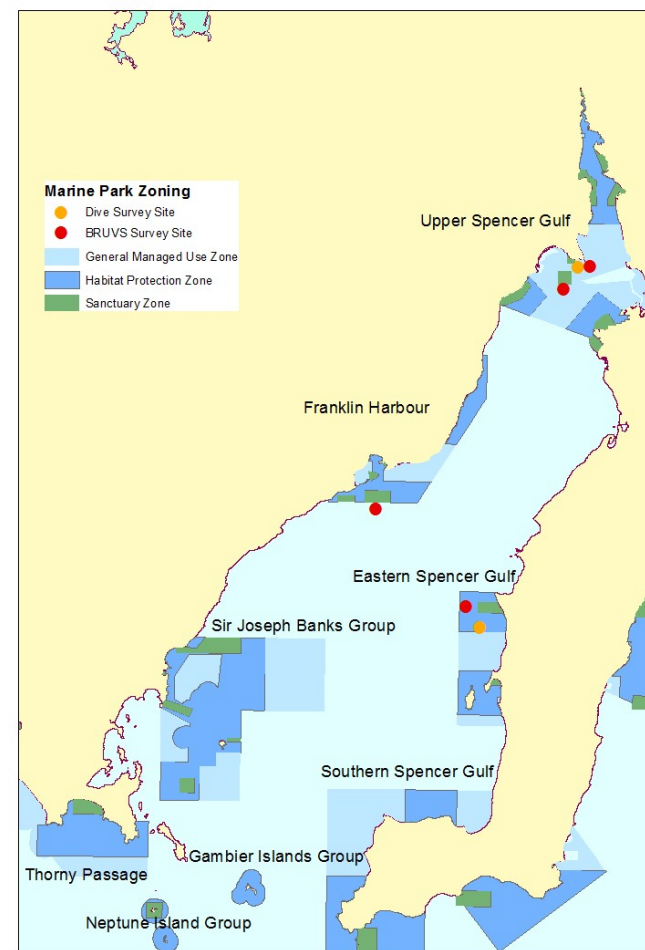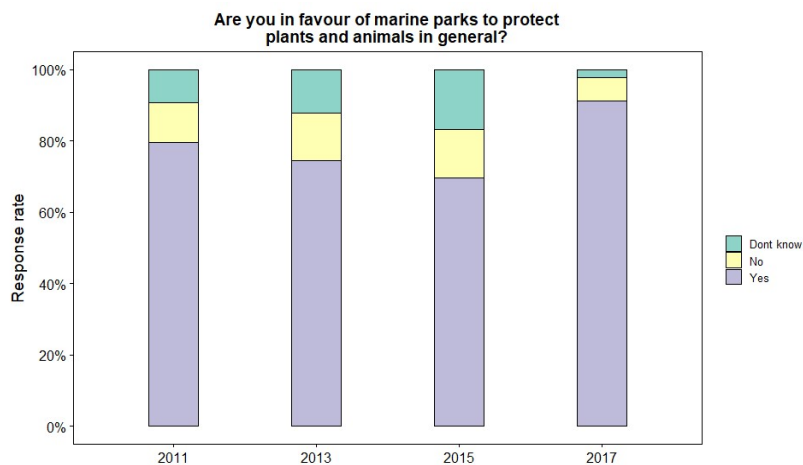
Overview: Indicators

- Collated 170 time-series datasets; many gaps
- Socio-economic data from national census (every 5 years)
- Contribution of marine industries to communities poorly understood (except F&A)
- Some ecological data-sets, but many gaps (e.g. soft-sediment deep-water, seagrass mapping incomplete, mangrove and saltmarsh data limited resolution)
- Good data on commercial fish and crustaceans (few on other species)
- Some data-sets on TEPS, but few ongoing, long-term dedicated programs
- Important pressures poorly understood
    - ❖ nutrients from finfish aquaculture
    - ❖ impacts of prawn trawling

Other limitations

- Many indicators are only monitored sporadically (TEPS) or infrequently (census)

- Many data-sets at spatial scales not useful for gulf (NRMs: e.g. split gulfs, statewide)

- No established marine monitoring regions (e.g. GSVKI, SG, WC, SE)

- No consolidated database available for ongoing use and reuse

- No ongoing integrated monitoring program

    - Limited understanding of community priorities (community well being)

    - No cohesive suite of objectives

    - No consolidated a suite of indicators

- Existing process for stakeholder engagement (SGEDI) could be better utilised by govt

- Reporting not well integrated - DEW, EPA, PIRSA, etc

Recommendations

1. Unlocking the power of data:

- Establish a consolidated database(s) to support future monitoring and reporting on the status of SA marine systems (part of NLMP)

- Data collected using government funds or to improve understanding marine ecosystems for community benefit (including EIS) should be publicly available in digital form (where legally possible and appropriate)

- Data should be FAIR: **F**indable, **A**ccessible, **I**nteroperable, and **R**eusable

- Maintenance of data, delivery of products - significant resources, major benefit

Recommendations

2. Future monitoring and reporting

- Need to establish integrated monitoring program (objectives, indicators, reporting, review, etc) to inform SoE reporting.

- Need to establish marine monitoring regions (e.g. GSVKI, SG, WC, SE)

- Need to refine reporting approach and time frame
    - ecological, economic and social indicators (noting census every 5 years)
    - consolidate DEW/EPA/PIRSA efforts?
    - align regional, state and national SoE reporting

- Align NMSP Refresh, NESP 2 MCH, NLMP

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