PZJA Torres Strait Finfish Fishery Resource Assessment Group

FFRAG Meeting 10

18-19 November 2021
Double Tree Hilton Hotel, Cairns

DRAFT Meeting Record

Note all meeting papers and records are available on the PZJA webpage:

https://www.pzja.gov.au/torres-strait-finfish-groups

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Australian Fisheries Management Authority

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1 Preliminaries

1. The tenth meeting of the PZJA Torres Strait Finfish Fishery Resource Assessment Group (FFRAG) commenced at 0855 hrs. FFRAG Chairperson, Mr David Brewer, welcomed participants and acknowledged the Traditional Owners of the various lands from which members were participating and paid respects the elders of the community past, present and emerging.
2. No apologies were received. Scientific member Ashley Williams, and QDAF member Ashley Lawson attended the meeting via video conference. Observers Dr Trevor Hutton and Quinten Hirakawa also attended via video conference.
3. The Chair reminded the RAG that the meeting would be recorded for the purpose of ensuring an accurate record. The Chair advised that the recording is kept secure and is deleted once the final meeting record is published. There were no objections to the meeting being recorded.

4. The Chair highlighted the obligation on members to participate in the meeting in a respectful and professional manner.

1.1 Adoption of Agenda

5. The agenda was adopted with two amendments (**Attachment A**):
    a) Traditional Inhabitant members requested a further discussion on the Western Line Closure. The RAG agreed to add the discussion after item 3 Stock assessments and RBC advice; and
    b) Item 3.2 Coral trout was bought forward ahead of item 3.1 Spanish mackerel to align with the availability of Dr Hutton.

1.2 Declarations of Interests

6. Consistent with the Protected Zone Joint Authority Fisheries Management Paper No. 1 (FMP 1), which guides the operation and administration of PZJA consultative forums, the RAG noted the requirement to declare all interests, perceived or real. Each member declared their interest in the fishery as documented in **Table 1** (below). In line with the AFMA standard for declaring potential conflicts of interest in Commonwealth MACs and RAGs to best protect the integrity of advice, members with grouped interests (industry, research, TSRA, AFMA) were sequentially asked to leave the room to allow the remaining RAG members to:
    - freely comment on the declared interests
    - agree if the interests precluded the members from participating in any discussions and
    - agree to any methods to treat the declared interest (e.g. the member provides preliminary input but leaves the room when any advice is formed).
7. The RAG noted that, in addition to the process under this item, it remained the obligation of all members to update their declarations throughout the meeting as required.

Research interests

8. Members with declared research interests left the room to enable free discussion of these interests (David Brewer, Rik Buckworth, Michael O'Neill, Ash Williams).
9. The RAG noted that FFRAG 10 aren't discussing specific research priorities or projects on day one of the meeting, however there may be a perception of conflict of interest when developing a harvest strategy project scheduled for day two of the meeting.
10. However, the RAG noted that there is value in having these members involved in discussion this research project.
11. It was noted that scientific members were appointed to the RAG in recognition of their scientific expertise relevant to the fishery. It was noted that any perceived conflict of interest would need to be managed on an ongoing basis throughout relevant deliberations.
12. The remaining members agreed that the scientific members should participate in all agenda items and advice being formed.
13. Members with research interests re-joined the RAG and were advised of the RAG consideration of their declared interests.

Industry members' interests

14. Members with declared fishing interests in the fishery left the room to enable free discussion of these interests (Tenny Elisala, Rocky Stephen, John Tabo Jr, Paul Lowatta, Maluwap Nona, Tony Vass, Yen Loban and Mark Anderson).
15. The RAG noted a perceived conflict of interest when recommending TACs. It was raised that the 'competitive TAC' system means there is reduced likelihood of one operation benefit over another from a TAC decision.
16. The RAG also noted the TSRA's link to leasing arrangements also a perceived conflict of interest.
17. It was noted though that the members were engaged in the meeting to provide industry expertise and knowledge within their cluster nations. This expertise and knowledge were critical to the meeting provided industry members acted in the interest of the fishery as a whole.
18. The remaining members agreed that the industry members should participate in all agenda items and advice being formed. The industry members re-joined the meeting and were advised of the RAG consideration of their interests.

Government agencies interests

19. Members with interests related to the business of the TSRA, AFMA, and QDAF left the meeting (Mark Anderson, Tenny Elisala, Rocky Stephen, Kenny Bedford, John Tabo, Keith Brighman, Yen Loban, Chris Boon, Selina Stoute, Ash Lawson).
20. The remaining RAG members discussed the declared interests of the members and participants that had left the room. It was noted that the TSRA had declared their holdings of Sunset licences and revenue generated from leasing these entitlements for the benefit of Traditional Inhabitants.
21. Consistent with advice from earlier RAGs, it was noted that it is important to maintain an awareness of this potential perceived conflict and ensure members acted in the interest of the fishery. The members agreed that TSRA views were important in forming advice to the PZJA.
22. The members noted AFMAs interest in the fishery was managing for sustainable fishing.
23. AFMA and TSRA members re-joined the meeting and were advised of the members' consideration of their declared interests. The RAG agreed that TSRA, AFMA, and QDAF members should participate in all agenda items and advice being formed.

Table 1. Attendance and declarations of interest – Finfish RAG 10 meeting members.

Name	Position	Declaration of interest
Members		
David Brewer	Chair	• Director – Upwelling P/L (David Brewer Consulting). • Honorary Fellow - CSIRO • Chair - Torres Strait Finfish RAG • Scientific member – Torres Strait Finfish Working Group • Scientific member – Northern Prawn Fishery RAG • Current consultancies with Quandamooka Yoolooburrabee Aboriginal Corporation, Newcrest Mining Ltd. • Ex co-investigator on the completed Torres Strait 'Non-commercial catch' project. • As a fisheries consultant, may apply for funds for Torres Strait fishery research projects in the future where consistent with his role as Chair.
Rocky Stephen	Industry member	• Councillor for Ugar. • Chairperson of Kos and Abob Fisheries Ugar. • Works with brother in a commercial fishing business on Ugar (Brother Bear Fisheries). • Eastern cluster representative on the PZJA Finfish RAG & Working Group. • Traditional inhabitant member - Torres Strait Scientific Advisory Committee. • TSRA Board member for Ugar TSRA Finfish Quota Management Committee. • TSRA Board Fisheries Advisory Committee member. • Member of Zenadth Kes Fisheries company.
John Tabo Jr	Industry member	• Commercial coral trout fisher (TIB). • Holds a Torres Strait Traditional Inhabitant Boat Licence. • Member of the Torres Strait Regional Authority Finfish Quota Management Committee. • Member of the Zenadth Kes Fisheries company.
Tenny Elisala.	Industry member	• TSRA Ranger Dauan, TIB licence holder, PBC director.
Paul Lowatta	Industry Member	• TIB industry member, Finfish RAG, PBC director
Kenny Bedford	Industry Member	• DML Consultancy - Partner Consultant • Indigenous Initiatives & Innovation - Partner Director • Zenadth Kes Fisheries Pty Ltd - Director • Meriba Ged Ngalpun Mab - Director • My Pathway - Director • Erubam le Land & Sea Council - Member • Erub Fisheries Management Association - Member
Tony Vass	Industry Member	• No financial interests in the Torres Strait. • Former mackerel fisher in Torres Strait 1990 to 2008, does not own or operate a licence in Torres Strait.
Michael O'Neill	Scientific Member	• Principal fisheries scientist working with the Queensland Government (Department of Agriculture and Fisheries, Fisheries Queensland) in the stock assessment program. • Principal scientist for TSSAC three-year project for Spanish mackerel stock assessment work.

Name	Position	Declaration of interest
		• Member of PZJA Finfish RAG and Working Group.
Selina Stoute	AFMA Member	• Employed by AFMA, no pecuniary interests or otherwise
Chris Boon	RAG Executive Officer - AFMA	• Employed by AFMA, no pecuniary interests or otherwise
Mark Anderson	Torres Strait Regional Authority (TSRA) Member	• Employed by TSRA. • Program manager for economic development fisheries and infrastructure. • No pecuniary interests as an individual - TSRA holds fishing licences on behalf of Traditional Inhabitants.
Ashley Williams	Scientific Member	• CSIRO Scientist. • Involved in previous Torres Strait research. • Project leader for 'Close-kin mark-recapture design' (CKMR) project
Rik Buckworth	Scientific Member	• Independent Fisheries Scientist with Sea Sense Consultancy. • Adjunct professor at Charles Darwin University • Ex-NT Fisheries • Ex-CSIRO Scientist. • Current CSIRO honorary fellow. • AFMA Northern Prawn RAG. • Project member for TS 'Spanish mackerel stock assessment' project. • Team member of 'Close-kin mark-recapture design' project. • Chair of Northern Territory Aquaculture Management Advisory Committee.
Ash Lawson	QDAF member	• Manager of the east coast Spanish mackerel, charter, and deep-water line fisheries. • Currently transitioning into managing the east coast inshore finfish fishery.
Permanent Observers		
Maluwap Nona	Malu Lamar	• TIB licence Holder. Has plans to start fishing in the Finfish Fishery next week. • Malu Lamar representative for the meeting. • Chair of 2 PBCs (Badu Ar Mua Migi Lagal & Maluilgal).
Casual Observers		
Quinten Hirakawa	TSRA officer	• TSRA project officer. • TIB licence holder with mackerel, line, cray, and BDM endorsements. • Commercial TRL fisher background. • 25 years working with Queensland Boating and Fisheries Patrol (QDAF). • Recent employment with TSRA Ranger Program and now with the TSRA Fisheries Team.

Name	Position	Declaration of interest
		• Co-investigator on behalf of TSRA for the current 'Spanish mackerel and coral trout biological sampling' project.
Yen Loban	TSRA fisheries portfolio member	• TIB licence holder. • Board director of the Zenadth Kes Fisheries Company. • Chair of the TSRA Board Fisheries Advisory Committee.
Trevor Hutton*	CSIRO	• Member of the PZJA Finfish Working Group. • Project team member for past 'FF harvest strategy' project. • May have interest in future Torres Strait Fisheries Research.
Aaron Tom	Industry	• TIB licence holder from Gudmalulgal nation. Interest is Western Line Closure.
Keith Brightman	TSRA officer	• TSRA project manager • Nil personal pecuniary interest in the fishery.

* attended day one until 1500 and day two from 1100 to 1200.

1.3 Review of Action Items from Previous RAGs

24. The RAG noted an update from the RAG Executive Officer on status of actions as detailed in the agenda paper. AFMA also reported on two items:

    a) FFRAG 9, Action 1 AFMA to present a summary of CDR catch and effort reporting for the TIB sector at FFRFAG. AFMA provided a summary which was included in the AFMA update under Agenda Item 2.2.

    b) FFRAG 7, Action 2 AFMA to request access to the logbooks of Mr Snowy Whitaker, *AFV Trader Horn* from the Townsville Maritime museum where they are reportedly catalogued. AFMA was advised by the museum that they do not hold those records.

25. The RAG agreed for Dr Rik Buckworth to contact Geoff McPherson to confirm if he has copies of Mr Whitaker's logbooks for the *AFV Trader Horn* and if not, whether he knows where copies might be stored (**Action 1**).

1.4 Out of Session Correspondence

26. The RAG noted the out-of-session correspondence since the last RAG meeting (FFRAG 9, 14-15 October 2021) as detailed in the agenda paper.

2 RAG Updates

2.1 Industry and Scientific Updates

27. Industry members provided the following updates to the RAG on developments within the Torres Strait Finfish Fishery since the last RAG meeting (meeting 9, 14-15 October 2021):

    a) The good weather has arrived and, as expected, a lot more Traditional fishing is being undertaken (now until around March is the peak effort for Traditional fishing);

    b) At Mer there are more boats fishing for coral trout (around 5) and only 1 boat fishing for Spanish mackerel;

c) TSRA were at Erub last week and fishers reported that on 3 days out of 5, fishers will take around 30 coral trout per day. Two new freezers are being set-up at Erub. There is concern amongst Erub fishers that the number of fish being sent out from Erub is not matching reported landings. They are concerned that the discrepancy is underreporting.

28. The RAG noted that the Scientific members had no further updates from those that were provided at FFRAG 9.

2.2 Government Agencies Update

29. The RAG noted AFMA updates as detailed in the agenda paper. The RAG considered in detail, two of the updates:

    a) Shark management measures. The RAG noted that in line with the fisheries Wildlife Trade Operation conditions, it will be a priority for the RAG to review shark management measures in the Fishery next year. The RAG noted that arrangements in the Fishery are mostly consistent with Commonwealth best practice and that a future review would be informed by an Ecological Risk Assessment of the Fishery which is also scheduled to be undertaken in 2022; and

    b) AFMA's summary of CDR data covering TIB reporting rates of fishing effort details. The RAG welcomed the reporting rates showing that there is a very high completion rate for the voluntary effort fields on the Catch Disposal Record (CDR) form (refer to Table 1 of the agenda paper). Industry members requested a further breakdown of the TIB CDR data by community. Industry members were specifically interested to understand the level of take being landed at Erub due to industry concerns that some catches are not being recorded through the Fish Receiver System. **Action 2:** AFMA to provide a summary of TIB CDR reporting by community.

30. The RAG also noted advice from AFMA that the pre-recorded presentation by Dr Leo Dutra shown at the RAG's previous meeting (meeting 9) on the outcomes of the project: *Scoping a future project to address impacts from climate variability and change on key Torres Strait Fisheries* will be made available to members on a restricted YouTube channel for a two week period. AFMA will advised members when available.

31. The RAG noted that TSRA and QDAF had no further updates from those that were provided at RAG 9.

2.3 Papua New Guinea National Fisheries Authority Update

32. The RAG noted that PNG NFA were unable to attend the meeting and that reports for the most recent Traditional Inhabitant Meeting and Joint Advisory Committee meetings were provided in the agenda paper. No further update on PNG Fisheries was provided.

2.4 Native Title Update

33. The FFRAG noted that Maluwap Nona as representative of Malu Lamar had no further native title updates from those that were provided at FFRAG 9.

3 Stock Assessment and RBC Advice

3.1 Spanish Mackerel Stock Assessment

34. The FFRAG reviewed the results of the updated Spanish mackerel stock assessment and Recommended Biological Catch (RBC) estimates as presented by FFRAG Science Members Dr Michael O'Neill and Dr Rik Buckworth under the funded project "*Torres Strait Spanish mackerel stock assessment*" (project number 200815) (**Attachment B**). Dr O'Neill also acknowledged the contribution of Dr Jo Langstreth on the project.

35. As well as presenting the outcome of the stock assessment and RBC calculations, the Project Team presented outcomes of the sensitivity analyses requested by the RAG (meeting 9) and initial comparative analysis of results from the current custom stock assessment model and Stock Synthesis software.

The stock assessment (including sensitivities)

36. In relation to the core stock assessment analysis the RAG noted:

    a) that the stock assessment was based on the same annual age structured model as the 2020 assessment, which uses all available harvest, catch rate data and fish age-frequency data (referred to as the 1940 custom model). The update to this model included an additional year of fish harvest and age-frequency data (fishing year 2020-21);

    b) that treatments to all data inputs into the assessment were the same as those for 2020 (as recommended by the RAG at its meeting on 14-15 October 2021, meeting 9). This includes reconstructing a catch history for the fishery prior to 1989, including harvests for Illegal, Unreported and Unregulated foreign fishing (IUU), treating standardised catch rates (tender data to be excluded, fishing power to be included) and advice on using all available fish age-frequency data as inputs; and

    c) in line with FFRAG recommendations, six specific agreed model analyses were performed (summary table at **Attachment C**). The alternative exploratory '1989 custom model' considered in 2020-21 was not applied (considered by the RAG at its 8th meeting on 4-5 November 2020).

