

Senate Inquiry into the Fisheries Quota System

Comments on management of the Southern and Eastern Scalefish and Shark Fishery (SESSF)

Dr Graham Edgar

Key points

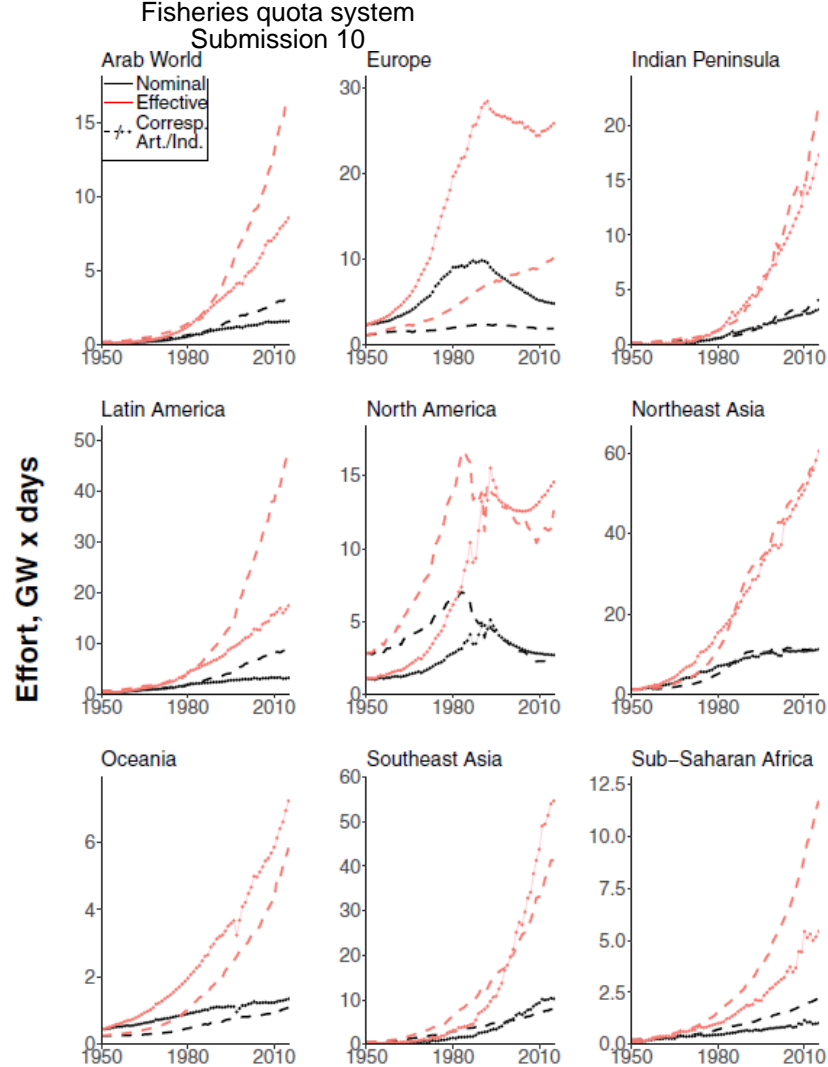
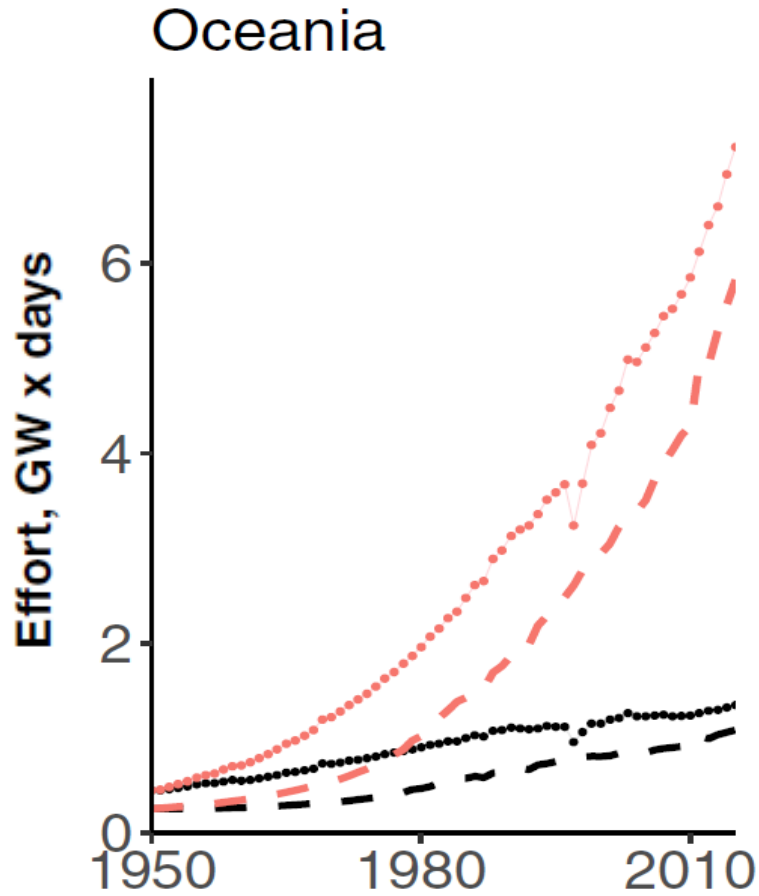
- Success of quotas and total allowable catch depends on accurate stock assessments
- SESSF stock assessments erratically fluctuate between successive assessments
- Modelled size of highly depleted stocks is consistently overstated
- Recent modelled rises in stocks following long-term decline are generally erroneous
- SESSF stocks have been fished down to lower levels, on average, than other comparable stocks worldwide
- Independent oversight is lacking – ‘red team’ approach needed
- Fisheries data are outdated by the time of public distribution
- Stakeholders can benefit from overfishing rather than precaution
- Public pays cost of overfishing – privatisation of profits, socialisation of costs
- Changing climate has, and will continue to, greatly affect stock trends
- Impacts of climate change should be factored into estimates of natural mortality and total mortality of stocks
- Adequate management requires much greater precaution
- From a fisheries perspective, Marine Protected Areas are needed for science, stock insurance, and intergenerational equity
- Australian Marine Parks have little value for science, insurance or equity as carefully located to maintain business as usual
- Effort buy-out provides an opportunity to establish no-fishing zones for scientific research
- AFMA is failing its ecologically sustainable development objectives – an independent review of AFMA seems warranted

Issues adversely affecting stock assessment models

- No catch trend information for most species, including bycatch
- Little (and decreasing) fisheries-independent or biological data for validation
- Inadequate funding for analysis - few Tier 1 stock assessments
- Stock size jumps erratically between successive assessments
- Overestimation bias for depleted stocks
- Recent stock increases evident in stock model output are generally erroneous
- Models extrapolate outside environmental bounds – little climate change consideration
- Between-species interactions largely ignored
- Technological improvements increasing catch efficiency are largely ignored
- Recreational catch largely uncontrolled and ignored
- Models rely on value judgments for parameterisation, subject to cognitive biases
- Models are overfitted
- Models are opaque and cannot be independently reproduced

=> Much more precaution needed

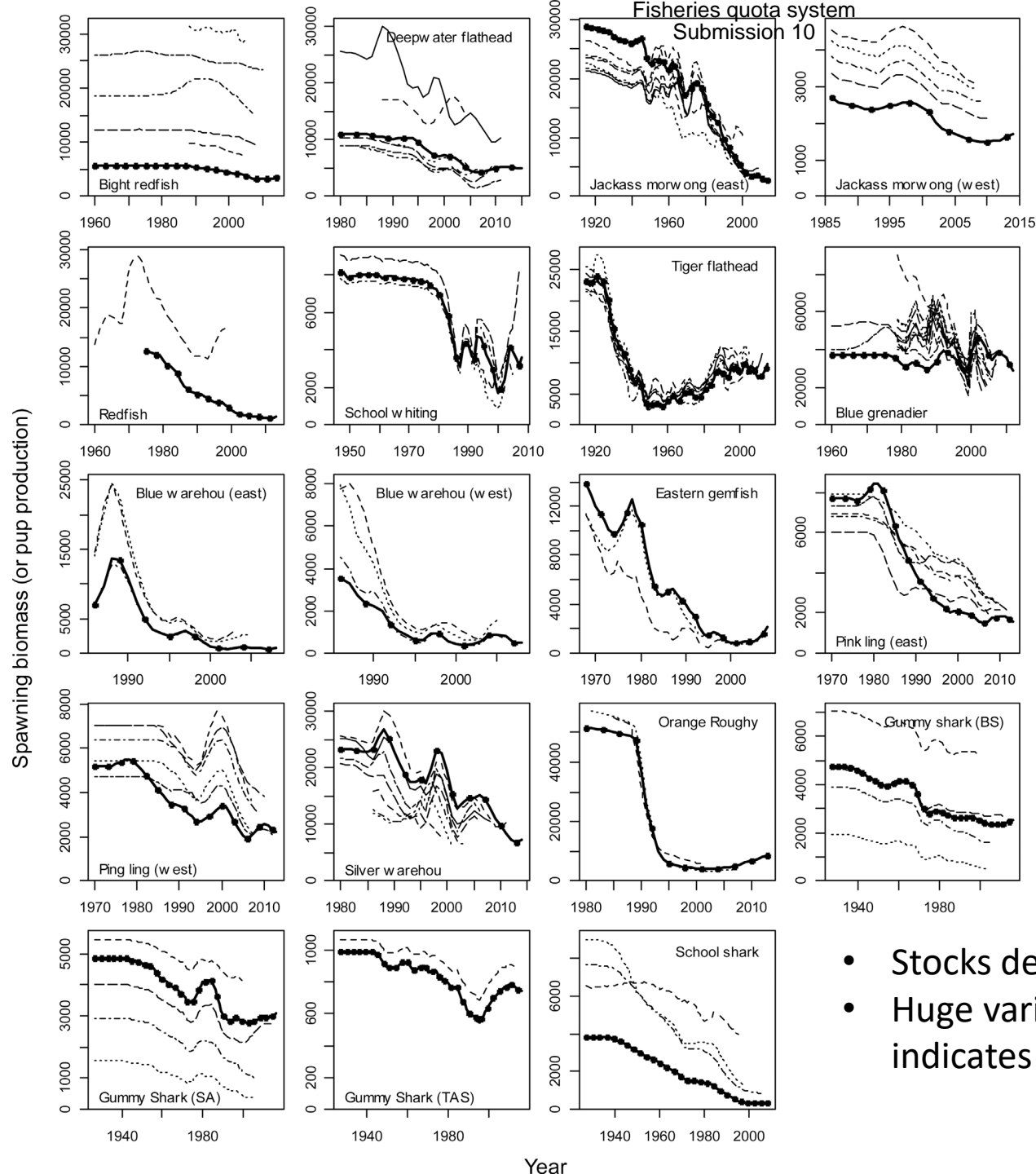
Technology creep



Rousseau, Y, Watson, RA, Blanchard, JL & Fulton, EA (2019) Evolution of global marine fishing fleets and the response of fished resources. *Proceedings of the National Academy of Sciences*, doi: 10.1073/pnas.1820344116.