37. In relation to the additional sensitivity analysis requested by the RAG (meeting 9) the RAG noted the following:
    a) Although there is no evidence at this time to indicate that the stock has a higher reproductive resilience than what has been estimated by the model previously (i.e steepness (h)~0.4), the RAG recommended the Project Team run a sensitivity analysis with higher steepness values.
        i. A sensitivity analysis was run using the parameter values from model analysis 2 but with fixed steepness values of 0.6 and 0.7 (see analysis 7-10 in **Table 1**). To achieve model convergence, it was necessary to fix natural mortality at a higher level (e.g. M=0.5) than used in the six core analyses (M=0.3 - 0.4). The model did not fit well to the catch rate index, but fitted slightly better to the age data (**Figure 1**). The RAG noted advice from the Project Team that they intend to undertake a literature review to assist future examination of steepness options;

b) it is possible to include annual TIB catch rates and the early McPherson catch rate data (McPherson., G (1986)) into the assessment. Model analysis 2 was shown to fit well to the additional data (analysis 11-13 in **Table 1**). The RAG noted that TIB catch rate data is currently not influential in the model due to the relatively small number of years of data.

38. Having considered the sensitivity analysis, the RAG agreed to rely on the six core analyses at this time but **recommended** that the TIB catch rate data and early McPherson catch data be further tested in the next stock assessment.

Table 1: Summary of data inputs for the 6 key analyses and 7 sensitivity analyses from the 2021 Torres Strait Spanish mackerel stock assessment.

Analysis	Catch Rate	Mortality Rate	Models of historical catch estimates 1940-1988	Age	Start Year	Fix Steepness	Catch Rate TIB	Catch Rate Old
1	4	0.3	Historic catches (actual) + **polynomial** model + IUU tapered	0	1940	0	0	0
2	4	0.35	Historic catches (actual) + **polynomial** model + IUU tapered	0	1940	0	0	0
3	4	0.4	Historic catches (actual) + **polynomial** model + IUU tapered	0	1940	0	0	0
4	4	0.3	Historic catches (actual) + **logistic** model + IUU tapered	0	1940	0	0	0
5	4	0.35	Historic catches (actual) + **logistic** model + IUU tapered	0	1940	0	0	0
6	4	0.4	Historic catches (actual) + **logistic** model + IUU tapered	0	1940	0	0	0
7	4	0.35	Historic catches (actual) + **polynomial** model + IUU tapered	0	1940	0.6	0	0
8	4	0.35	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0.7	0	0
9	4	0.5	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0.7	0	0
10	4	0.7	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0.7	0	0
11	4	0.35	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0	1	0
12	4	0.35	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0	0	1
13	4	0.35	Historic catches actual + **polynomial** model + IUU tapered	0	1940	0	1	1

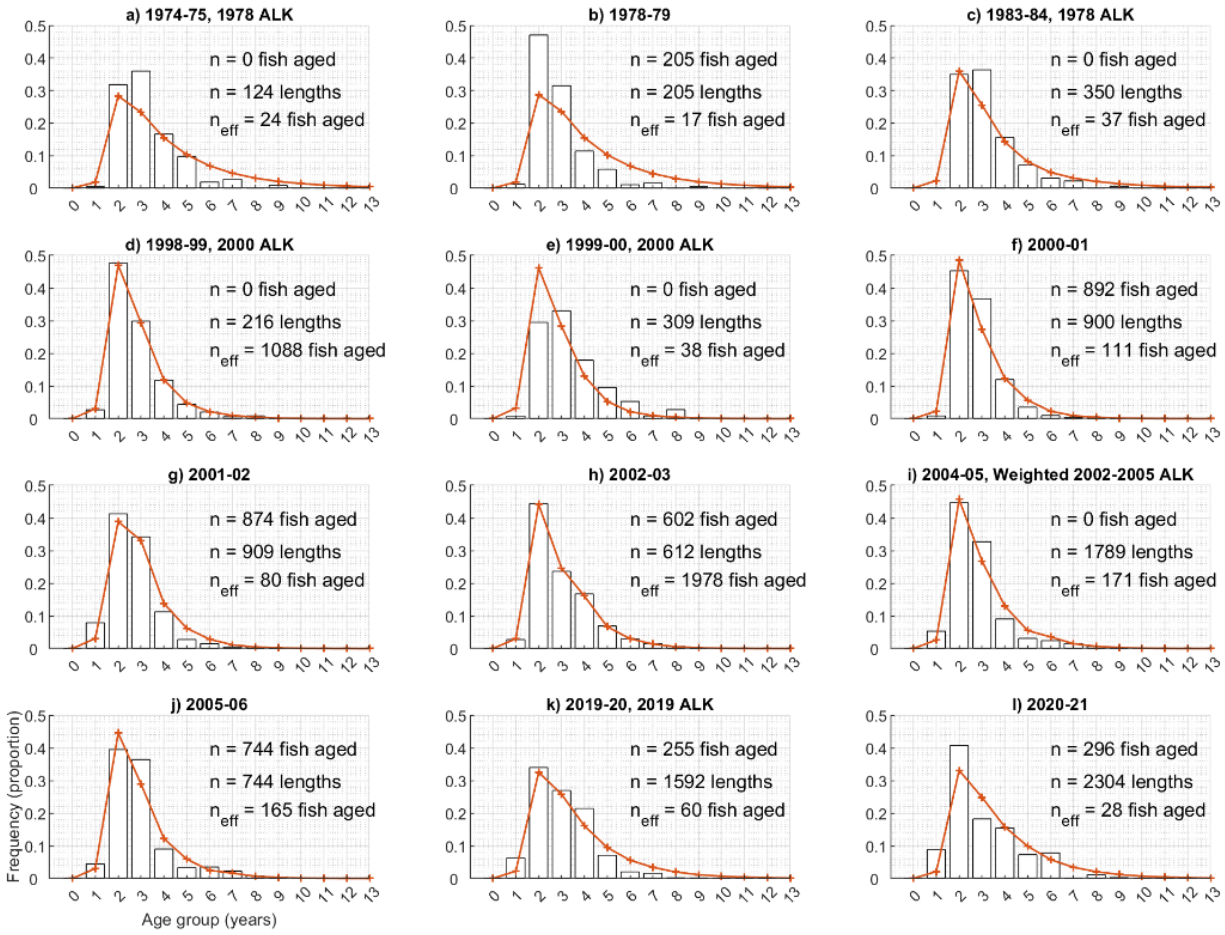


Figure 1: Model results from *sensitivity analysis number 7* from the 2021 Torres Strait Spanish mackerel stock assessment. Predicted age frequencies are plotted (in red) over the observed age data from biological sampling.

The stock assessment results

39. Based on the six agreed model runs, the RAG noted that the results of the updated 2021 stock assessment show:

    a) The estimated median spawning biomass of Torres Strait Spanish mackerel across all six model scenarios for 2020-21 was 29% (B_{29}), which is similar to the estimated level of 30% (B_{30}) in 2019-20. The estimates from each of the six analyses ranged between 25% (B_{25}) and 34% (B_{34}), of unfished biomass in 1940 (B_0);

    b) The standardised average catch rate (number of fish harvested per operation day) of legal-sized Spanish mackerel in 2020-21, using logbook data from Sunset fishing operations, was similar to 2019-20.

        i. The RAG noted that whilst the two goodness of fit tests for the model were acceptable (i.e. model fits to the standardised catch rate and age data), the standardised catch rate predicted for the 2019-20 year was slightly lower than the fitted value from last year's stock assessment for 2019-20 (**Figure 2**). This was attributed to a shift in recruitment deviations (**Figure 3**) to account for the lower than expected standardised catch rate in 2020-21.

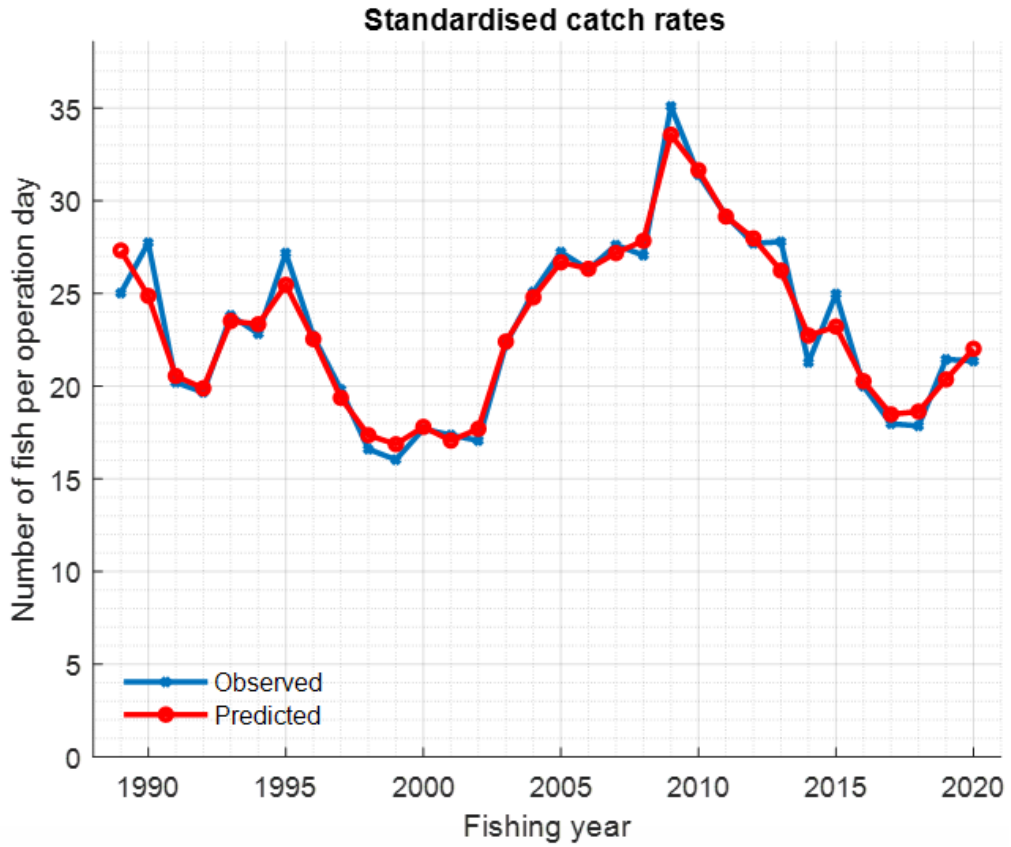


Figure 2. Standardised catch rates for Torres Strait Spanish mackerel (sunset sector data) as observed from reported CPUE data, and as predicted by the 'custom' stock assessment model.

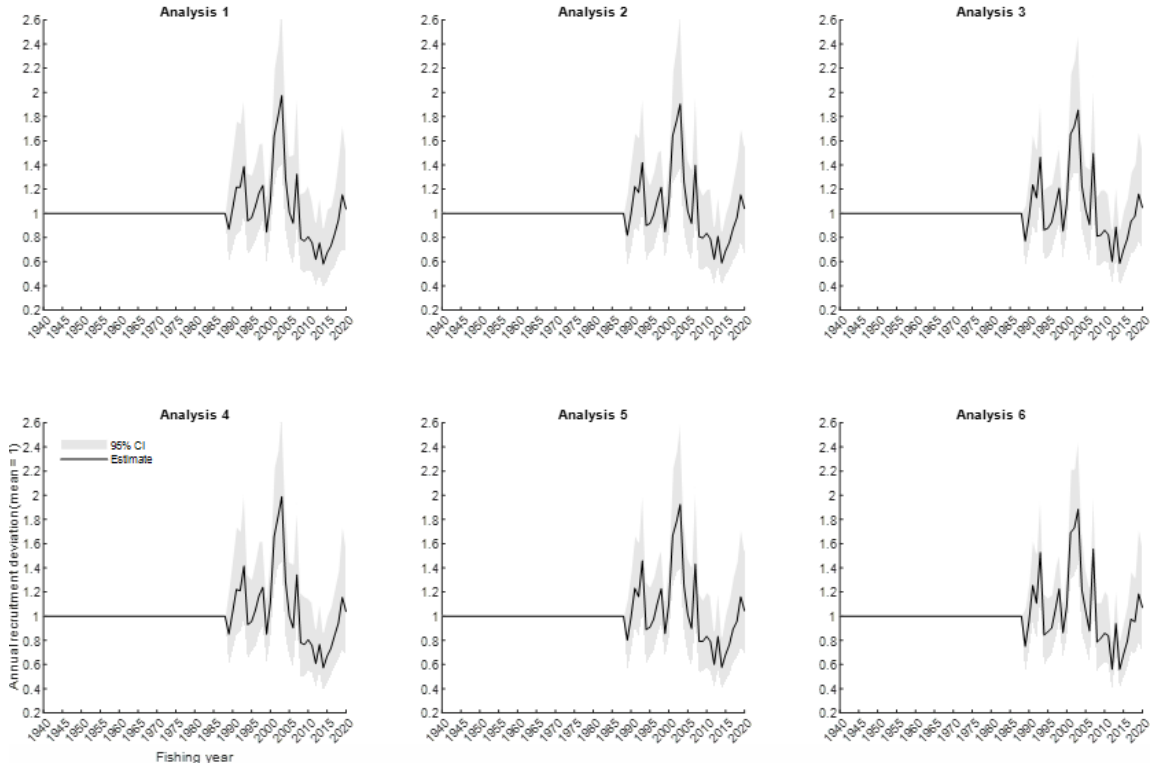


Figure 3. Recruitment deviations as predicted by the 6 key analyses from the 2021 Torres Strait Spanish mackerel stock assessment.

Selecting an appropriate RBC calculation method

40. The RAG agreed to apply the same methodology from 2020 to guide advice on an RBC for the 2022-23 fishing season. Whilst a final harvest strategy is yet to be agreed for the Torres Strait Finfish Fishery, a consistent approach has been applied over recent seasons. This approach is consistent with progress made to date on developing a preferred harvest strategy for the fishery.

41. Consistent with 2020, the FFRAG:

    a) agreed to forecast the stock biomass to the 2022-23 fishing season based on an assumed level of total harvest in 2021-22 (74 t = 50 t sunset, 4 t TIB harvest (based on the mean of the past three TIB fishing seasons), 15 t subsistence, 5 t recreational and 0 t for charter and PNG catches) and assuming average recruitment occurring;

    b) considered five different constant harvest rates applied to the results of the six model runs. Each level of harvest rate related to building the stock to different target reference points (F_{MSY} through to F_{60}). Unlike 2020, the RAG did not request, or need, additional projections for the mean RBC between F_{48} and F_{60};

    c) reviewed fish population projections to evaluate risk to the stock. Consistent with the 2019 and 2020 approach used by the FFRAG, it was agreed to consider how many years in a model projection the stock would drop below the limit reference point (B_{20} or 20% of the unfished spawning biomass level in 1940) during a 12 year-time period (three times the age of full sexual maturity)[1] assuming average recruitment and the constant catch (RBC) related to building the stock to the different target reference points. The FFRAG agreed, in line with the *Commonwealth Harvest Strategy Policy,* that if more than 10% of model runs (based on over 1000 simulations) dropped the stock below $B_{LIM,}$ this would represent unacceptable risk to the stock;

    d) agreed B_{48} continued to be a sensible interim target reference point, noting that B_{48} is the default proxy for B_{MEY} when no economic data are available (under the *Commonwealth Harvest Strategy Policy)*. B_{MEY} measures the biomass of fish to yield the sustainable maximum-economic-yield (MEY) from the stock. B_{MEY} also relates to the long-term aspirational target reference point of B_{60} recommended by industry under the harvest strategy work completed to date; and

    e) reviewed the fish population projections to evaluate the likelihood of the biomass reaching the reference point of B_{48} after 12 years. When applying a constant catch (RBC) of 95 tonnes per year, three of the six model runs build the stock spawning biomass close to B_{48} in 12 years (**Figure 4**).