Fig. 3. Yearly nominal (black) and effective (red) fishing effort by region and sector, 1950–2015. The effective effort assumes a 2.6% increase in technological creep per annum. The dashed lines represent the artisanal fishing sector (including powered and unpowered), and the dotted lines represent the industrial sector.

- Fishing effort continues to accelerate across Australia, particularly when increasingly efficient technology is considered.

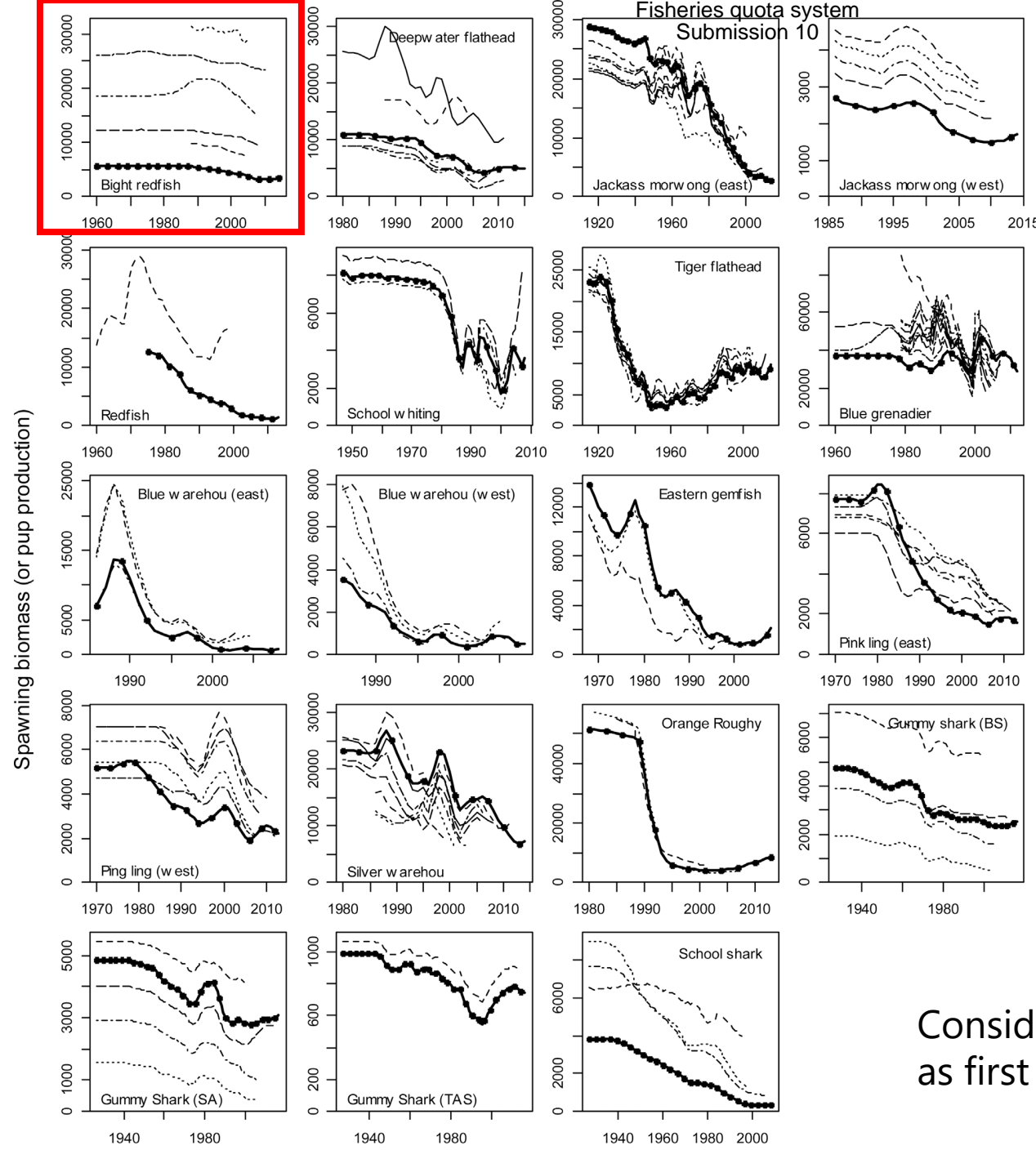


SESSF

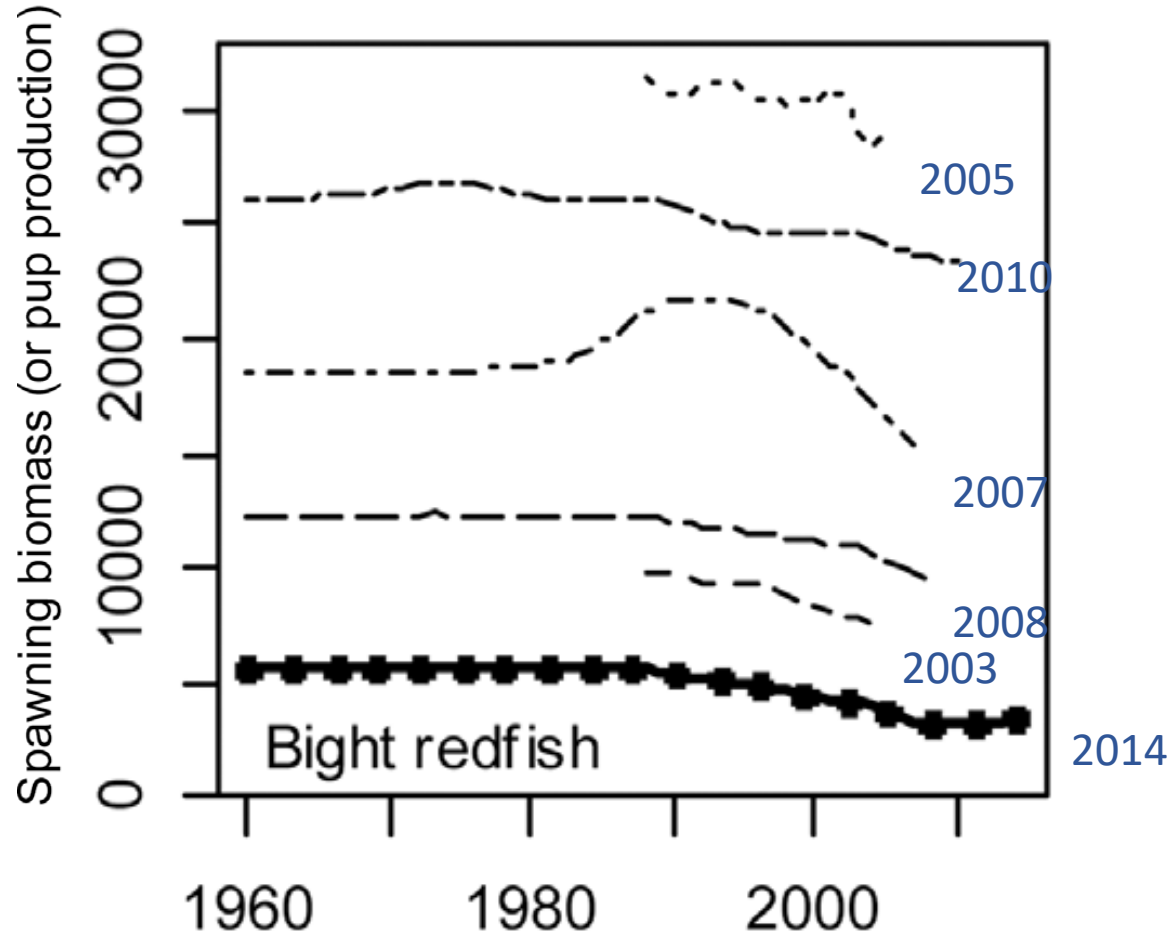
Fig. 1. Time trajectories of modelled spawning stock biomass by stock for major SESSF fisheries. Solid lines indicate the most recent assessments.

Punt, AE, Day, J, Fay, G, Haddon, M, Klaer, N, Little, LR, Privitera-Johnson, K, Smith, AD, Smith, DC & Sporcic, M (2018) Retrospective investigation of assessment uncertainty for fish stocks off southeast Australia. *Fisheries Research*, **198**, 117-128.

- Stocks declining over time
- Huge variation among repeated stock assessments indicates high uncertainty



Consider Bight redfish
as first example



- Huge variation in estimates of stock size between assessments conducted in different years
- Most recent assessment has lowest stock size and depletion (B/B_0)
- Huge write-down in book value of public asset accepted without discussion – 20,000 tonne write-down from 2010 to 2014 = \$200,000,000 at \$10/kg

log standard deviation describing variation in stock size when outdated assessments are compared to most recent assessment = 0.60
=> half of earlier estimates of stock size lie outside 67% and 150% of the most recent modelled value.

Punt, AE, Day, J, Fay, G, Haddon, M, Klaer, N, Little, LR, Privitera-Johnson, K, Smith, AD, Smith, DC & Sporcic, M (2018) Retrospective investigation of assessment uncertainty for fish stocks off southeast Australia. *Fisheries Research*, **198**, 117-128.

- Huge variability in modelled estimates between successive stock assessments

Precaution required

Consistent with the 'Harvest Strategy Policy', which establishes a more precautionary approach to harvest control rules for species for which assessments are more uncertain.

The discount factors to be applied are 5% for Tier 3 and 15% for Tier 4 (i.e. no reliable information available on either current biomass or current exploitation rate).

Harvest strategy framework for the southern and eastern scalefish and shark fishery 2009 amended (2019)

- The level of precaution formally applied when managing poorly known stocks is trivial compared to year-by-year fluctuations in stock estimates, even for the best studied stocks

Results of retrospective analyses for different national and trans-national groups assessing 230 major stocks. Total number of stocks assessed, mean relative biomass depletion (B/B_0) and bias are shown. Smaller depletion numbers indicate greater levels of depletion.