42. Although not used in the RBC calculation, the RAG also considered projection results for a reduced number of simulations. Referred to as the 'feasible simulations'. The feasible simulations excluded around 50 simulations (or around 5% of all simulations) that were considered unrealistic for the historical period 1940-2020. These simulations were found to near crash the population (having predicted unrealistically high levels of fishing mortality and unreasonably low stock biomass). The RAG agreed that further exploratory work is required to understand the possible drivers of the unfeasible runs (for example do they arise from certain parameter estimates drawn from the covariance matrix) and options to objectively exclude runs in the future to avoid inadvertently adding bias to the risk results (see paragraph 41(c) above). For example, the analysis of risk could be biased if only pessimistic simulations were excluded without excluding similarly extreme but overly optimistic simulations.

[1] The FFRAG reviewed and agreed to the rationale of the 12-year timeframe being three times the full age of maturity i.e., based on age-length information by four years of age most fish are fully mature and contributing to the stock.

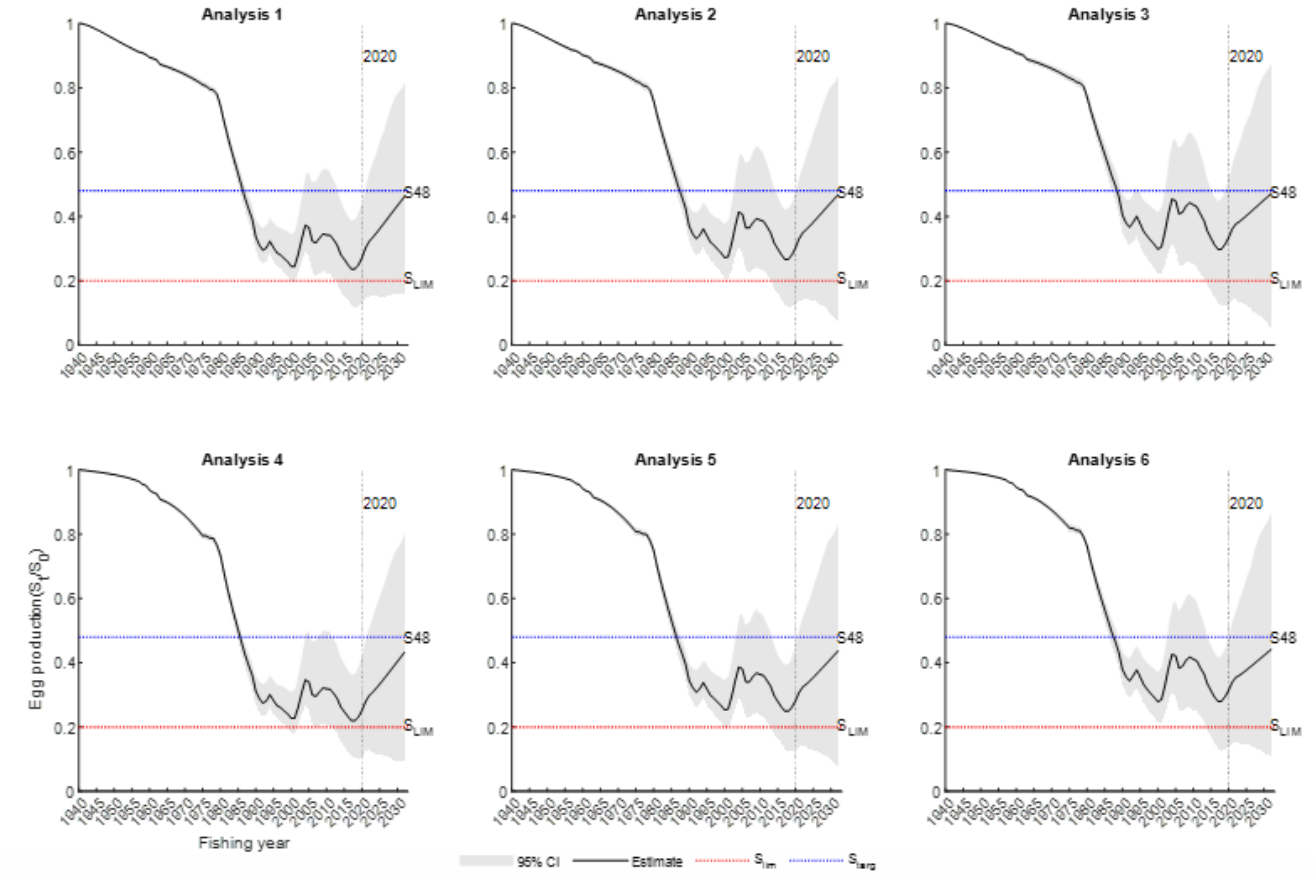


Figure 4. Predicted spawning biomass over 12 years, assuming average recruitment and a constant RBC of 95 tonnes, as predicted by the 6 key analyses from the 2021 Torres Strait Spanish mackerel stock assessment.

RBC advice

43. In line with the agreed RBC calculation method described above, the FFRAG **recommended** a 95 tonne RBC for Spanish mackerel for the 2022-23 season. The FFRAG agreed that this RBC:

    a) is based on the application of a constant harvest rate of F_{50} to the estimated biomass in the 2022-23 fishing season. The application of constant harvest rates of F_{48}, F_{40} and F_{MSY} represented an unacceptable risk to the stock as more than 10% of model runs (based on over 1000 simulations), dropped the stock below B_{LIM};

    b) poses an acceptable low risk of the stock falling below the limit reference point (less than 10% of model runs and simulations dropping the stock below 20% of unfished spawning stock biomass in 1940); and

    c) would build the stock on average close to the interim target reference point (for B_{48}) within a reasonable timeframe of 12 years (three times the age of sexual maturity) and assuming average recruitment to be occurring.

Comparative analysis between the custom stock model and Stock Synthesis software

44. The RAG noted that the Project Team had completed a comparison of results for a single model analysis (analysis 2) between the custom stock model and Stock Synthesis software. The Project Team aim to compare results for all of the six-core model analysis in 2022.

45. The comparison of the single model analysis showed that the custom stock model and Stock Synthesis software performed very similarly:

    a) Parameter estimation were very similar (**Table 2** below);
    b) Recruitment deviation patterns were very similar (**Figure 5** below);
    c) Stock Synthesis software fitted both the catch rate and age data well;

Table 2. Key parameter estimates from the 'custom' stock model and Stock Synthesis software as calculated in the 2021 Torres Strait Spanish mackerel stock assessment.

Key parameter	SS	Custom Model
SR_LN(R0)	11.7525	11.9
SR_BH_steep	0.473328	0.4
SR_sigmaR	0.292016	0.28
Age_inflection_Fleet(1)	1.71587	1.77
Age_95%width_Fleet(1)	0.696199	0.709

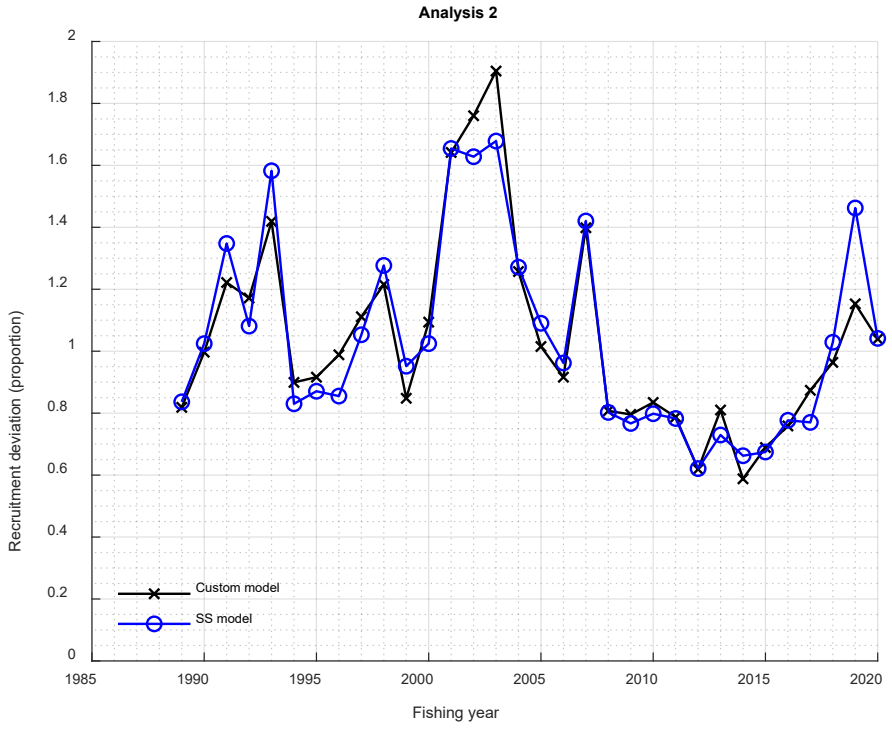


Figure 5. Recruitment deviations from the 'custom' stock model and Stock Synthesis software as calculated in the 2021 Torres Strait Spanish mackerel stock assessment (analysis 2).

46. Estimates of biomass were similar throughout the time series (**Figure 6),** and equivalent in 2020-21. However, it was unclear why the Stock Synthesis software estimates a drop in the spawning biomass at the start of the time series compared with estimated trend from the custom model. This result will be subject to further review by the Project Team.

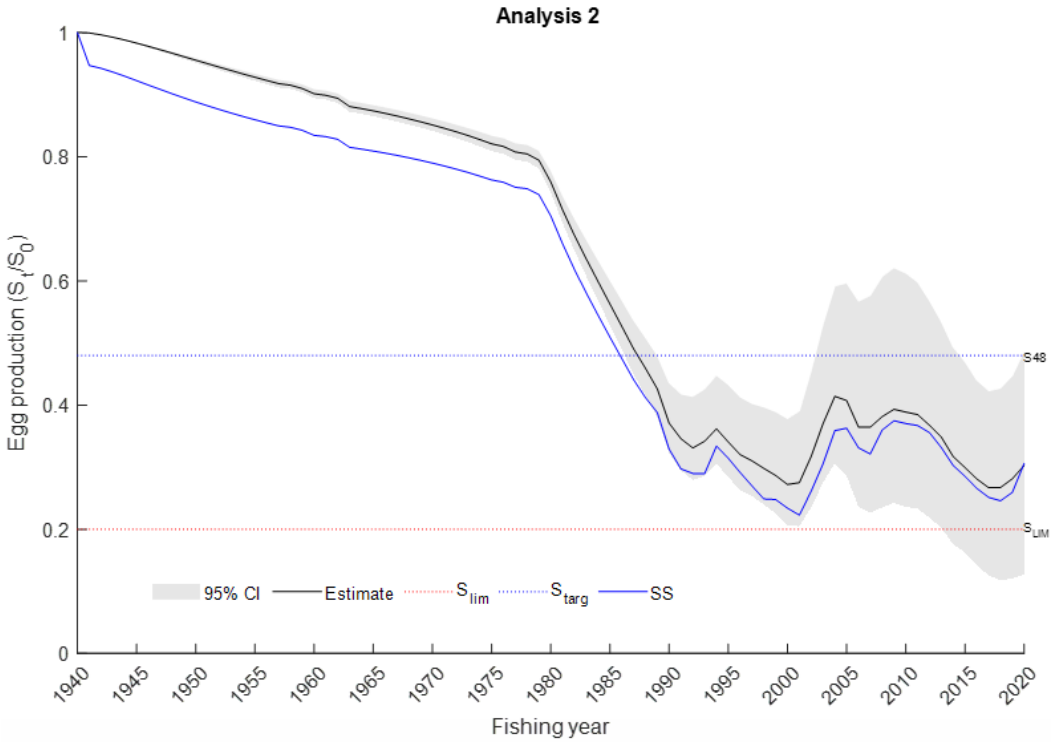


Figure 6. Spawning biomass estimates from the 'custom' stock model and Stock Synthesis software as calculated in the 2021 Torres Strait Spanish mackerel stock assessment (analysis 2).

3.2 Coral Trout

47. The RAG noted presentations by Dr Hutton on coral trout data from the 1995-1996 CSIRO fish dive survey in the Torres Strait and an updated Catch per Unit Effort (CPUE) data series (**Attachment D**). Dr Hutton acknowledged the previous stock assessment and CPUE standardisation work undertaken by Dr Matt Holden (UQ) and Dr George Leigh (QDAF) on coral trout as part of the now completed, harvest strategy project.

48. Dr Hutton also provided a brief overview of the preliminary stock assessment undertaken by Dr Leigh and Dr Holden for Torres Strait coral trout (combined species). The preliminary stock assessment was first presented to the RAG at its meeting on 13-14 March 2019, (meeting 4).

Summary of coral trout data in the 1995-1996 CSIRO fish dive survey in the Torres Strait

49. The RAG noted that the CSIRO study surveyed fish fauna off the edge of reefs in the Torres Strait using visual transects at 276 sites on 41 reefs between August 1995 and January 1996. Key findings were:

    a) relative observations across the four trout species (bar cheek, blue spot, common and passion fruit) are available for 1995 data only as only one species (*Plectropomus maculatus*, bar cheek trout) was observed in 1996;

    b) the 1995 data indicated *P. leopardus* (common trout) to the be the most commonly observed followed by *P. maculatus* (bar cheek trout);

    c) coral trout species (all four species) were only observed in the eastern/central sites. This result is unusual as the species are known to occur throughout the region; and

    d) the density estimate for the four trout species was 30.45 fish per hectare. This estimate is comparable to the density estimates calculated in the preliminary stock assessment undertaken by Dr Leigh and Dr Holden. The preliminary stock assessment estimated the densities of 32.73 fish per hectare in zone TS3 and 35.65 fish per ha in zone TS5.

50. The RAG noted that whilst it is reassuring that the density estimates from the survey and the preliminary assessment are comparable, a better understanding of the survey is recommended to understand why so many 'zero counts' were observed, especially at the sites on the western side of the Torres Straits.. This result is not intuitive. To gain a better understanding of the survey, the RAG agreed for Dr David Brewer to contact Brian Long, co-author of the '1995-1996 CSIRO fish dive survey' report (*Influences of coastal processes on large scale patterns in reef fish communities of Torres Strait, Australian*) to get further insight as to why coral trout were not observed at so many of the sites (zero counts) (**Action 3**).

CPUE time series (not standardised)

51. An additional three years (2018, 2019 and 2020) was added to the 'raw' or nominal'[2] CPUE time series for coral trout (note this includes all four species and is based on sunset catch data only) (**Figure 7**). The RAG noted:
    a) that compared to standardised CPUE time series (ending in 2017) the recent raw CPUE has a significant upward trend;
    b) advice from the scientific members that it was not possible using raw CPUE data alone, to discern whether the recent trend simply reflects variability between a small number of boats or actual stock abundance;
    c) given the likely high abundance of coral trout, it may be more difficult to detect smaller changes in abundance (e.g. a 10% change in abundance when the starting abundance is near virgin biomass ~ B_{80}); and
    d) that the standardised CPUE time series has a similar downward trend to Spanish mackerel from around 2009.

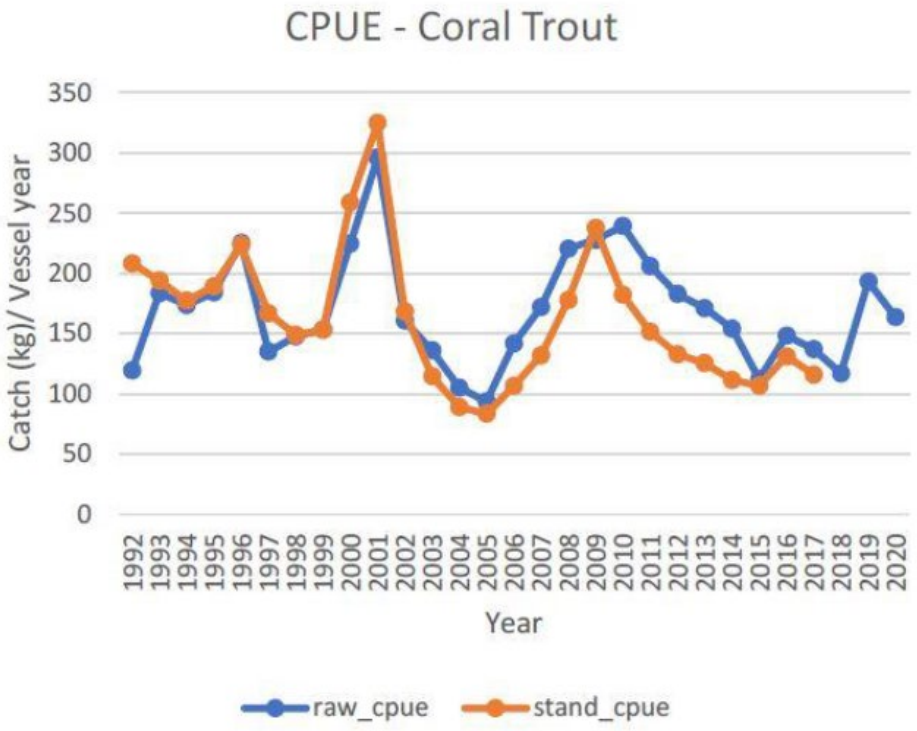


Figure 7. CPUE (not standardised) data 1992-2020, and standardised CPUE data from 1992-2017 for coral trout in the Torres Strait Finfish Fishery.

[2] Otherwise referred to as the 'observed' CPUE time series. This means the CPUE time series is based on reported catch information only. There has been no treatment (known as standardisation) of the data to account for factors that might impact the relationship between catch rate and abundance. Standardised CPUE is used as an indicator of stock abundance.

52. Reflecting on work undertaken during the harvest strategy project, the RAG noted that one option proposed was to monitor total catch and standardised CPUE trends annually and look for a sudden increase in total catch or decrease in CPUE below a certain level. If this occurred, then a stock assessment would be required. Two triggers identified were:

    a) catches from TIB + Sunset sector exceeding 90 t (being two thirds of the constant catch TAC of 134.9 t); and

    b) if the standardised catch rate per day drops below 90.6 kg per primary vessel day. The catch rate associated with B_{80} was determined to be 120 kg per day based on an average from 2012-2017. It was recommended that if catch rates falls below 90 kg per day (as a proxy for B_{60}) it would trigger an assessment.

53. Recent catches of coral trout have remained well under 90t with reported catches for the 2020-21 fishing season being 18.9 t (seasonal catches since 2014-15 are provided in the agenda paper, see paragraph 10).

54. The RAG noted advice from the scientific members that it was unlikely that standardisation of the recent CPUE data, even if there was a boat or spatial effect occurring, would bring the time series down to the stock assessment trigger level of 90kg per day. This is because it is unlikely that there has been significant depletion of the stock and catches remain relatively low.

Effects of live fishing

55. Industry members sought advice on the risks of fishing for live coral trout. This advice was sought in response to concern from one industry member about live boats re-entering the fishery. The industry concern with live fishing was that operators tend to fish harder on areas and cause localised depletion.

56. The RAG noted advice from the Scientific Member, Ashley Williams, that coral trout are not known to move large distances once settled onto a reef. Instead animals remain on their home reef. The main linkage of animals between reefs occurs through larval dispersal. The Scientific member further advised that a large-scale study on the live-reef fish industry (based on scientific observers) in the Great Barrier Reef did not find evidence of the industry concerns.

57. **Action 4:** Ashley Williams to circulate the following report *The Effects of Line Fishing on the Great Barrier Reef and Evaluations of Alternative Potential management Strategies* to the RAG.

RBC advice

58. Having considered recent catch data, previous assessments, outcomes the 1995-1996 CSIRO dive survey and the updated CPUE data series (non-standardised), the FFRAG **recommended** no change to the notional TAC of 135 t for Coral trout for the 2022-23 season. The FFRAG agreed that whilst there is no new data to scientifically guide a change to the TAC, based on all lines of evidence it is highly unlikely that the stock is at risk from fishing:

    a) Fishing levels remain low in the Fishery. The total reported catch for 2020-21 fishing season is 18.9 t;

    b) Outcomes of the 2006 Management Strategy Evaluation (MSE) analysis and the 2019 preliminary stock assessment both predict the current biomass to be high relative to virgin biomass:

        - *MSE:* Four constant catch scenarios of 80, 110, 140 and 170 tonnes were tested which all achieved a biomass for the fishery of at least 60 per cent of virgin total biomass by 2025 (B_{60}). The biomass in 2004 was estimated to be more than 60 per cent of unfished levels (Williams et al. 2011, 2007).

Commercial catch in recent years has been below historical catch levels and well below the lowest catch level simulated in the MSE (80 t per year).

- *preliminary stock assessment:* This assessment found the coral trout stock to be around 80 per cent of virgin biomass (B_{80}). All of the model estimates of current spawning biomass were above 65 per cent estimated virgin biomass (B_{65}).

c) Although there is some uncertainty with the 1995/96 CSIRO dive survey, the density estimates provide a level of validation of the density estimates derived from the preliminary stock assessment; and

d) It is unlikely that standardisation of the recent CPUE data even if there was a boat or spatial effect occurring, would bring the time series down to the stock assessment trigger level of 90kg per day considered under the harvest strategy work completed to date for the fishery.

59. The RAG agreed that although the Fishery remains relatively under fished, it **recommends** that work continue to collect information needed to inform future assessments and to develop control rules for the fishery. Doing this now will assist in effectively managing the expansion of the fishery. Priorities remain:
    a) improving TIB catch data (location and species split reporting)
    b) collecting length and age data (noting the current biological program is also providing information on catch composition for species split information); and
    c) development of a harvest strategy.

Western Line Closure

60. The RAG noted advice from industry members that stakeholders are frustrated with the seeming lack of progress towards opening the Western Line Closure. The RAG noted these frustrations were most recently delivered at the TSRA Board meeting held two weeks ago. Accordingly industry members sought clarification of the work plan considered at the RAG's previous meeting (meeting 9) and advised of their initiative to travel to Gudamalulgal communities between 6 and 10 December 2021 with the support of the TSRA and Malu Lamar. The purpose of the trips being to 'communicate' that there is Traditional Owner agreement to support the opening (noting the support of a TRL Industry meeting in July 2021), as well as discussing the scientific considerations and 'data needs' to ensure a responsible opening of the fishery (as identified at previous FFRAG meetings).

61. The RAG recalled that the recommended plan to consult with Gudamalulgal communities was not focused on whether to open the fishery or not, but on developing the conditions or arrangements of the opening. The RAG agreed with the recommendations from an industry member to edit the draft meeting record to more accurately reflect this intention. The agreed amendments are to replace wording of '*community consultations'* with '*community communication'* and '*proposed re-opening'* to '*recommended re-opening'*.

62. The RAG noted that the timeline agreed to at FFRAG 9, scheduled community visits to take place in March 2022. This timeline was developed at the time by AFMA and industry members previously identified to undertake the visits (AFMA and Traditional Inhabitant members).

63. Industry members recommended that the western line opening be tabled for approval by the PZJA as soon as possible. AFMA advised that as part of any recommendation to the PZJA to change the closure, it is necessary to provide the PZJA with advice on likely risks (and benefits) and corresponding management strategies to address those risks. The key purpose of the meetings proposed with Gudamalulgal communities is to engage those communities directly in the identification, consideration and management of potential risk to fish stocks in the opening area.

64. The Chair asked the RAG scientific members whether there are any issues from a scientific assessment perspective which need to be addressed before the opening. The Scientific members reiterated previous advice that key to having an accurate understanding risk is knowing the likely species to be targeted, the level of fishing effort expected and the size and

productivity of the resources to be targeted. Noting previous industry advice that it is expected that the fishing effort will be limited at least in the short term, the scientific members reiterated their advice that an adaptive management approach may be appropriate. That is to:

a) allow fishing on the expectation effort will initially be limited to a small number of TIB fishers;

b) collect and monitor accurate catch information to learn more about target species and effort (what species, where is fishing being conducted and when). Trends in this data (eg CPUE) can then be assessed. Collecting comprehensive CDR data as soon as the fishery opens is vital, as this will ensure that any potential 'new' species are recorded accurately. This is particularly important for vulnerable species such as black jewfish;

c) implement additional biological monitoring as soon as possible (length and age). Collecting this information early in the development of new fisheries provides invaluable data for future assessments; specifically to understand the productivity of the stocks;

d) assess the need for a fishery independent survey once more is known about the likely nature and extent of the fishery; and

e) develop a harvest strategy to guide management of the developing fishery. As more is known about the likely nature and extend of the fishery, additional management measures may be required to ensure the sustainability of fishing into the future.

65. The RAG noted that meetings with Gudamalulgal communities should aim to:

a) identify the aspirations of the community for a commercial reef line fishery. What species do the community want to target, where, when and how many fishers are likely to participate. Do communities have an idea of how much they might be able to take (eg tonnage);

b) what impact/interaction, if any, do communities expect between Traditional fishing (kai kai) and a future commercial fishery for finfish in their waters? Is this a concern for communities and do communities have plans on how these concerns could be managed;

c) raise awareness and seek community views on any species-specific concerns/considerations they may have, noting black jewfish is known to be vulnerable to overfishing;

d) raise awareness and seek commitment from communities to accurately report catches through the fish receiver system. Noting possible 'new' species not yet caught in the TS Finfish Fishery could have different common names in different areas. It is also recommended to discuss naming conventions with communities. A species identification and labelling sheet could be developed to assist fishers with consistent species reporting, including in Creole;

e) raise awareness and seek support from communities on the likely need to collect more information to support the development and management of a finfish fishery in their region (for example length and age);

f) raise awareness with communities that little is known scientifically (notwithstanding what is known through traditional knowledge) on the nature and extent of fish stocks in the region. This means a precautionary approach is needed to manage the risk to stocks from increased fishing. It is unclear how many fishers may be able to operate in the fishery economically and it is likely that additional management measures will need to be introduced as the fishery develops (for example catch limits etc);

g) further define the boundary of the opening. For example where exactly is the recommended boundary north of Turnagain Island.

66. Industry members sought specific advice from the Scientific members on the likely spawning times of black jewfish and whether or not the timing of the opening, or seasonal fishing effort should take this into account. Noting the scientific members did not have this information at the meeting, the RAG agreed for AFMA to provide any available information on the spawning patterns of black jewfish to members out of session (**Action 4**).

67. The RAG noted that AFMA will assist industry members going to the Gudamalagal communities in December, as far possible, with supporting information.

68. An industry observer raised that once buyers are established, the market will provide clear demands in respect to desired species and sizes of fish. It was further discussed how the licencing system will work in the newly opening fishery area. AFMA clarified that unless changed, a finfish fishery licence would allow fishers to target finfish species as defined and regulated in *Torres Strait Fisheries (Finfish) Management Instrument 2020*.

4 Harvest Strategy Development

69. The RAG reviewed work to date on developing a harvest strategy for Spanish mackerel (as outlined in Table 1 of the Agenda paper) and agreed on both the outstanding components to be progressed and a work plan for doing so.

70. The RAG agreed that objectives (including guiding principles), indicators (biomass) and reference points (target and limit reference points) for a future Spanish mackerel harvest strategy were well progressed and **recommended** that a Management Strategy Evaluation (MSE) now be undertaken to finalise a harvest strategy for Spanish mackerel that meets Traditional Owner objectives and are robust to uncertainties. The RAG developed a scope for the MSE project which is provided at **Attachment E**.

71. The RAG agreed to defer further discussion on coral trout until its next meeting. In doing so the RAG agreed that:

    a) based on stock status and fishing levels, the highest priority for the fishery should be to progress a harvest strategy for Spanish mackerel; and

    b) consistent with its advice on 14-15 October 2021 (meeting 9), the highest immediate research priority for coral trout is to progress the CPUE standardisation methodology and analysis. Given the likely status of the stock, the size of the fishery in terms of catch, the level of information available for the fishery, and the costs involved in undertaking fishery independent surveys, it is likely that CPUE analysis will be central to harvest strategy options in the short to medium term. The RAG also noted that biological and catch composition data is now being collected for the fishery. These data will support future stock assessments.

72. During the discussion for developing the MSE research scope, the RAG noted a point raised by industry members and Malu Lamar in regards to the use of the term ‘Traditional Inhabitant’. It was requested by these members that this term be amended to ‘Traditional Owner’ in this research scope. It was discussed that this would reflect the terminology as defined by the *Native Title Act 1993*, of which a main objective is to provide for the recognition and protection of native title rights.

73. The RAG noted that the term ‘Traditional Inhabitant’ is defined in the *Torres Strait Fisheries Act 1984,* the *Torres Strait Treaty,* and decisions of the Protected Zone Joint Authority. This term applies to all individuals who have fisheries access rights within the Protected Zone, extending beyond Traditional Owners as defined in the *Native Title Act 1993.*

74. The RAG agreed to amend the term in the MSE research scope document, however noted that the resolution of this issue is not a matter for the RAG and requires consideration at the PZJA level. The use of these terms is guided by the legislation relevant to the Fishery.

75. The representative for Malu Lamar advised the RAG of his intention to seek further legal advice draft a letter to be tabled to the PZJA to address this issue.

76. A TSRA Observer noted that in developing the Finfish Harvest Strategy it was important to give ‘optimum use’ of fisheries resources the same emphasis as the Commonwealth Harvest Strategy Policy (CHSP) Objectives. He noted the TS Beche-de-mer Harvest Strategy made mention of the CHSP strategies in the Introduction but these were not identified as being included as an 'objective' of the Beche-de-mer Harvest Strategy and that it would be important to emphasise the ‘optimum use’ aspects of the CHSP in the Finfish Harvest Strategy.

5 FFRAG Priorities and Date for the Next Meeting

77. The RAG agreed that the immediate priorities for the RAG were to:
    a) provide advice as necessary on the Western Line Closure including any future fishingthat may occur;
    b) further develop harvest strategies for the Spanish mackerel and coral trout;
    c) review shark management measures; and
    d) undertake annual fishery assessments and provide RBC advice.
78. The RAG noted that the Working Group is also scheduled to consider management priorities atits meeting scheduled for 25 November 2021 and that this may impact priorities for the RAG.
79. The RAG agreed to the following meeting schedule (noting some members need to confirmavailability once the local council meeting scheduled for 2022 are known):
    a) 8 September 2022, RAG 11, key focus: review data for Spanish mackerel stockassessment.
    b) 3-4 November 2022, RAG 12, key focus: Stock assessment outcomes and RBC advice
80. The RAG noted however that additional meetings may be scheduled to support the progress onthe harvest strategy and that AFMA remained committed to convening a RAG meeting in an Eastern Island community sometime next year (noting plans to do so this year were postponeddue to COVID 19).