Country/assessment group	Stocks	Depletion (B/B_0)	Bias (overestimation)	Corrected Depletion
Australia (SESSF)	19	0.29	22%	0.24
Argentina	6	0.60	39%	0.43
Canada	12	0.41	74%	0.23
Multinational Tuna Commission	6	0.78	-21%	1.00
Multinational_ICES	42	0.91	11%	0.82
Multinational_ICES Arctic Fisheries Working	6	1.12	51%	0.74
Multinational_Other Organisations	5	0.49	18%	0.42
New Zealand	15	0.44	0%	0.44
South Africa	8	0.56	22%	0.46
USA	111	0.68	16%	0.58

- SESSF stocks are the most highly depleted set of stocks in analysis considering 230 major stocks worldwide (average 29% of initial biomass).
- When reported SESSF stock size is compared with later updated and more accurate assessment for the same year, the original estimate is found to be overstated by 22%, on average.
- Optimal depletion (B/B_0) target for SESSF to achieve maximum economic yield is 48%

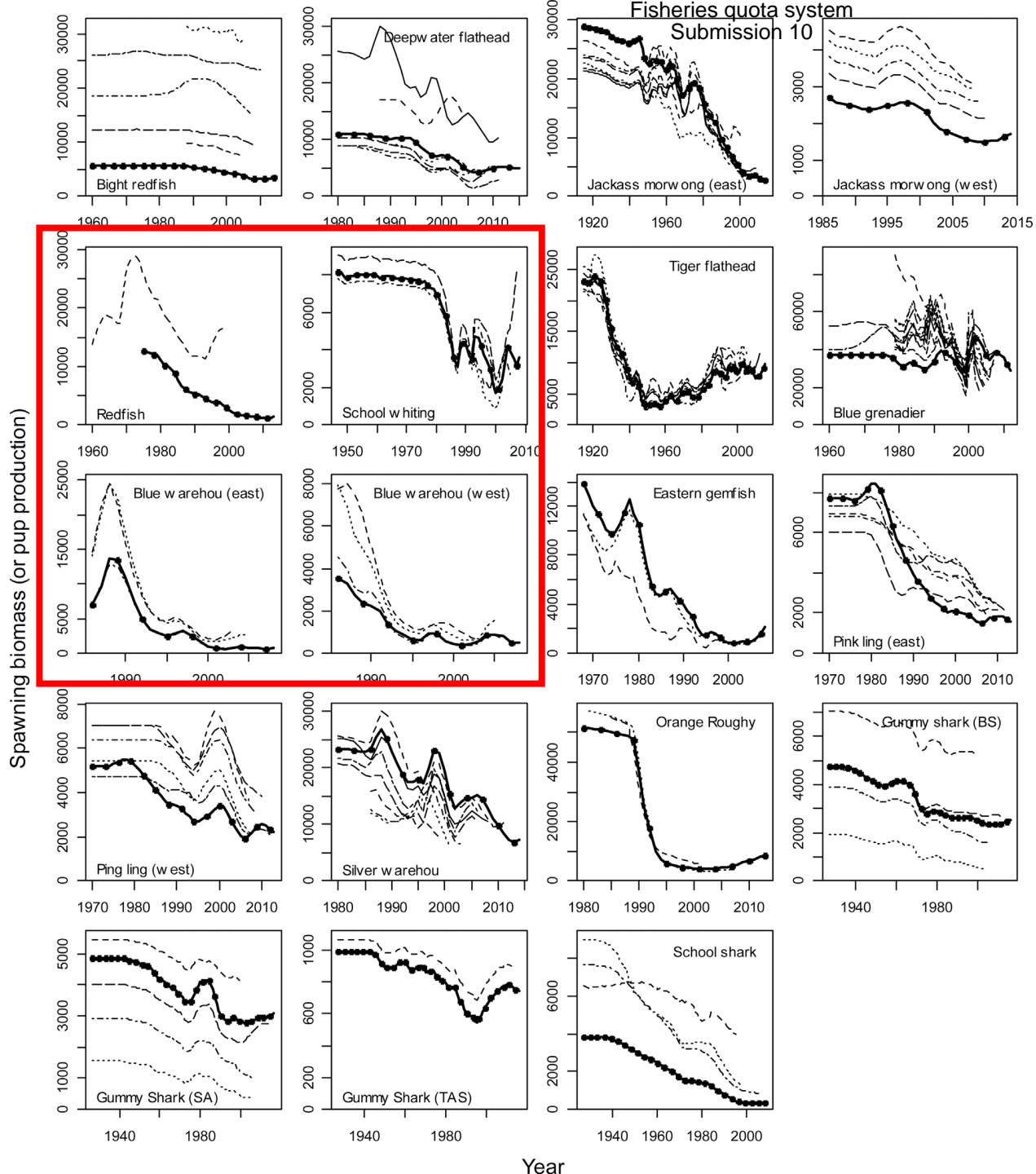
“PGY [pretty good yields] can be obtained at quite high stock sizes, and there is little long term yield to be lost by keeping most stocks at 50% of unfished stock size. Given the growing social acceptance of more intact ecosystems as an objective of fisheries management, higher target stock size ranges than 35–40% should be considered desirable. Furthermore, it is generally expected that fisheries will be more profitable at the higher end of stock sizes, and economic arguments would favor aiming at or above the 35–40% target levels.”

However,

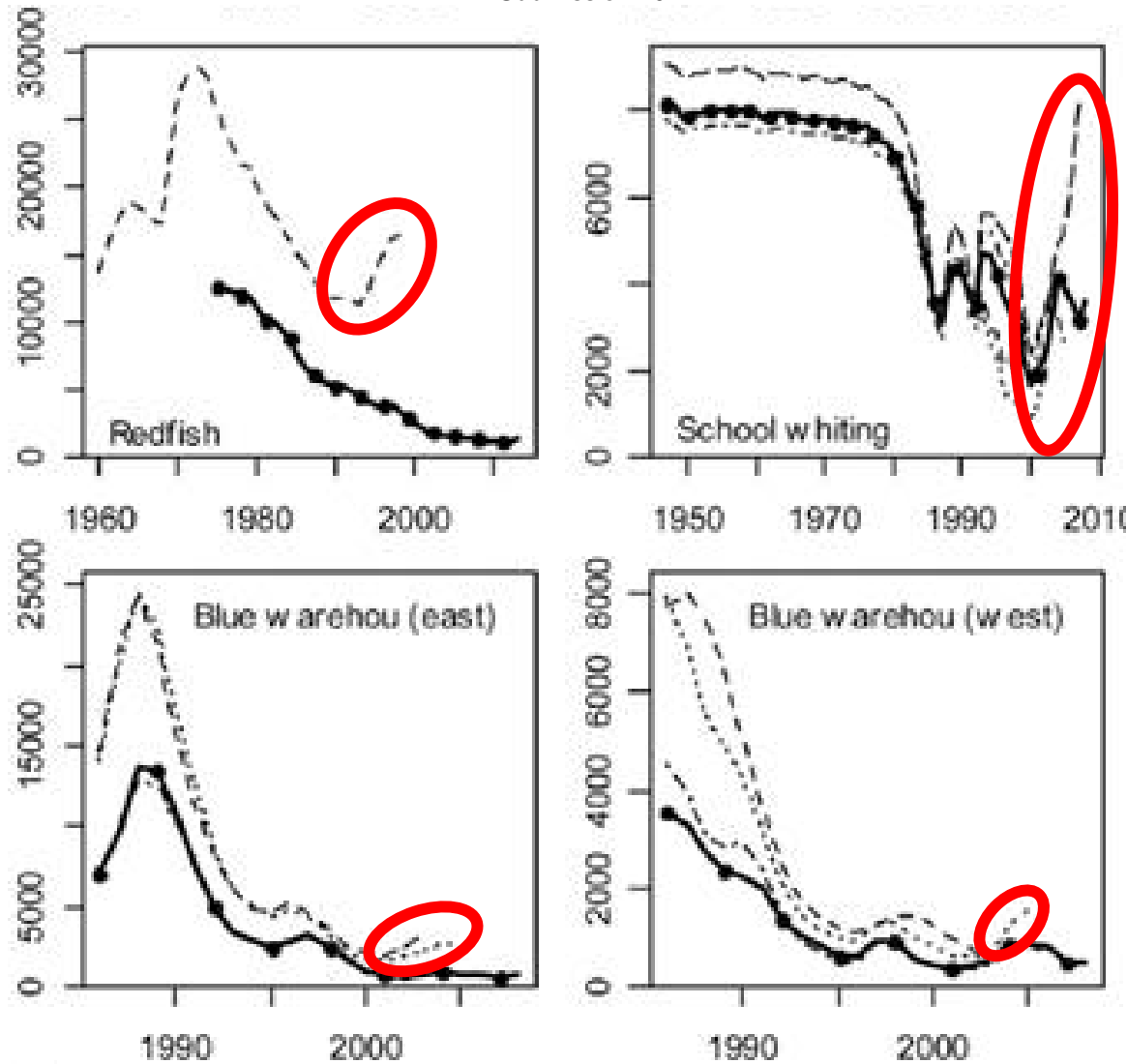
“there is considerable short-term cost in foregone yield during the rebuilding.”

Hilborn, R. (2010). Pretty Good Yield and exploited fishes. *Marine Policy*, 34(1), 193-196.
[doi:10.1016/j.marpol.2009.04.013](https://doi.org/10.1016/j.marpol.2009.04.013)

- Rationale for keeping depletion in the 40-50% range
- No benefits from overfishing, other than quick return as resource is extracted
- But socially difficult to recover from past overfishing