6 Other Business

81. There was no other business nominated for RAG consideration.

Attachments

A FFRAG 10 agenda as adopted.

B 2021 Torres Strait Spanish mackerel stock assessment presentation.

C Model analyses from the 2021 Torres Strait Spanish mackerel stock assessment.

D Coral Trout CSIRO dive survey data and updated CPUE time-series presentation.

E Research scope - *Management Strategy Evaluation of Spanish mackerel for the TorresStrait Finfish Fishery*

Attachment A

10th MEETING OF THE PZJA TORRES STRAIT FINFISH FISHERY RESOURCE ASSESSMENT GROUP (FFRAG 10)

Thursday 18th November – Friday 19th November 2021

Joint Face to Face / Video Conference Meeting

Venue: Hilton Doubletree Hotel - Cairns

DRAFT AGENDA

1 PRELIMINARIES

1.1 Acknowledgement of Traditional Owners, Welcome and Apologies

The Chair will welcome members and observers to the 10th meeting of the FFRAG.

1.2 Adoption of Agenda

The FFRAG will be invited to adopt the draft agenda.

1.3 Declaration of Interests

Members and observers will be invited to declare any real or potential conflicts of interest and determine whether a member may or may not be present during discussion of or decisions made on the matter which is the subject of the conflict.

1.4 Action Items from Previous Meetings

The FFRAG will be invited to note the status of action items arising from previous meetings.

1.5 Out-of-Session Correspondence

The FFRAG will be invited to note out of session correspondence on FFRAG matters since the previous meeting.

2 UPDATES FROM MEMBERS

2.1 Industry & Scientific Members

Industry and scientific members will be invited to provide a verbal update on matters concerning the Torres Strait Finfish Fishery, in particular, providing comment on fishing patterns, behaviours, prices, and market trends this season.

2.2 Government Agencies

The FFRAG will be invited to note updates from AFMA, TSRA and QDAF on matters concerning the Torres Strait Finfish Fishery.

2.3 PNG National Fisheries Authority

The FFRAG will be invited to note a verbal update from the PNG National Fisheries Authority if a representative is in attendance.

2.4 Native Title

The FFRAG will be invited to note a verbal update from Malu Lamar (Torres Strait Islander) Corporation RNTBC if a representative is in attendance.

3 STOCK ASSESMENTS AND RBC ADVICE

3.1 Spanish Mackerel

The FFRAG will be invited to review the updated stock assessment outcomes and recommend a Recommended Biological Catch for Spanish mackerel for the 2022-23 fishing season.

3.2 Coral Trout

The FFRAG will be invited to consider presentations by Dr Trevor Hutton on;

a) relevant finfish data collected as part of the CSIRO study: Milton and Long (1997) *Influence of coastal processes on large scale patterns in reef fish communities of Torres Strait, Australia*. This data may be relevant to progressing the preliminary coral trout stock assessment; and

b) an updated Catch Per Unit Effort data time series.

Having regard for new catch data, previous assessments and the updated CPUE data time series, the FFRAG will also be invited to recommend a 2022-23 season Recommended Biological Catch.

3.3 Western Line Closure

The FFRAG are invited to note and discuss an update provided by the Australian Fisheries Management Authority (AFMA) on the progression to date towards the recommended opening of the *western line closure.*

4 HARVEST STRATEGY DEVELOPMENT

The FFRAG will be invited to discuss and provide advice on options for progressing the development of a harvest strategy for the fishery.

5 PRIORITIES FOR THE RAG DATE AND VENUE FOR NEXT MEETING

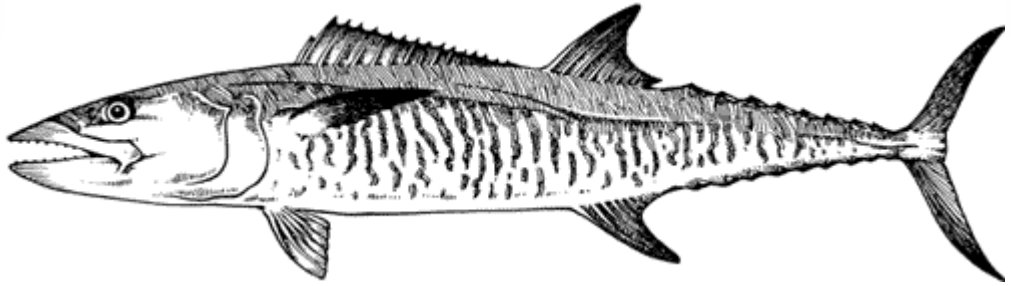
FFRAG members will be invited to discuss future priorities for management of the Finfish Fishery. This discussion will lead on from FFRAG 9 and will form the final advice from the FFRAG for 2021.

The FFRAG will confirm arrangements for FFRAG 11 and 12, tentatively scheduled for September and October 2022, and be advised of upcoming meetings of the FFWG (25 November 2021) and PZJA meeting to decide next season's sustainable catch limits (January 2022).

6 OTHER BUSINESS

FFRAG members will be invited to discuss other business for consideration.

The Chair must approve the attendance of all observers at the meeting. Individuals wishing to join the meeting as an observer must contact the Executive Officer – Chris Boon (chris.boon@afma.gov.au)



Torres Strait

Scomberomorus commerson

Spanish mackerel

The 2021 stock assessment.

FFRAG meeting #10, 18-19 November 2021

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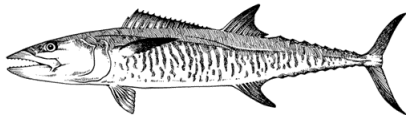
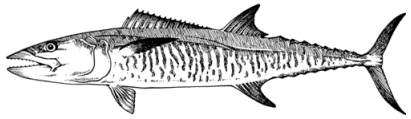


Presentation sections:

1. Recommended Biological Catch (RBC) results.

2. Learnings from extra analyses.

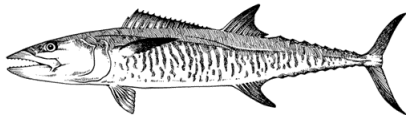
3. An initial Stock Synthesis (SS) analysis.



Section 1 – Core results

- Review biomass and RBC estimates for the 6 core analyses.
- FFRAG #9 agreed on 6 analyses, varying data inputs for natural mortality (M) and total harvest.

List of data inputs (treatments) for 2021.



Number of treatments?

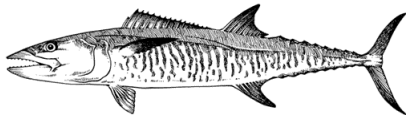
1. Total harvests: (2)
   - Two methods for historical estimates 1940-1988.
   - One Taiwanese IUU harvests.

2. Standardised catch rates: (1)
   - Tender/dory data (out)
   - Qld north east coast fishing power offset (in)

3. Fish age frequencies: (1)
   - All years with fish age or length data (in)

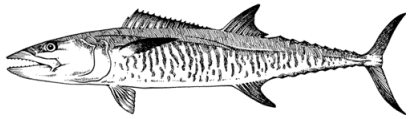
4. Natural mortality rate (M; maximum age = 13.5 years) (3)
   - 0.3, 0.35, 0.4 per year (in)

5. Steepness estimated (1)
   - Estimated (in)



Summary indicators

Indicator	Median results
Median 2020-2021 spawning biomass/unfished biomass	29 per cent
Limit point: spawning biomass / unfished biomass	20 per cent
Harvest taken in 2020-2021 (all fishing sectors)	52 tonnes
Recommended Biological Catch (RBC) for 2021-2022	94 tonnes

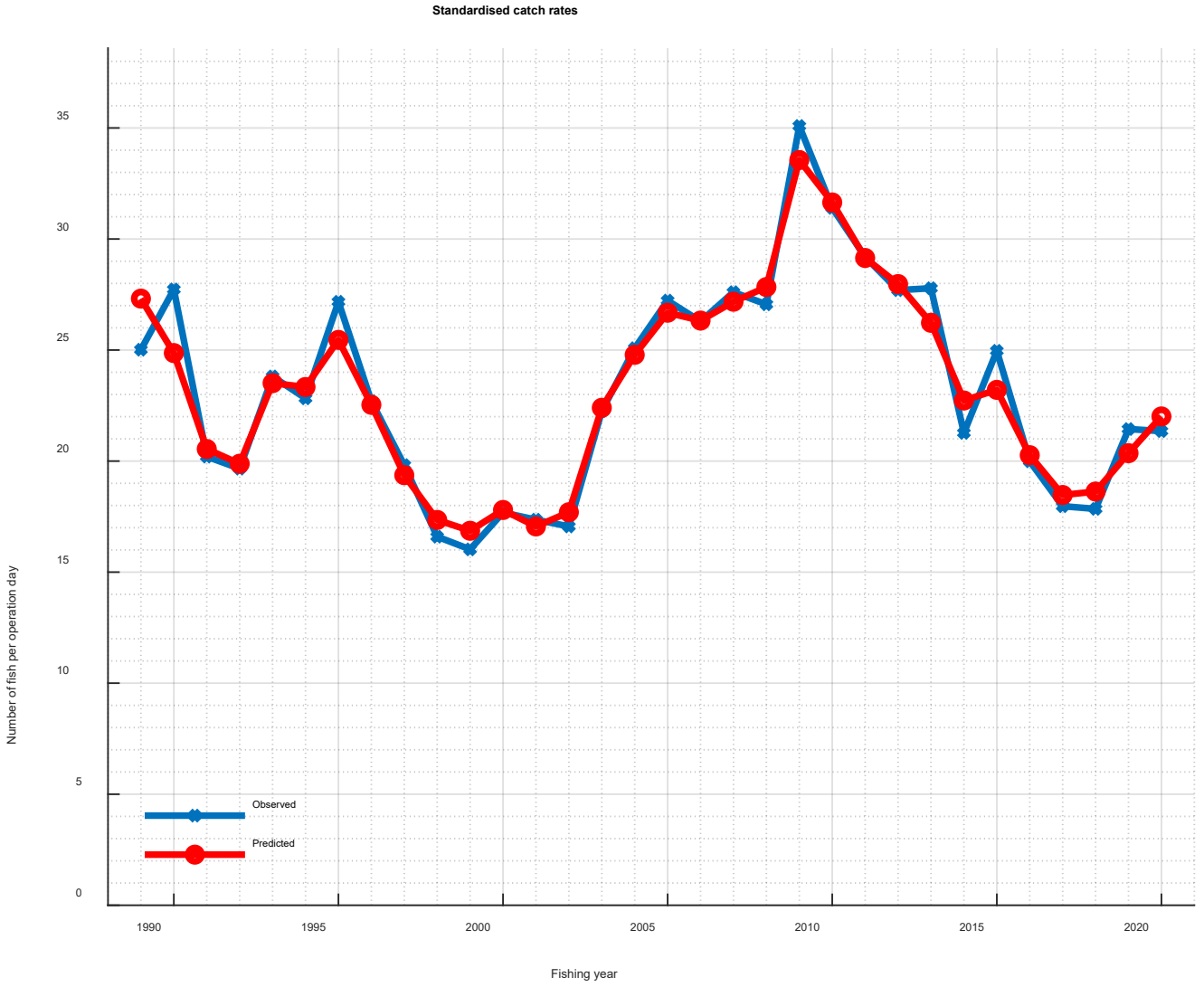


Summary indicators

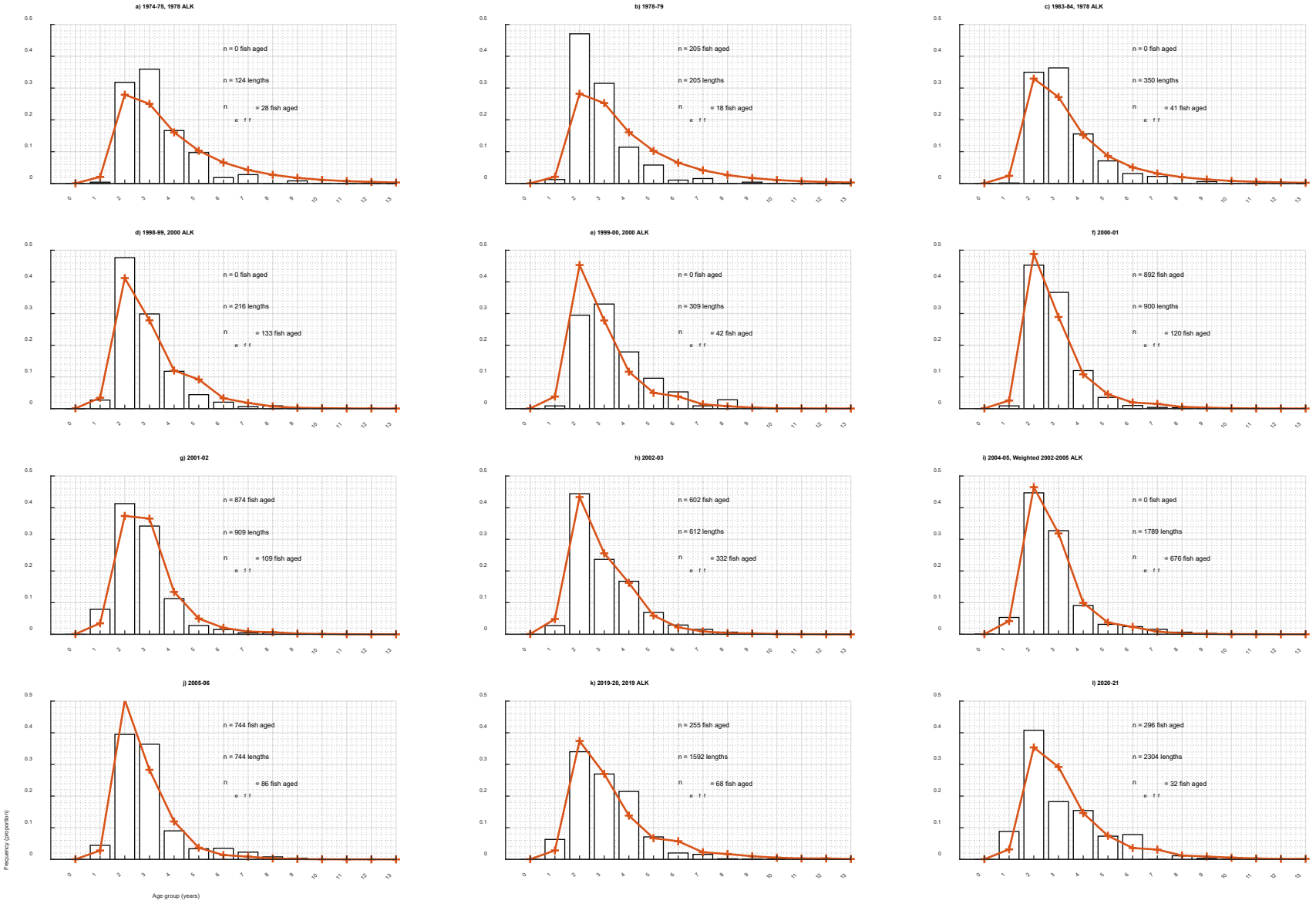
Indicator	Median results
Maximum Sustainable Yield (MSY) for 2022-23	131 tonnes
Median F_{40} harvest from the $B_{2022\text{-}23}$ exploitable biomass	129 tonnes
Median F_{48} harvest from the $B_{2022\text{-}23}$ exploitable biomass	102 tonnes
Median F_{50} harvest from the $B_{2022\text{-}23}$ exploitable biomass	95 tonnes
Median F_{60} harvest from the B_{2021} exploitable biomass	68 tonnes

Standardised catch rates

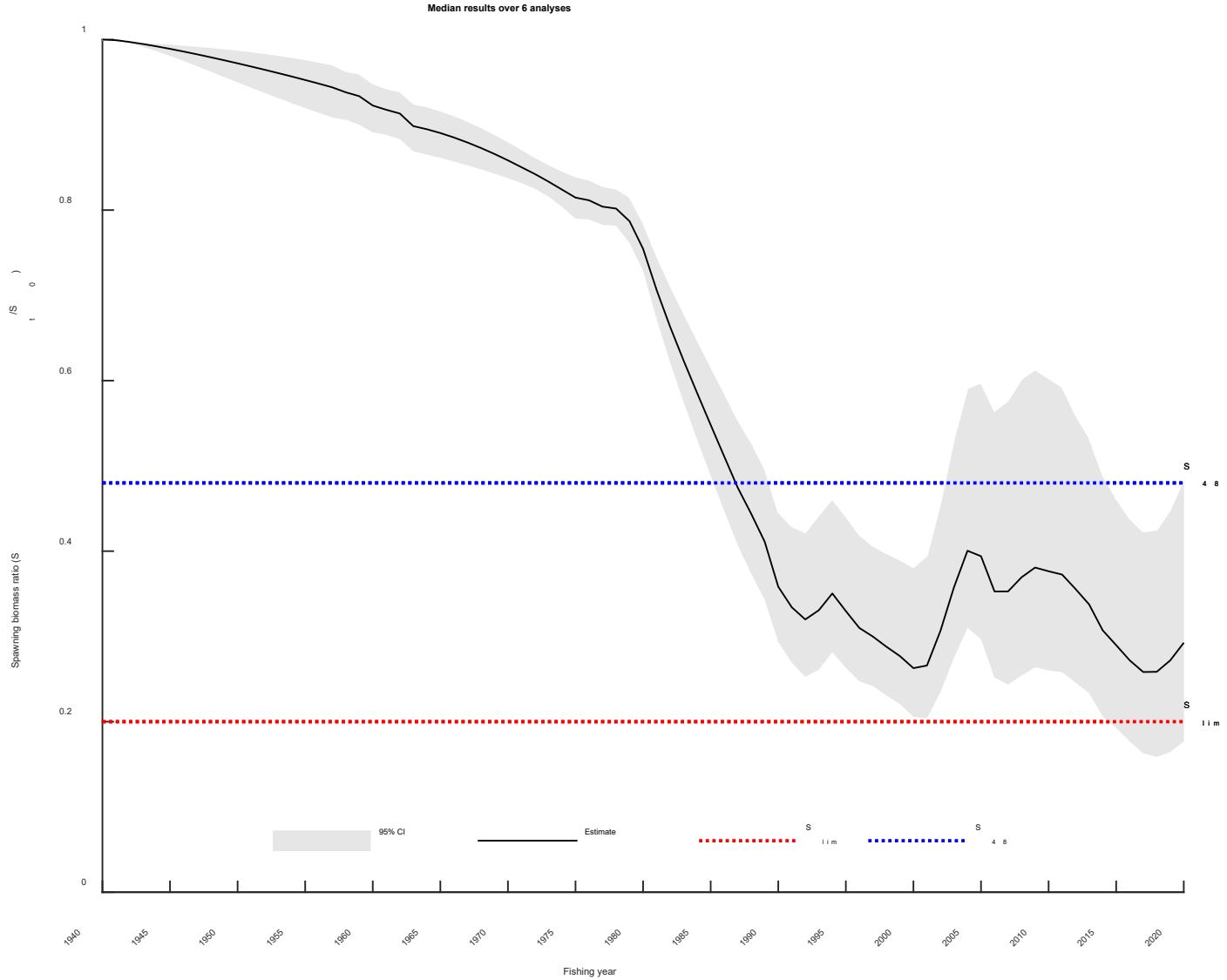
SM02 and TSF01 logbooks; CIs ≈ ± 3 fish



Example: analysis 3 age fit. negLL = -180.9

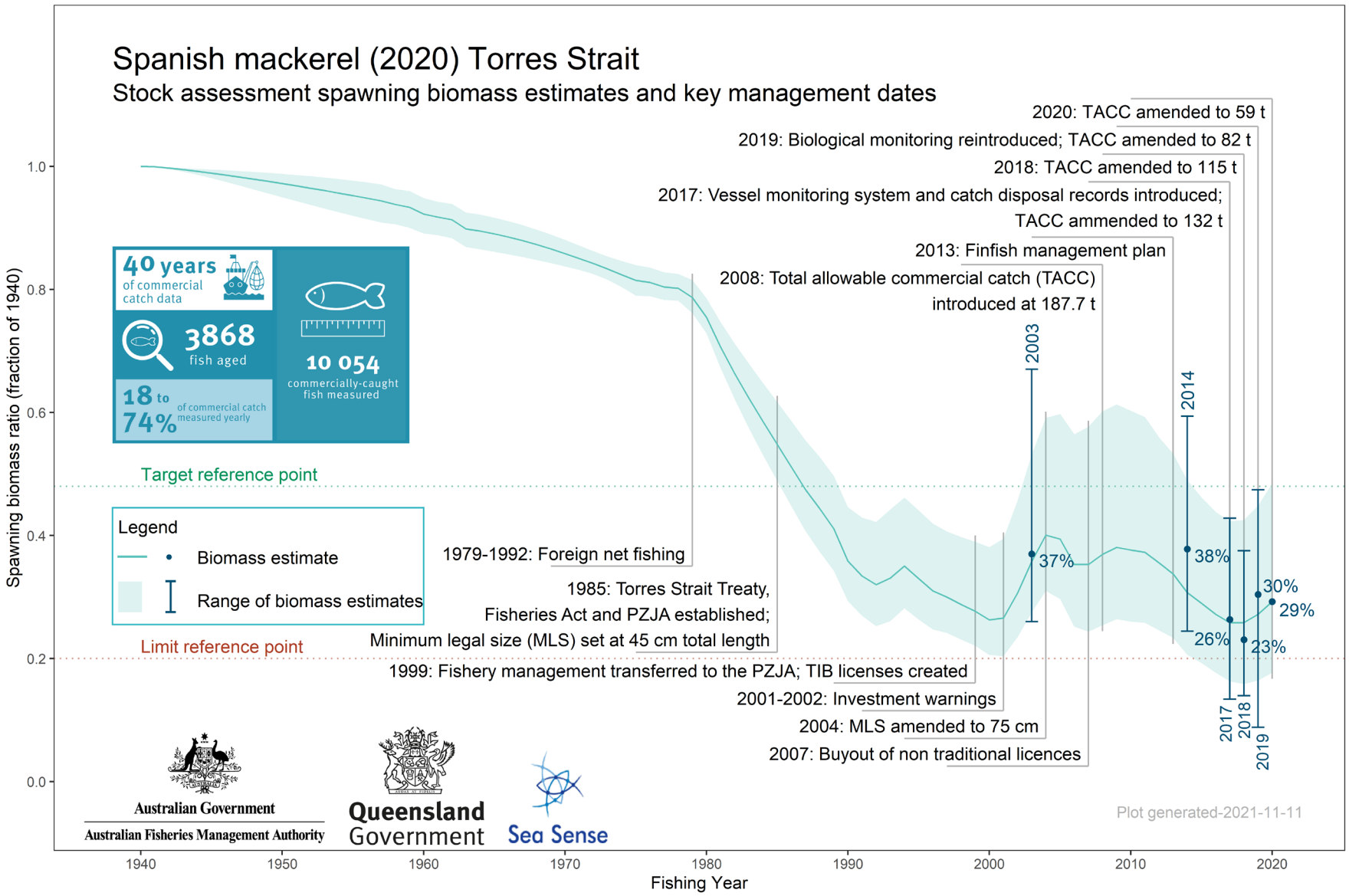


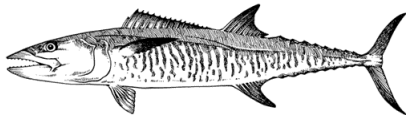
Spawning biomass (egg) ratios



Spanish mackerel (2020) Torres Strait

Stock assessment spawning biomass estimates and key management dates

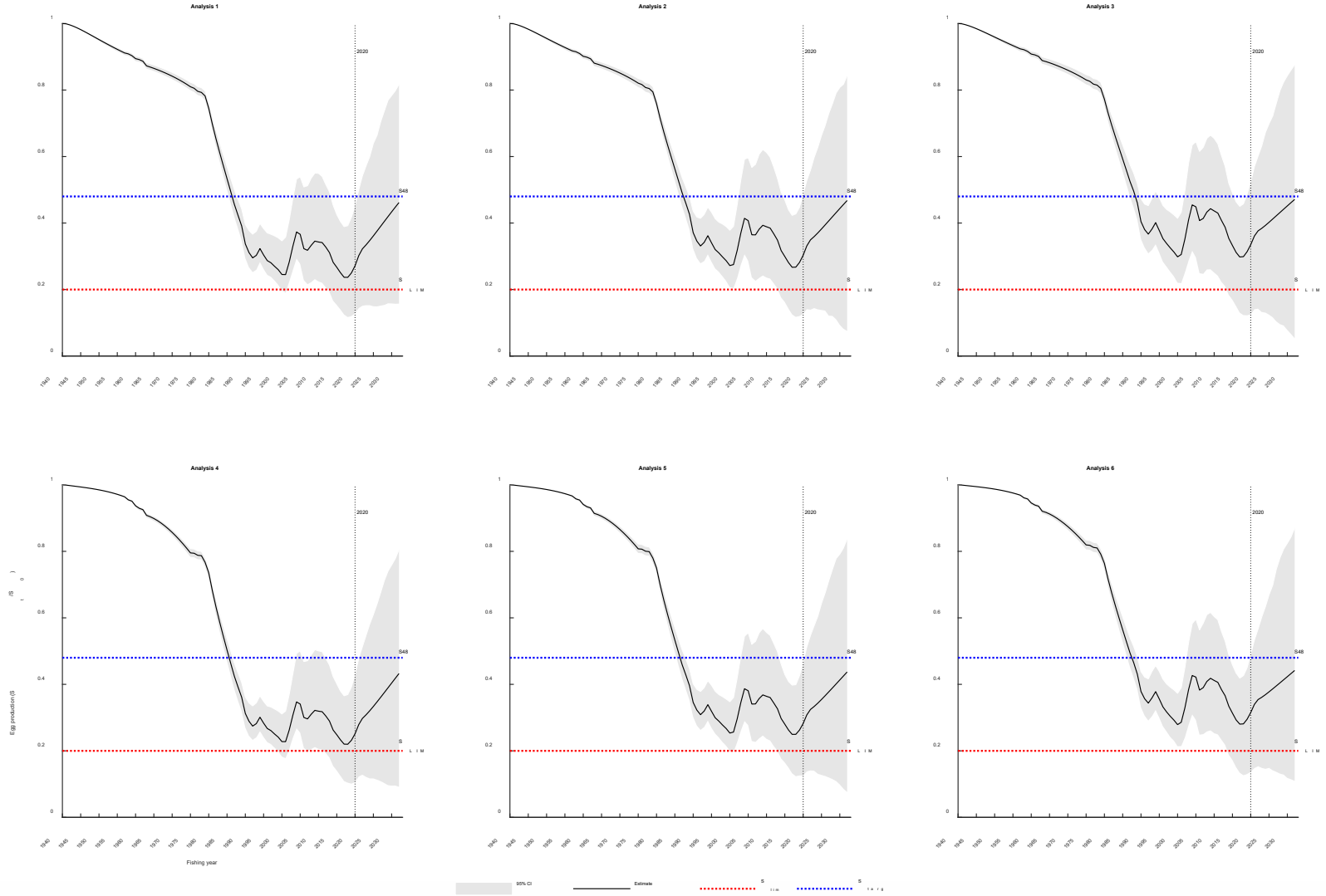


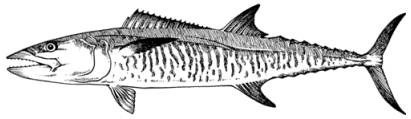


Summary of potential RBC's for all fishing sectors

No.	Name of RBC approach 1940 custom model	Fishing year for the RBC calculation	% of <u>all</u> simulations below S_{20} over 12 years and 6 analyses Assuming average recruitment, and the constant RBC	% of <u>feasible</u> simulations below S_{20} over 12 years and 6 analyses Assuming average recruitment, and the constant RBC	Median RBC tonnes Over 6 analyses
1	Constant F_{MSY}	2022-23	**12.8%**	**8.4%**	**131**
2	Constant F_{40}	2022-23	**12.6%**	**8.2%**	**129**
3	Constant F_{48}	2022-23	**10.4%**	**5.8%**	**102**
4	Constant F_{50}	2022-23	**9.9%**	**5.3%**	**95**
6	Constant F_{60}	2022-23	**8.6%**	**3.9%**	**68**

Spawning biomass forecast for the RBC = 95t

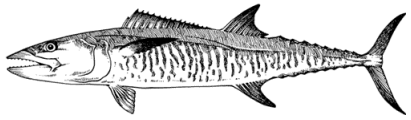




Section 2 – More analyses!

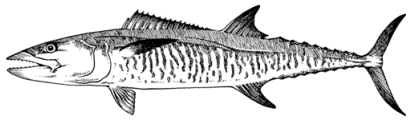
- For FFRAG investigations on data inputs and assumptions.
- Results are not for RBC consideration.

What were the extra analyses 7 - 13



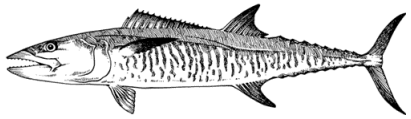
Analysis	Used	Catch Rate	M	Harvest	Age	Start Year	Fix Steepness	Catch Rate TIB	Catch Rate Old
1	1	4	0.3	1	0	1940	0	0	0
2	1	4	0.35	1	0	1940	0	0	0
3	1	4	0.4	1	0	1940	0	0	0
4	1	4	0.3	2	0	1940	0	0	0
5	1	4	0.35	2	0	1940	0	0	0
6	1	4	0.4	2	0	1940	0	0	0
7	0	4	0.35	1	0	1940	0.6	0	0
8	0	4	0.35	1	0	1940	0.7	0	0
9	0	4	0.5	1	0	1940	0.7	0	0
10	0	4	0.7	1	0	1940	0.7	0	0
11	0	4	0.35	1	0	1940	0	1	0
12	0	4	0.35	1	0	1940	0	0	1
13	0	4	0.35	1	0	1940	0	1	1

Results

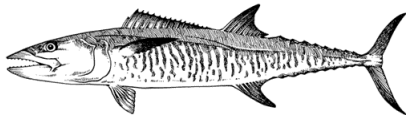


	Negative Log-Likelihoods					
Analysis	CatchRate4	FishAge	RecDevs	CatchRateTIB	CatchRateOLD	Total
1	-42.4671	-177.171	6.1255	0.1842	-4.6643	-213.513
2	-45.8954	-179.374	4.919	0.1593	-4.6429	-220.35
3	-50.0925	-181.004	4.595	0.1557	-4.6091	-226.502
4	-43.4609	-176.92	6.5718	0.186	-4.7368	-213.809
5	-48.2519	-178.362	5.9748	0.1689	-4.7554	-220.639
6	-54.1745	-179.102	6.468	0.188	-4.7595	-226.809
7	**8.4143**	**-189.709**	**-35.9572**	0.1248	-4.515	-217.252
8	**9.6235**	**-189.592**	**-36.6381**	0.0764	-4.3964	-216.607
9	**0.41**	**-200.884**	**-36.6052**	-0.1065	-4.464	-237.079
10	**-9.0476**	**-204.717**	**-36.07**	-0.3483	-3.9698	-249.834
11	-45.4504	-179.642	4.7552	0.1313	-4.6426	-220.206
12	-45.9536	-179.337	4.9408	0.1592	-4.6432	-224.993
13	-45.4967	-179.615	4.775	0.1315	-4.6429	-224.848

Q&A



- Can high reproductive resilience (steepness) work?
- Does extra data help?
- Is our selection of core analyses still suitable?