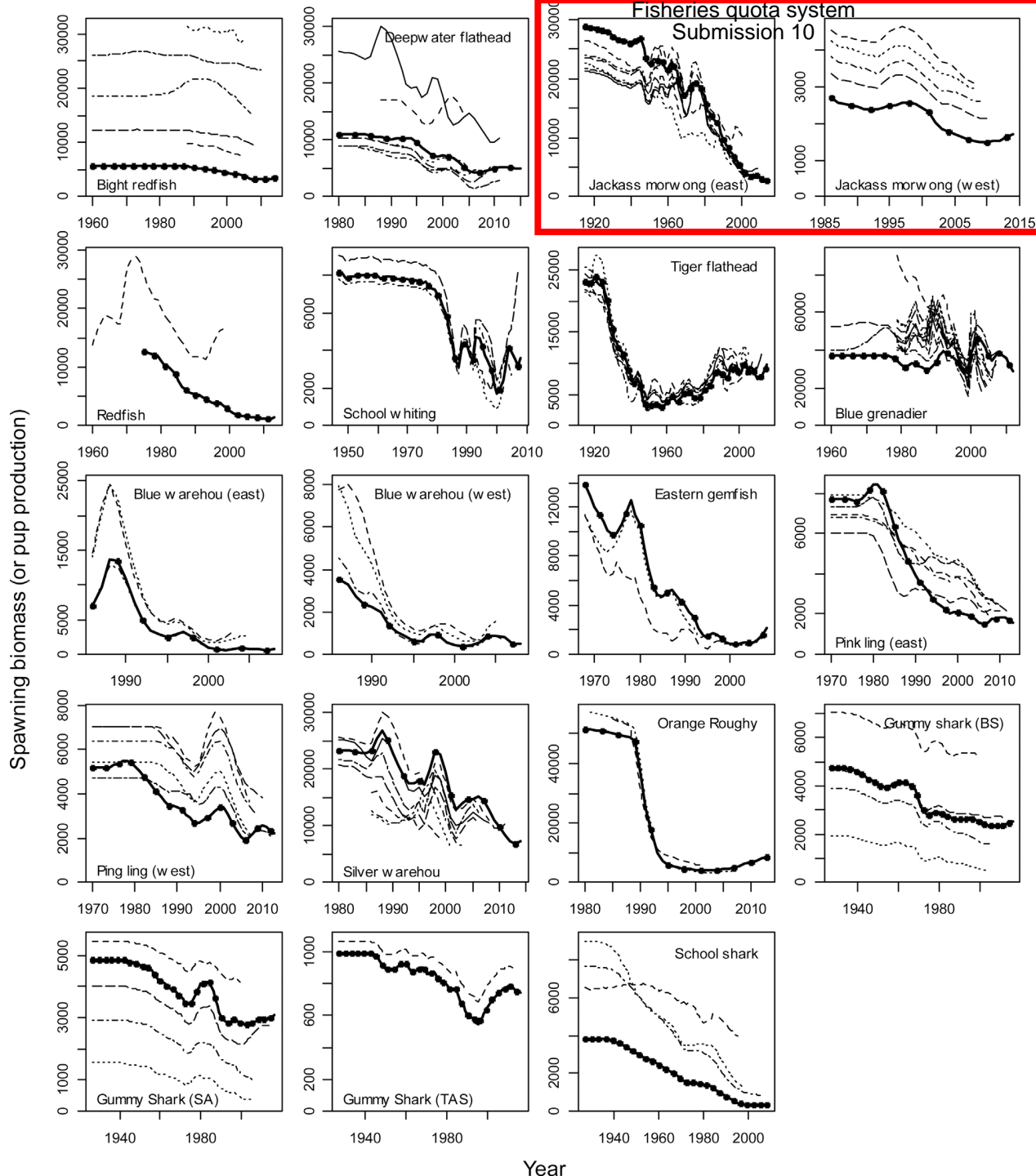


Spawning biomass (or pup production)



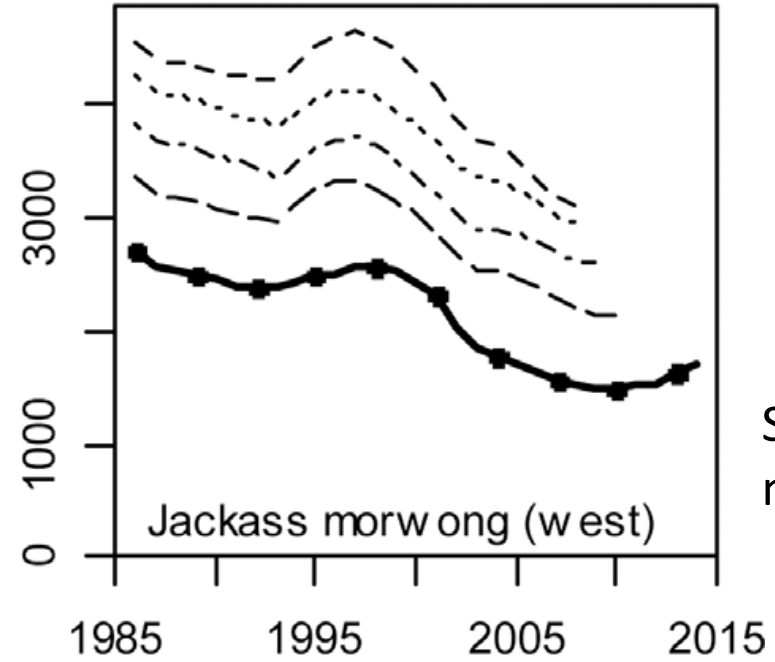
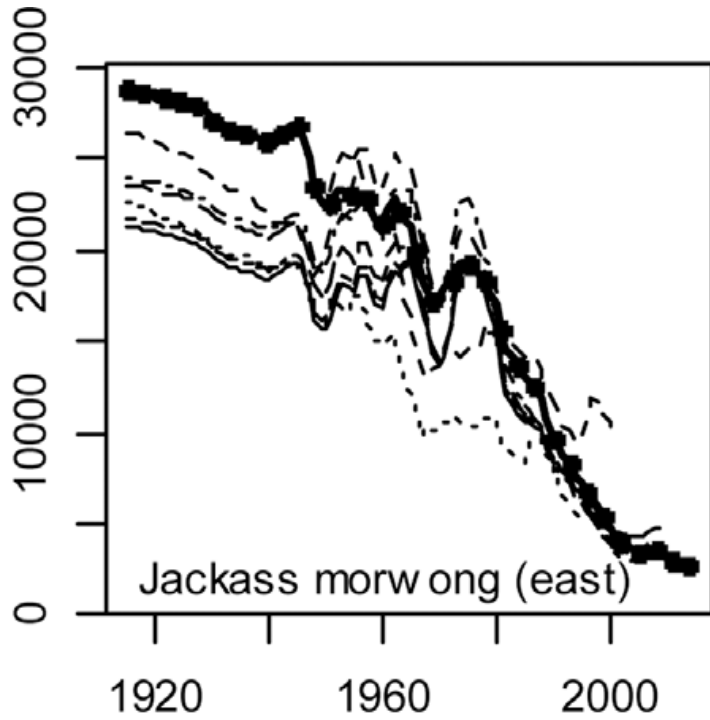
Solid black lines are most recent assessments

- Consistent rises in final years of assessment that are found to have been erroneous in subsequent assessments
- These artefacts are likely driven by recognition and removal of over-estimation bias in past years but with final year including bias.



Focus on jackass morwong plots

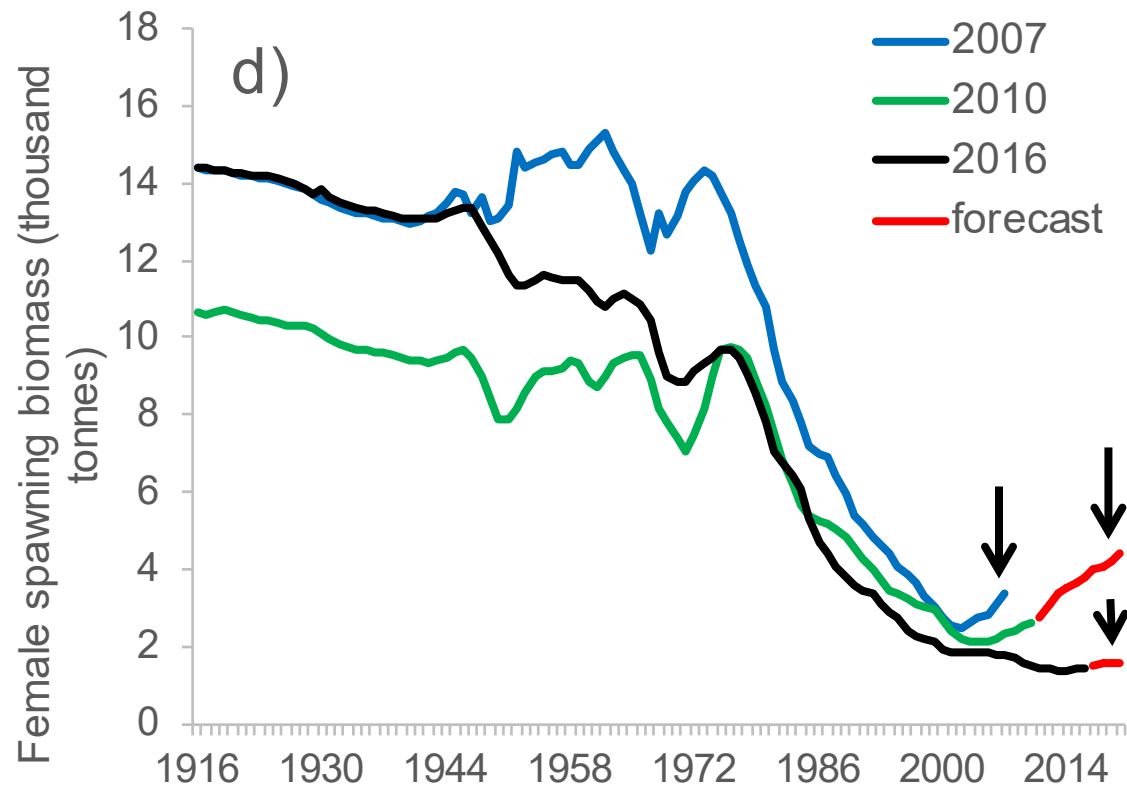
Spawning biomass (or pup production)



Solid black lines are most recent assessments

- Jackass morwong case example

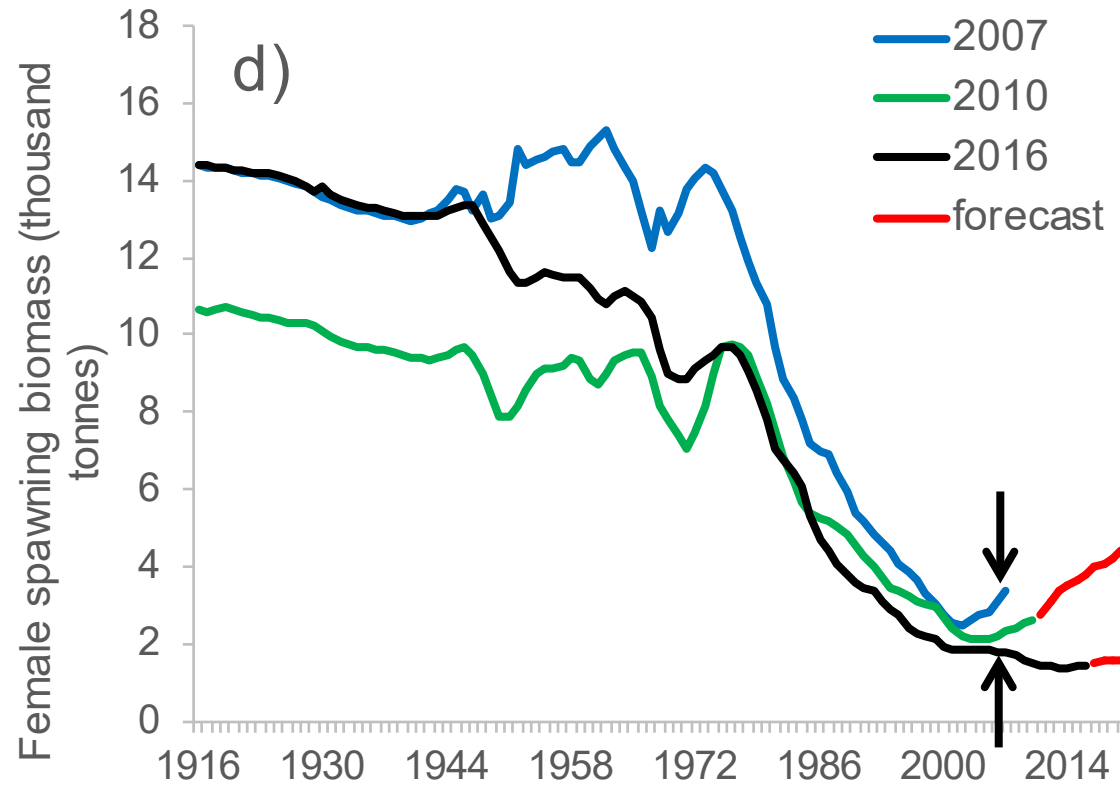
Jackass morwong (*Nemadactylus macropterus*) fishery



- Modelled stock biomass: major decline from 1976
- Modelled stocks are predicted to be rising in final year of assessment
- This upward stock trajectory found to be illusory in subsequent assessments

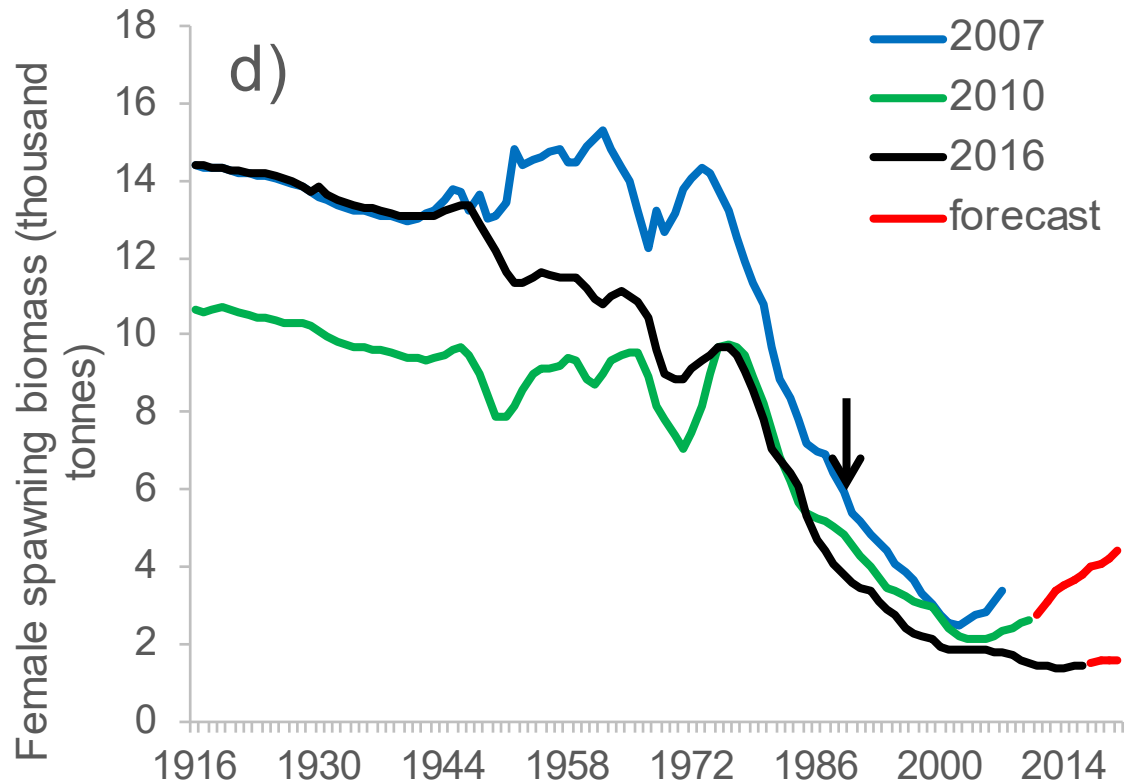
Edgar, G. J., Ward, T. J., & Stuart-Smith, R. D. (2018). Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without expanded network of 'no-fishing' reserves. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28, 1337–1350. doi:DOI: 10.1002/aqc.2934

Jackass morwong (*Nemadactylus macropterus*) fishery



- 93% overestimation in biomass in 2007, as later recognised in 2015 stock assessment

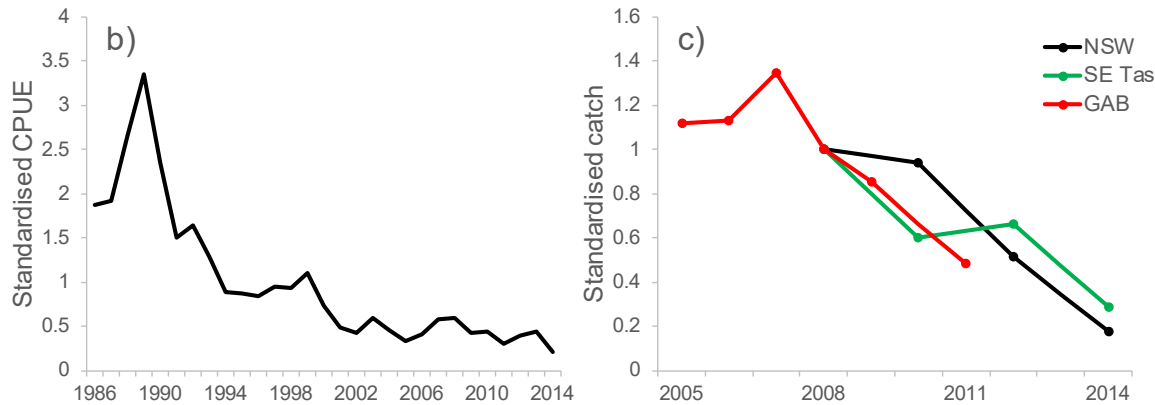
Jackass morwong (*Nemadactylus macropterus*) fishery



- Recommended catch = 0 in 2007-9 because $B/B_0 < 0.2$
- Climate-induced recruitment shift hypothesis: suggestion that stocks will never recover to original size, so another baseline year is needed
- 1988 rather than 1916 used as baseline year, increasing B/B_0 by 3.5x ($B_0 = 4080$ cf. 14,402 tonnes)
- Continued fishing despite clear evidence of recruitment failure and stock collapse

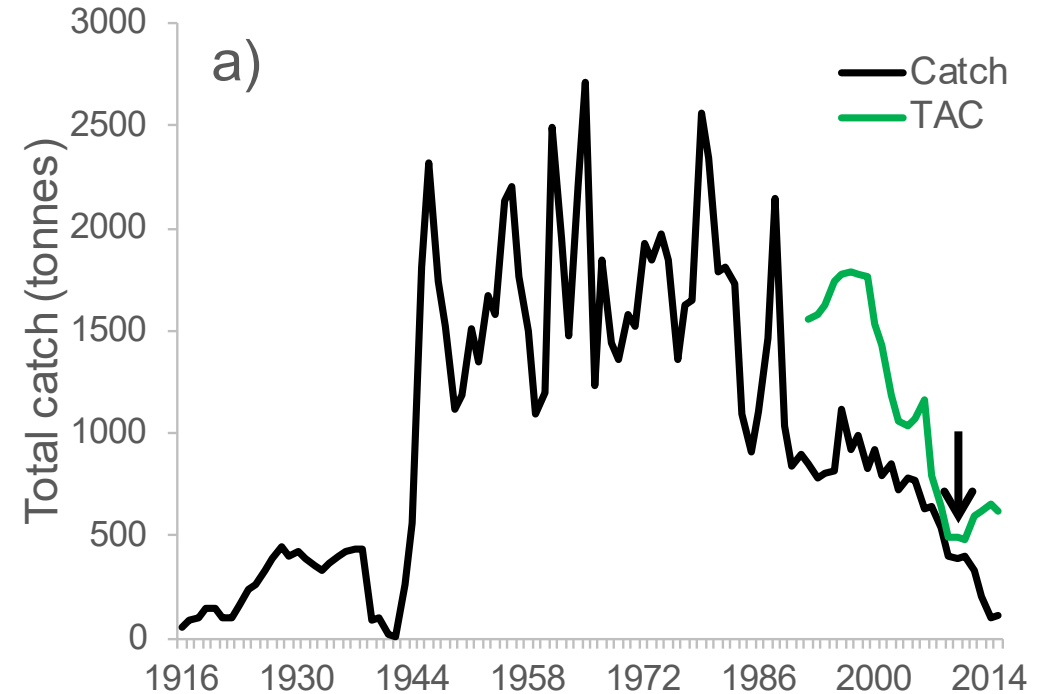
Jackass morwong (*Nemadactylus macropterus*) fishery

Catch Per Unit Effort (CPUE)



- CPUE 90% decline 1988-2014
- Fishery independent data
=>recent 80% decline (2005-14)

Actual catch is lower than Total Allowable Catch (TAC)



- In addition to catches, Catch Per Unit Effort and fishery independent surveys also indicate stock size has fallen below 20%, and thus recommended catch should be 0.
- Unanimous agreement that the stock has collapsed with recruitment failure.
- Management response is contrary to universal practice with recruitment failure, decision is to increase fishing pressure by setting a higher TAC

Stock model parameterisation uncertainty

“Catch curve analysis on fish between 5 and 26 years old produced an estimate for total mortality of 0.18 yr^{-1} . Using a [natural mortality] value for M of 0.09 yr^{-1} , a fishing mortality (F) of 0.09 yr^{-1} was estimated.”

“The rate of natural mortality for the base-case analysis was set to 0.15 yr^{-1} in accordance with previous assessments.”