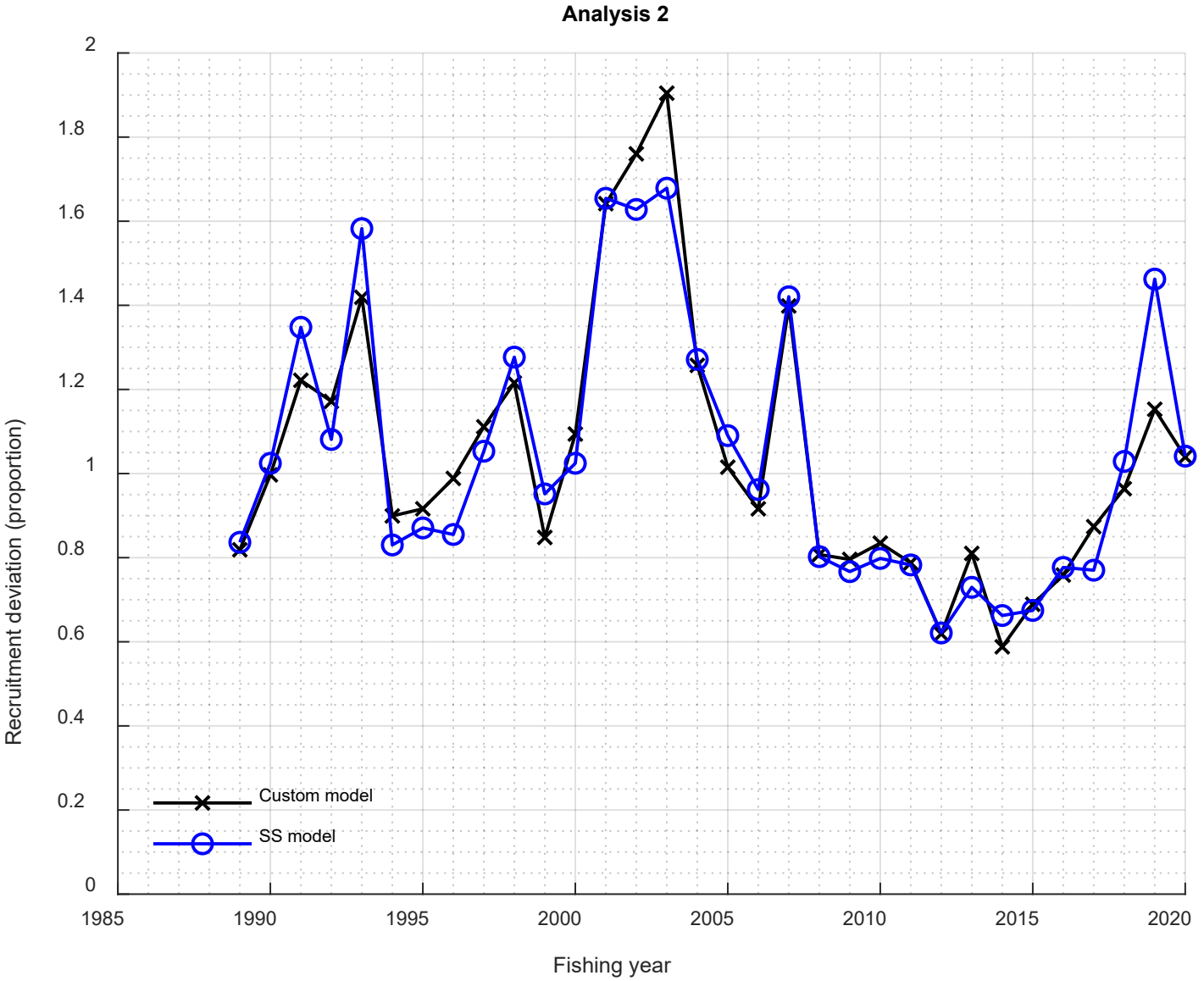


Section 3 – Stock Synthesis model

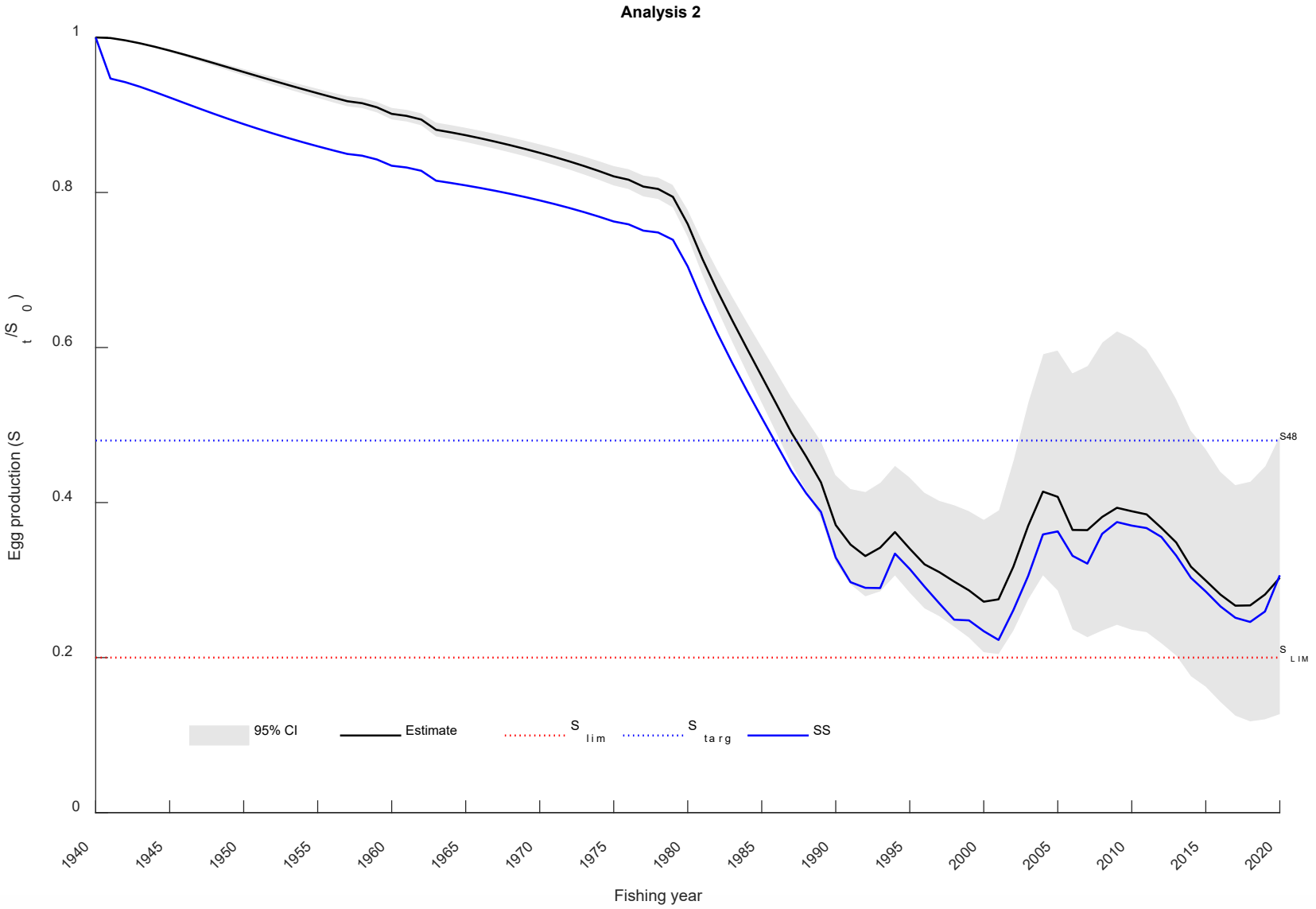
- A single run on analysis 2 data.
- Results are not for RBC consideration.