$M = 0.20 \text{ yr}^{-1}$ $B_{2016}/B_0 = 52\%$

Applied: $M = 0.15 \text{ yr}^{-1}$ $B_{2016}/B_0 = 36\%$

$M = 0.10 \text{ yr}^{-1}$ $B_{2016}/B_0 = 21\%$

‘Best estimate’: $M = 0.09 \text{ yr}^{-1}$ $B_{2016}/B_0 = 18\%$



• Changes in the estimated natural mortality parameter (M) have huge impacts on estimated stock depletion (B/B_0)

• ‘Best estimate’ of natural mortality, but not applied in final model

Tuck, GN (2016) *Stock assessment for the Southern and Eastern Scalefish and Shark Fishery: 2015 Part 1: Tier 1 assessments. Report 2014/0818. Australian Fisheries Management Authority, Canberra.*

- Slight variation in some parameters set by the modeller can result in huge variation in stock estimates.
- Selection of parameters for stock model is subjective, not always supported by best independent information.
- Jackass stock assessment report states that the best estimate of natural mortality M is 0.09 yr^{-1} . However, if 0.09 yr^{-1} is entered in stock model then stock estimate (18% depletion) is below the limit reference point of 20%.
- $M = 0.15 \text{ yr}^{-1}$ generates a much higher stock estimate (36%), and is used instead of the best estimate 0.09 yr^{-1} .

Issues affecting use of stock models in management

- Outdated data
- Huge uncertainty associated with stock model output
- Little consideration of discrepancies from previous stock estimates
- Optimism when dealing with uncertainty
- Lack of independent oversight/auditing – no red team
- Irrelevant Total Allowable Catch
- Need for no-fishing scientific reference areas – climate change

Outdated data

Current Australian fisheries and aquaculture statistics: 2019/20

(<https://www.agriculture.gov.au/abares/research-topics/fisheries/fisheries-data#australian-fisheries-and-aquaculture-statistics-2020>)

- Data are three years old before publicly available

Dealing with uncertainty

“... uncertainty has been characterized almost uniformly by overly optimistic interpretations of the present and future states of the fishery.”

Bax, N, Tilzey, R, Lyle, J, Wayte, SE, Kloser, RJ & Smith, ADM (2005) Providing management advice for deep-sea fisheries: lessons learned from Australia's orange roughy fisheries. *FAO Fisheries Proceedings*, **3**, 259-272

- Repeated choice of the most optimistic scenario in the face of uncertainty
=> declining stocks through ratcheting – i.e. stocks remain stable when optimism was the correct call and decline incrementally when pessimism was needed

Why tendency for over-optimism?

Fishing industry

- rapid return on investment
- increased ITQ sale value

Management

- avoid public criticism

Science

- avoid industry criticism
- good relations for future research support

Impact on public

- Loss of natural capital/future income
- Declining biodiversity
- Reduced inter-generational equity
- Buy-out cost – privatisation of profits, socialisation of costs

Securing Our Fishing Future DAFF05/248M 14 December 2005
Australian Fisheries and Conservation Minister Senator Ian Macdonald:

"It is important that fishers have as complete a picture as possible of the future operating environment for Commonwealth fisheries so that they can make a balanced decision on whether to stay in the industry or apply to the Government's \$150 million fishing concession buyout. The message from the Australian Government is clear: overfishing in Commonwealth fisheries is unacceptable and if you think you can't operate in that environment, you should consider applying for the buyout," Senator Macdonald said.

"There will not be any further assistance of this kind."

<https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id:%22media/pressrel/KLAI6%22>

TAC has little relevance in SESSF

“Of the nine species with readily accessible decadal data on TAC and actual catch in the Southern and Eastern Scalefish and Shark Fishery, only two species – the tiger flathead and the pink ling – achieved 50–100% of the allocated TAC in 2015.

“Catches of eastern school whiting were well over the TAC (166%), whereas catches of the other six species – blue grenadier, deepwater flathead, jackass morwong, bight redfish, silver warehou – averaged 24% of the TACs. In most cases the TAC therefore appears irrelevant.”

Edgar, G. J., Ward, T. J., & Stuart-Smith, R. D. (2018). Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without expanded network of ‘no-fishing’ reserves. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28, 1337–1350. doi:DOI: 10.1002/aqc.2934

Lack of independent oversight

- Little, if any, independent scrutiny
- Research funding directed through fishing sector priorities – negligible support for research that could potentially generate negative findings/ public good fisheries research
- Little tolerance of contrary findings

Example of intolerance

A coordinated social media response quickly followed publication of a scientific peer-reviewed article by Edgar et al. 2018*, where findings contradicted the message “*not one single fish stock that is Commonwealth managed is either overfished or subject to overfishing*”

[This quote is frequently repeated, including from Senator Colbeck, Assistant Minister for Fisheries, Hansard 12 Sep 2018
<https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;db=CHAMBER;id=chamber/hansards/8d55c149-a657-4f9b-a36f-9b3925147068/0236;query=Id:%22chamber/hansards/8d55c149-a657-4f9b-a36f-9b3925147068/0052%22>]

Seafood Industry Australia

“The basic premise of the paper is not supported by any evidence or credible scientific literature”

<https://seafoodindustryaustralia.com.au/2018/06/05/seafood-industry-australias-response-to-edgar-ward-and-stuart%E2%80%90smiths-research-article/>

The Australian Fisheries Management Authority

“AFMA rejects the claim that there have been rapid declines across Australian fish stocks”

<https://www.afma.gov.au/response-research-paper-edgar-et-al-regarding-australian-fishery-stocks>)

Fishing Research and Development Corporation

“FRDC responds to attack on Australian fisheries science”

<http://www.frdc.com.au/Media-and-Publications/News-and-Media-Releases/FRDC-responds-to-attack-on-Australian-fisheries-science>

*Edgar, G. J., Ward, T. J., & Stuart-Smith, R. D. (2018). Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without expanded network of ‘no-fishing’ reserves. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28, 1337–1350. doi:DOI: 10.1002/aqc.2934

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SENATE

Wednesday, 12 September 2018

Senator COLBECK:

“a piece of alleged science—I think is probably better to say—which is based on people going snorkelling in inshore waters and trying to correlate that to the impacts on our Commonwealth waters outside three kilometres. This is not science.”

“... quite frankly, a disgrace.”

- Criticism includes misleading statements to Parliament – none of the data used in the paper involved snorkelling.

Seafood Industry Australia

<https://seafoodindustryaustralia.com.au/2019/01/23/australias-commercial-fish-stocks-sustainable-csiro-paper-highlights-edgar-paper-flaws-rejects-claims-of-rapid-decline/> [recently removed from the website]

“We raised our concerns regarding the process of peer review, publishing and promotion of the ‘Edgar’ paper with the University of Tasmania (UTas). We have engaged in meaningful discussions with UTas regarding process changes. We look forward to their initiatives to prevent a recurrence of situations like this that discredit the hard and accurate work of so many other researchers and the efforts of our commercial fishers, coming into effect. We encourage other research organisations to make sure they have suitably rigorous processes to ensure scientific rigour and processes are maintained.”

Seafood Industry Australia's Right to Information request to the University of Tasmania

Dear Vice Chancellor,

Further to my conversations regarding the recent paper by Edgar, Ward and Stuart-Smith, I have detailed the information we are requesting.

1. Draft and/or alternative versions; including papers with alternative titles, of Graham J. Edgar et al's research paper, "Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without an expanded network of 'no-fishing' reserves".
2. Internal and external peer review comments made on Edgar et al's research paper, its drafts and alternative versions; including papers with alternative titles.
3. Any and all points raised by internal and external peer reviewers that were incorporated, or were not incorporated by Edgar et al's research paper.
4. Details of the responses to internal and external peer reviewers comments by the authors; its drafts and alternative versions.
5. Details of any refusals to peer review Edgar et al's research paper, its drafts and alternative versions; including papers with alternative titles.
6. Any and all academic journal or magazine submissions and feedback made on Edgar et al's research paper, its drafts and alternative versions.
7. Details of any direct or in-kind external funding or donations for the Edgar et al's paper, its drafts and alternative versions.
8. Details of conflict of interest declarations made by Edgar et al's paper, its drafts and alternative versions; including papers with alternative titles
9. Copies of correspondence with environmental NGOs including, but not limited to: AMCS, PEW Foundation or WWF; related to the Edgar et al's paper.
10. Copies of correspondence with any members of the Australian Greens or any other registered political party related to the Edgar et al's paper.
11. Copies of communication undertaken to promptly inform industry stakeholders directly impacted by the research of the research findings.

I look forward to your response.

Regards

Jane Lovell, CEO



The scientific process – involves dealing with disagreements through debate in publications and face-to-face meetings

Received: 19 December 2017 | Revised: 4 April 2018 | Accepted: 7 April 2018
DOI: 10.1002/aqc.2934

RESEARCH ARTICLE

WILEY

Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without an expanded network of 'no-fishing' reserves

Graham J. Edgar¹ | Trevor J. Ward² | Rick D. Stuart-Smith¹

Received: 27 January 2019 | Revised: 2 May 2019 | Accepted: 5 May 2019
DOI: 10.1002/aqc.3161

VIEWPOINT

WILEY

Weaknesses in stock assessment modelling and management practices affect the sustainability of fisheries

Graham J. Edgar¹ | Trevor J. Ward² | Rick D. Stuart-Smith¹



Received: 26 June 2018 | Revised: 7 September 2018 | Accepted: 16 October 2018
DOI: 10.1002/aqc.2992

COMMENTARY AND CORRESPONDENCE

WILEY

Comments on the evidence for the recent claim on the state of Australian fish stocks

L. Richard Little¹ | Jemery Day¹ | Malcolm Haddon¹ | Neil Klaer¹ | Andre E. Punt^{1,2} | Anthony D.M. Smith¹ | David C. Smith¹ | Geoff N. Tuck¹

Received: 18 July 2018 | Revised: 7 November 2018 | Accepted: 16 December 2018
DOI: 10.1002/aqc.3045

COMMENTARY AND CORRESPONDENCE

WILEY

Comments on Edgar et al. (2018) paper for south-western Australia

Dan Gaughan¹ | Nick Caputi¹ | Brett Molony¹ | Brent Wise¹ | Gavin Begg² | Stephen Mayfield² | Michael Steer² | Tim Ward² | Adrian Linnane² | Ben Stobart² | Sean Sloan³ | Thor Saunders⁴

- Agreement on many points in response papers: “Edgar et al. (2018) provide some valid points about improving fisheries stock assessment and management, including fishery independent data, fishing-power changes, precautionary management, responding to changing harvestable biomass, collecting discard information, expansion of ecosystem-based fisheries management, and transparency in stock assessments. However,” Gaughan et al. 2018. 31

The scientific process

- Forum discussion at the Australian Marine Science Association annual meeting, Perth
- CSIRO/UTAS workshop (Dr A. Hobday/Dr R. Watson facilitation) – positive discussion, consensus, recommendations for improving aspects of fisheries management related to stock assessments

Question: Why were workshop recommendations not acted on, discussed publicly or progressed further?

How have jackass morwong fared since Edgar et al (2018)?

487 tonne Jackass morwong catch in 2015/16, most recent data at time of publication
208 tonnes in 2019/20, most recent data today => 57% decline

“the preliminary 2021 stock assessment (assuming average recruitment from 2016 onwards) estimated that eastern jackass morwong biomass had dropped below Blim [i.e. $B/B_0 < 20\%$] for the period 2013–2021. However, it was estimated to reach a minimum of 15 per cent in both 2018 and 2019, followed by recovery to 22 per cent (of the post-productivity shift from 1998 equilibrium spawning biomass) in 2022.”

South East Resource Assessment Group (SERAG) Meeting 2 2021 Meeting minutes 19–20 October 2021

https://www.afma.gov.au/sites/default/files/serag_2_oct_2021_minutes.pdf

- Even with revision that downgraded target by 3.5x, the recommended catch should have been reduced to 0 tonnes in 2013, as then below limit reference point of 20%.
- Stock had dropped to 4% of virgin biomass in 2018.
- Rising stocks have been predicted in all recent stock assessments, none have eventuated. This latest projected rise in 2022 is likely to also be found erroneous in future assessments.

Jackass morwong

[2021-2022]

You are here: [Home](#) / Fisheries Management / Species

Morwongs have creamy flesh with a distinctive flavour. They are ideally suited to frying, baking, steaming or barbecuing whole (gilled and gutted).
Morwongs can be used in place of snapper or red emperor as an inexpensive centrepiece for a buffet.



Jackass morwong

[2022-2023]

You are here: [Home](#) / Fisheries Management / Species

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Morwongs can be used in place of snapper or red emperor as an inexpensive centrepiece for a buffet.



“it is unlikely the stock [jackass morwong] will ever recover to the target reference point”

Southern and Eastern Scalefish and Shark Fishery Resource Assessment Group (SESSFRAG) Chairs’ Meeting 2022 Meeting minutes 27-29 April 2022 www.afma.gov.au/sites/default/files/sessfrag_minutes-april22.pdf

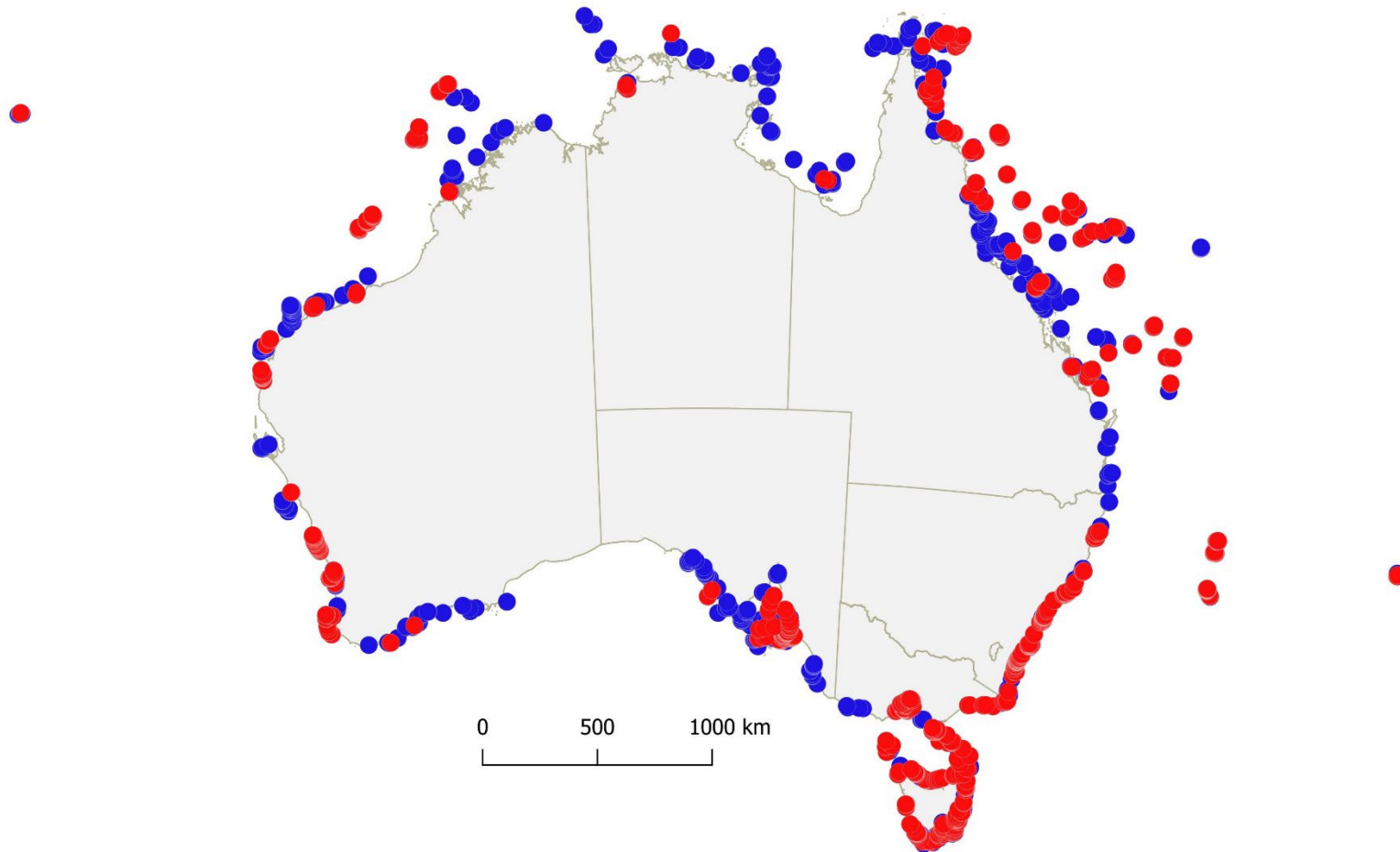
- Catch limit reduced from 463 tonnes in 2021-22 to 20 tonnes in 2022-23.
- Stock still classed as “Not subject to overfishing” and “Not overfished”.

Question: Would closing the jackass morwong fishery in 2022 be necessary if precautionary management had been applied when 20% limit reference point was first exceeded in 2007?

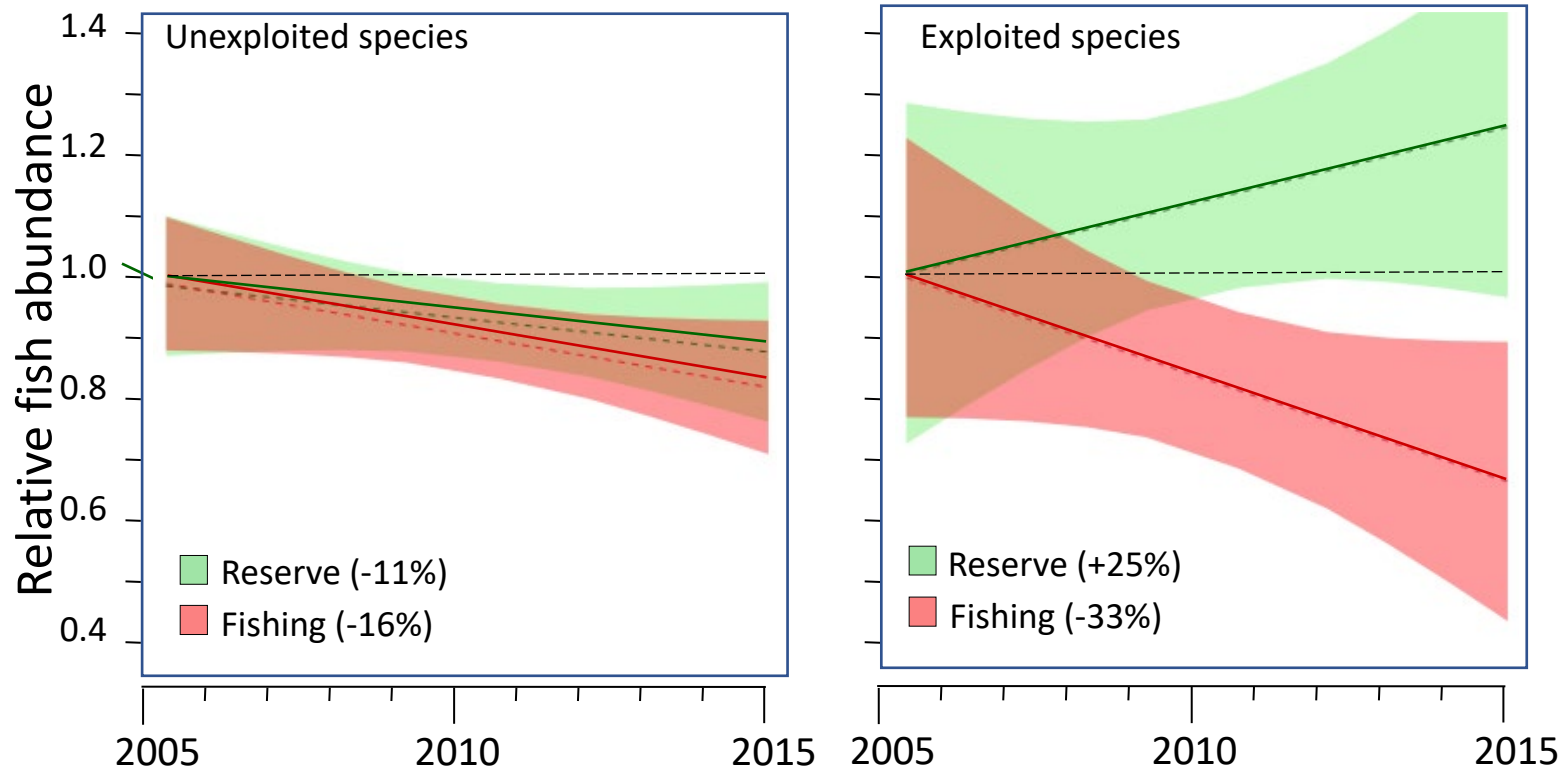
Fisheries 'catch 22'

- Fishers approach catch quota (e.g. Eastern pink ling): => fishery is **sustainable** because the fishery achieved quota with surplus left, so on target and all is going well
- Fishers catch well below quota (e.g. Jackass morwong): => fishery is **sustainable** because the quota was designed as a sustainable take, so excess remains and all is going well
- Fishers exceed quota (e.g. Eastern School Whiting) => fishery is **sustainable** because fishing mortality not excessive

In addition to specific comments on the Jackass morwong fishery, Edgar et al (2018) investigated trends in reef fish populations around Australia.



Australian sites surveyed for publication.
Sites with repeat surveys in red.



Trends in abundance of fishes observed during underwater transects around Australia.

Edgar, G. J., Ward, T. J., & Stuart-Smith, R. D. (2018). Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without expanded network of 'no-fishing' reserves. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28, 1337–1350.

- Populations of unexploited species were declining, on average, around Australia – probably in large part due to rising sea temperatures
- Populations of exploited species were rising within no-fishing (Reserve) zones, and declining more rapidly than unexploited fishes outside no-fishing zones (Fishing).
- => fishing and climate change were probably both contributing to declining patterns

Need for effective Marine Protected Areas (MPAs) for fisheries management

- In addition to biodiversity conservation, MPAs are needed for science as, amongst other scientific benefits, they provide counterfactual areas for distinguishing broad-scale climate impacts from effects of fishing.
- Research outputs can benefit fishers by reassuring the public that fishing is not responsible when climate change has caused stock declines.

Test:

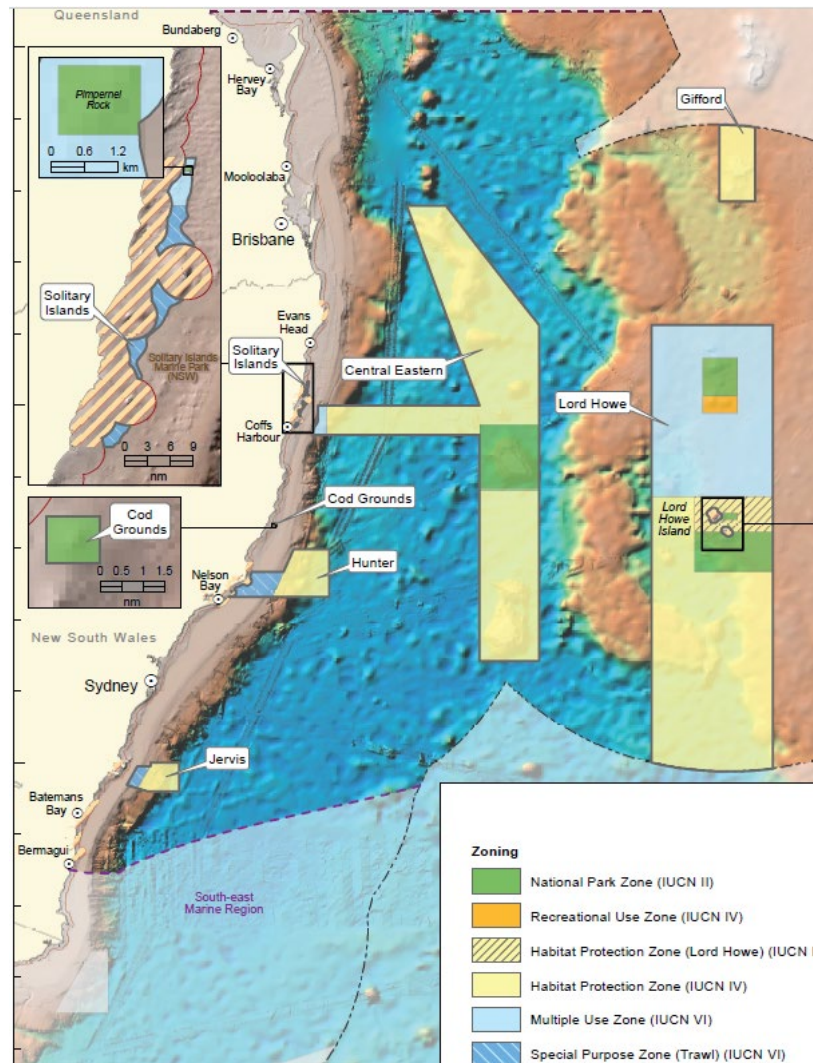
- if fish population declines inside no-fishing zones are similar to declines outside => region scale impact, not fishing
- if fish population declines inside no-fishing zones are less than declines outside => the difference is attributable to fishing
- Fishery scientists also agree that MPAs are needed as insurance when fishery management is inadequate, as appears the case for Jackass morwong, Orange Roughy, John Dory, Redfish, Blue Warehou, Stripey Trumpeter, etc.

“Reserves are only likely to be an effective strategy for fisheries management where effort is not or cannot be effectively controlled across the wider stock.”

Buxton, CD & Kearney, R (2014) *An assessment of the threats to marine biodiversity and their implications for the management of State and Commonwealth fisheries. Fisheries Research Development Corporation Project 2010/226 Final Report*. Institute for Marine and Antarctic Studies, Hobart, Australia. Available at http://frdc.com.au/research/Final_Reports/2010-226-DLD.pdf#page=44.

Australian Marine Parks

Most Marine Protected Areas are carefully placed to have little or no value for either science or stock insurance



- The Australian Marine Park network was specifically designed through three iterations to avoid any impact on oil exploration/production and fishing activity.
- However, if resource extraction is not affected then business continues as usual, and no environmental, science or economic benefits can be expected, only management costs.

See Devillers, R., et al. 2015. Reinventing residual reserves in the sea: are we favouring ease of establishment over need for protection? *Aquatic Cons.: Mar. Freshw. Ecosystems* 25, 480-504.

Example of biases in location: Temperate East Marine Parks Region

- Fishing and other anthropogenic threats are concentrated on the continental shelf and upper slope. Yet only 0.01% of this inshore region excludes all fishing (National Park zoning).
- The two small National Park zones in this inshore region (4 km² and 1 km²) both preceded the AMP network, to protect threatened grey nurse sharks.
- No useful scientific reference areas exist.



Current fisheries management may contravene the Fisheries Administration Act

Fisheries Administration Act 1991

No. 161, 1991

Includes amendments up to: Act No. 123, 2017

6 Objectives

- (1) The Authority, in the performance of its functions, must pursue the objectives of:
 - (a) implementing efficient and cost-effective fisheries management on behalf of the Commonwealth; and
 - (b) ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development (which include the exercise of the precautionary principle), in particular the need to have regard to the impact of fishing activities on non-target species and the long term sustainability of the marine environment; and

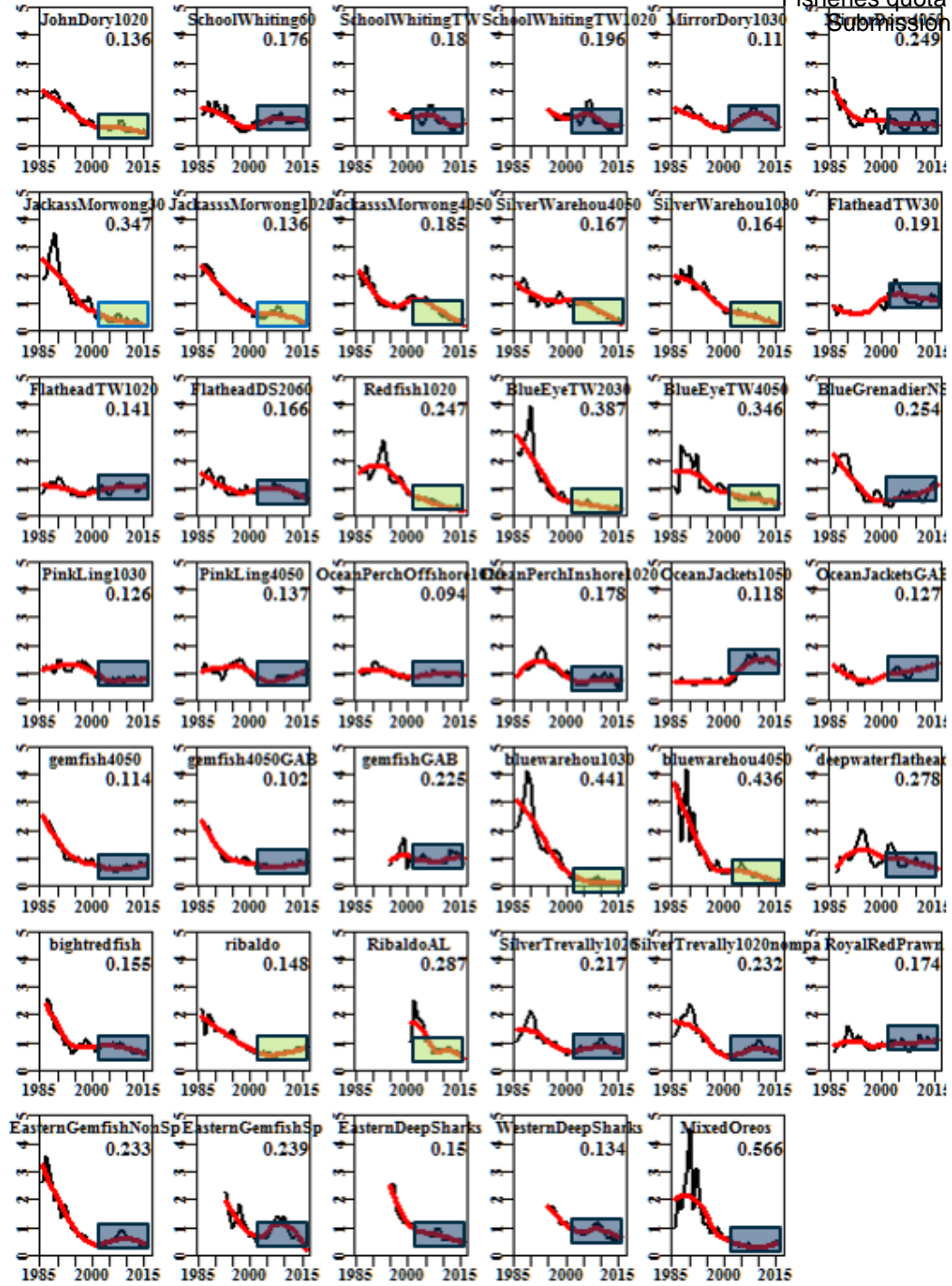
6A Principles of ecologically sustainable development

The following principles are *principles of ecologically sustainable development*:

- (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equity considerations;
- (b) if there are threats of serious or **irreversible** environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- (c) the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;
- (e) improved valuation, pricing and incentive mechanisms should be promoted.

“it is unlikely the stock [jackass morwong] will ever recover to the target reference point”

Southern and Eastern Scalefish and Shark Fishery Resource Assessment Group (SESSFRAG) Chairs’ Meeting 2022
Meeting minutes 27-29 April 2022 www.afma.gov.au/sites/default/files/sessfrag_minutes-april22.pdf



AFMA record with SESSF

- a decline to 48% of initial stock biomass is the target to maximise return to fishers and the public

Figure 100. CPUE standardisation by Haddon (in prep) with trend since 2000 highlighted by boxes (yellow signify species previously highlighted for concern)

Knuckey et al (2018). Understanding factors influencing under-caught TACs, declining catch rates and failure to recover for many quota species in the SESSF. FRDC Project No 2016/146. Fishwell Consulting, 2018. [CC BY 3.0] 164pp.