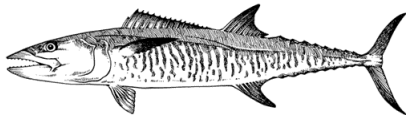
- ..\analysis\ss\plots_SS_output.html

Recruitment deviations



Analysis 2 data in SS



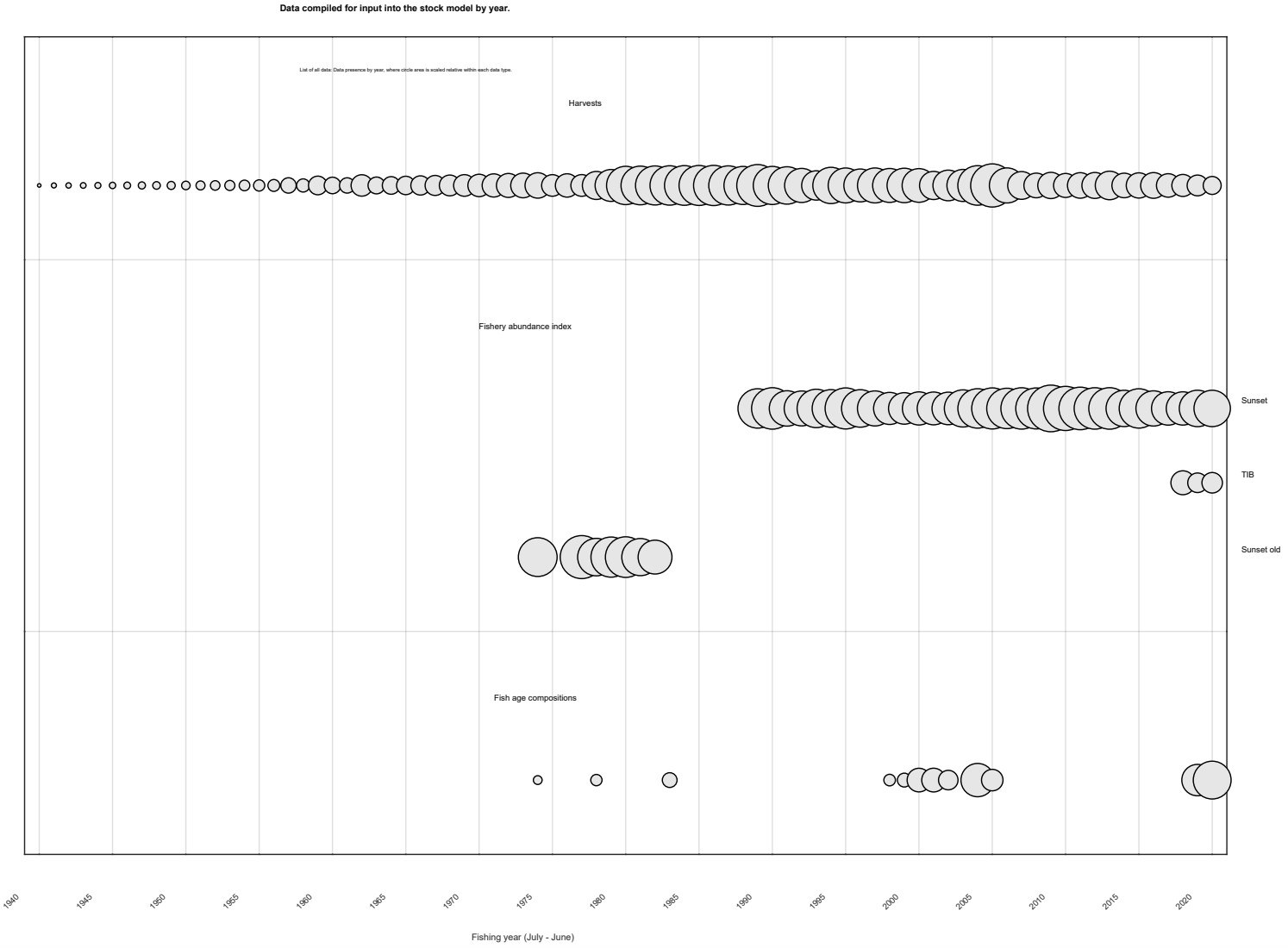


Supplementary slides

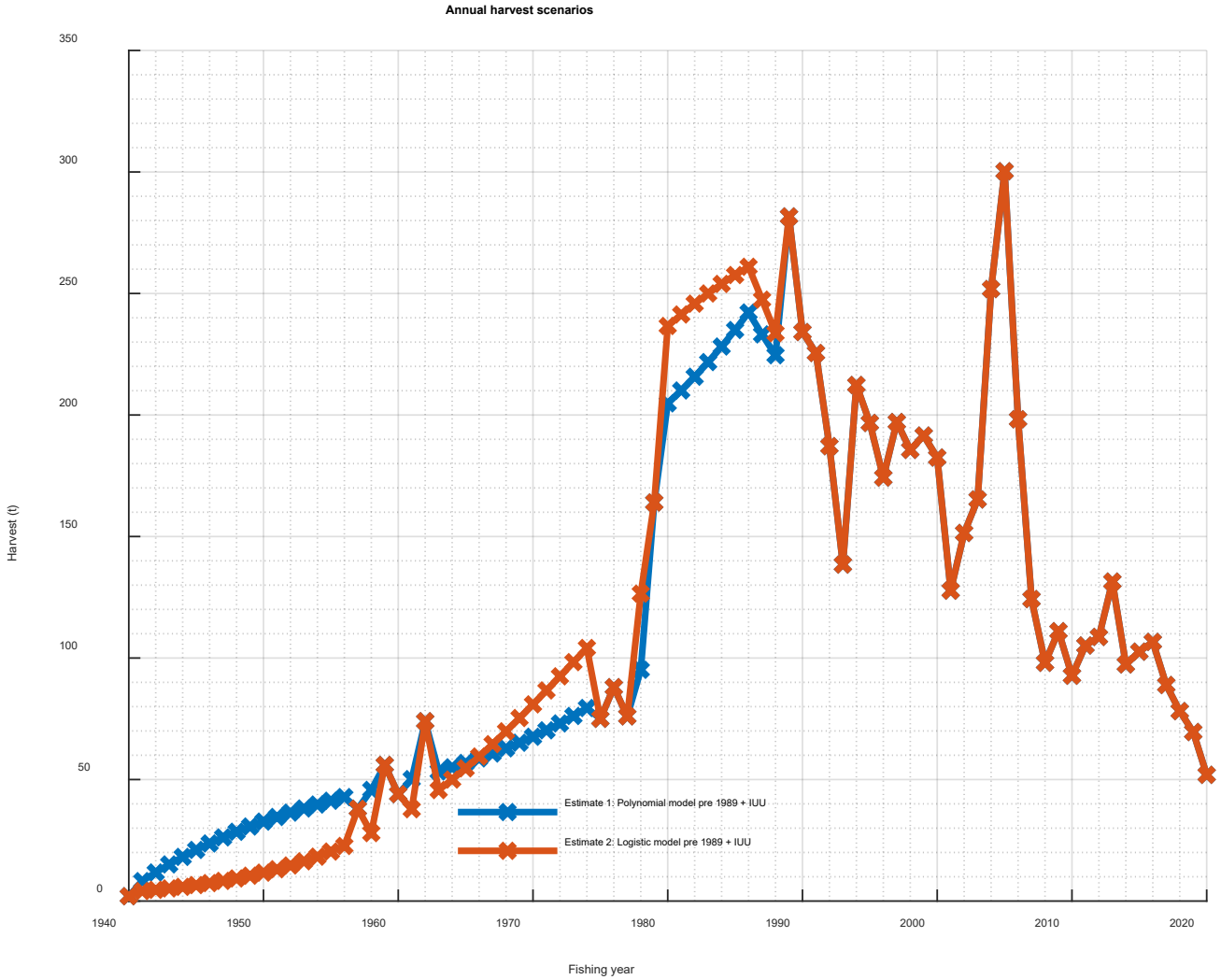
Section 1

Available data

TIB and Sunset old catch rates were only used in the extra analyses

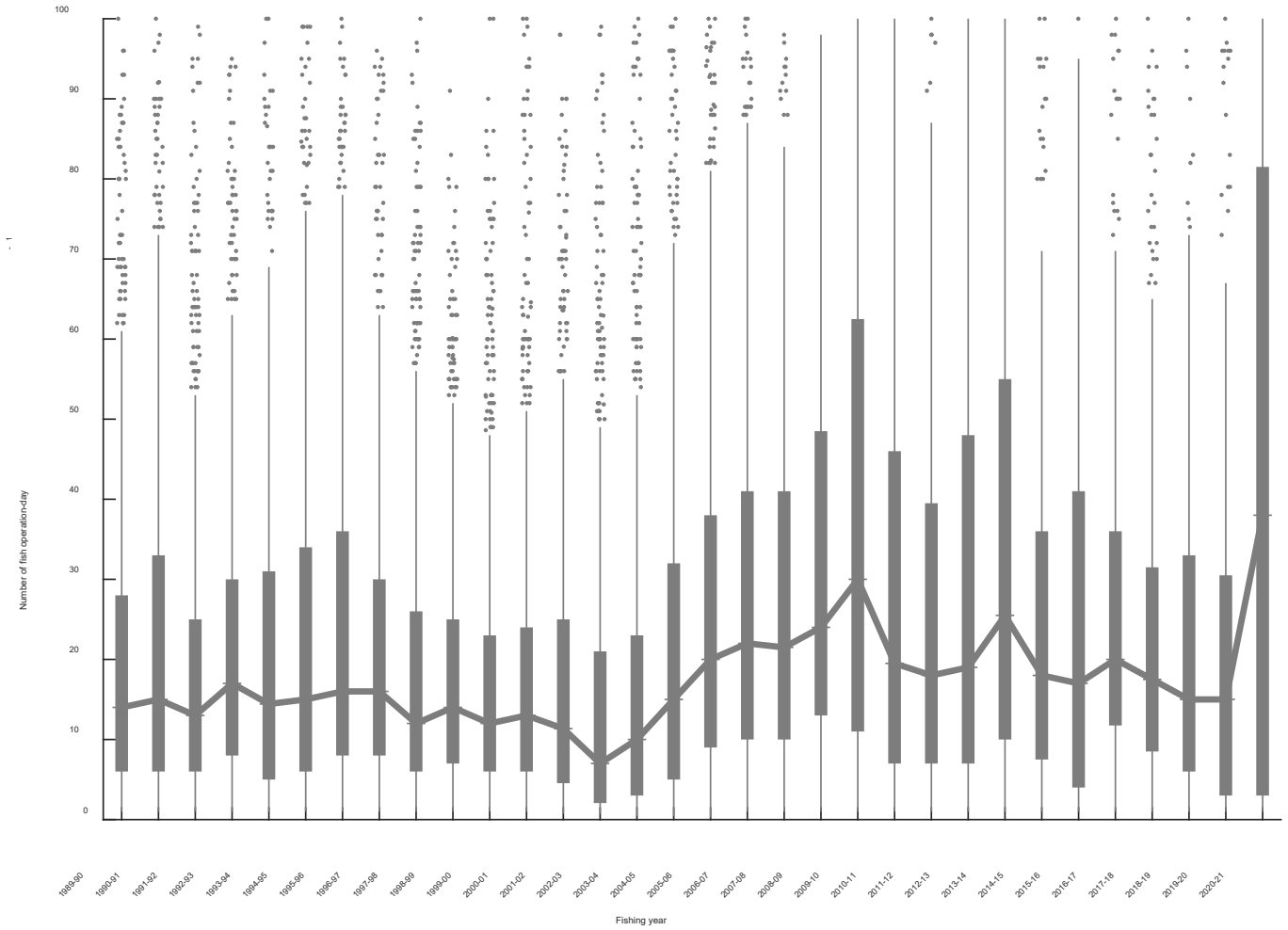


Estimated harvests (all fishing sectors)

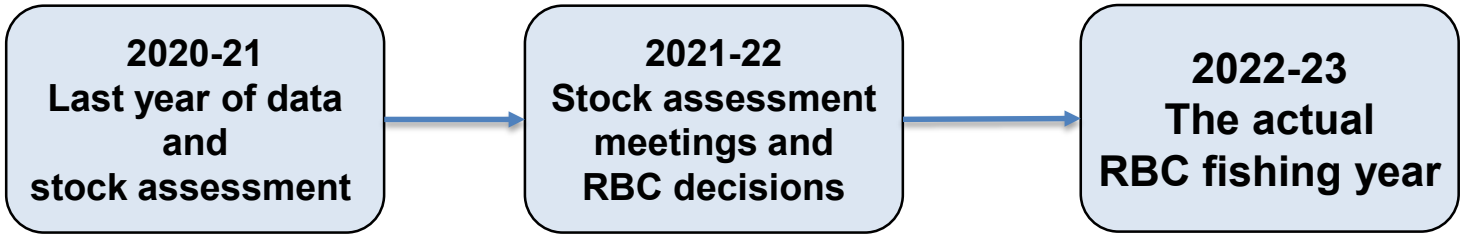


Data – Sunset nominal catch rates, boxplot

On each box, the line and central mark indicates the median, and the bottom and top edges of the box indicate the 25th and 75th percentiles, respectively. The whiskers extend to the most extreme data points not considered outliers, and the outliers are plotted individually using the '+' symbol. Y- axis was truncated at 100 fish. Only 2% of the data was above 100 fish, and the overall maximum catch per operation-day was 471 fish.



How do we calculate the Recommended Biological Catch (RBC)?



- The RBC calculation accounts for:
  - The time lag.
  - Average fish recruitment and a 2021-22 assumed harvest at 74 t.
  - Last year's assessment assumed a 2020-21 harvest at 55 t.

How do we form RBC advice?

Objectives:
Information from the RAG, WG, harvest strategy report, and policy frameworks.

Principles:
If biomass down, be cautious.
If biomass up, moderate and "bank fish"

Potential biomass target reference points:
B_{MSY}
B_{40}
B_{48}
B_{50}
B_{60}

Harvest control rules:
Constant harvest rate
Hockey stick (N/A)

Varies the RBC up and down according to fish biomass

RBC calculation rules:
Forecast two years
Mean recruitment deviation
Remove expected harvest in forecast year 1

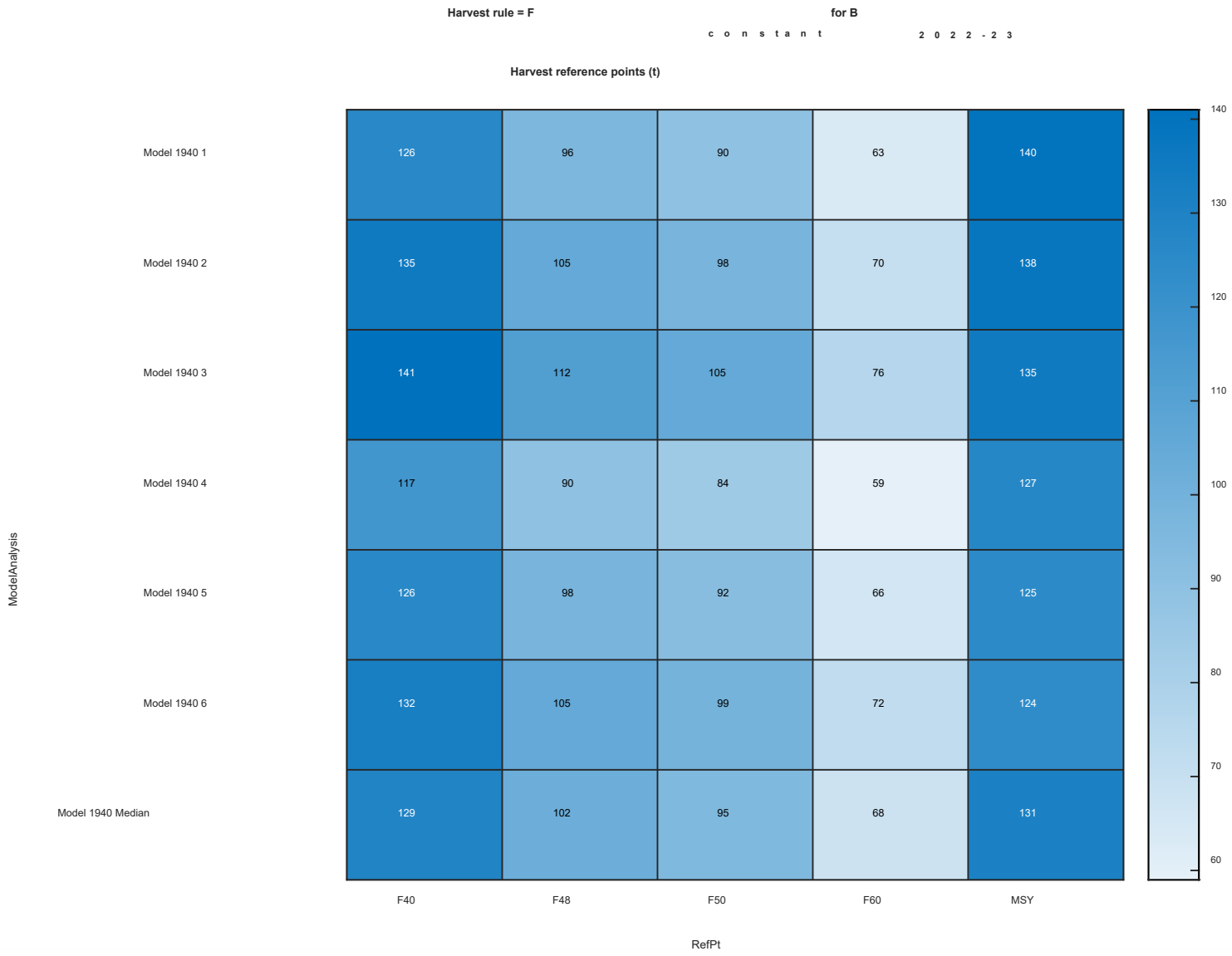
RBC projections:
Over 12 years
Mean recruitment deviation
Constant RBC harvest

Results criteria:
Biomass to reach B_{48}
B_{20} risk ≤ 10%

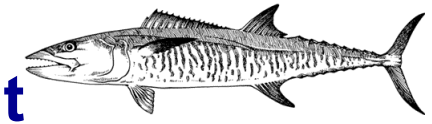
Form an RBC recommendation

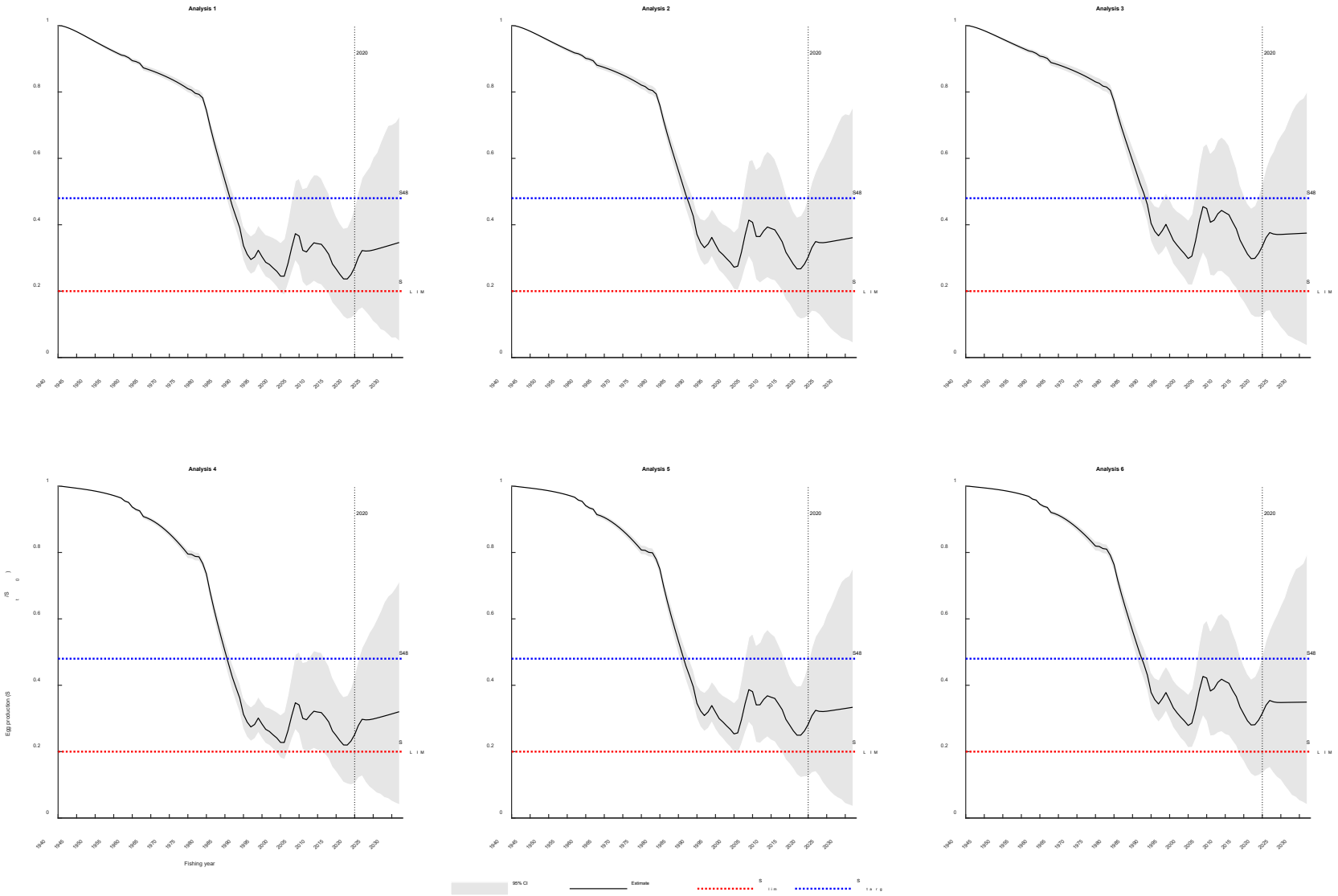
considering:
Results
RBC principles
Fish biology
Fishery knowledge

Potential RBC's for all sectors

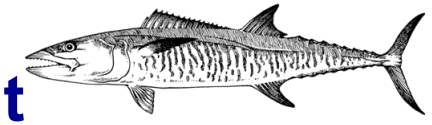


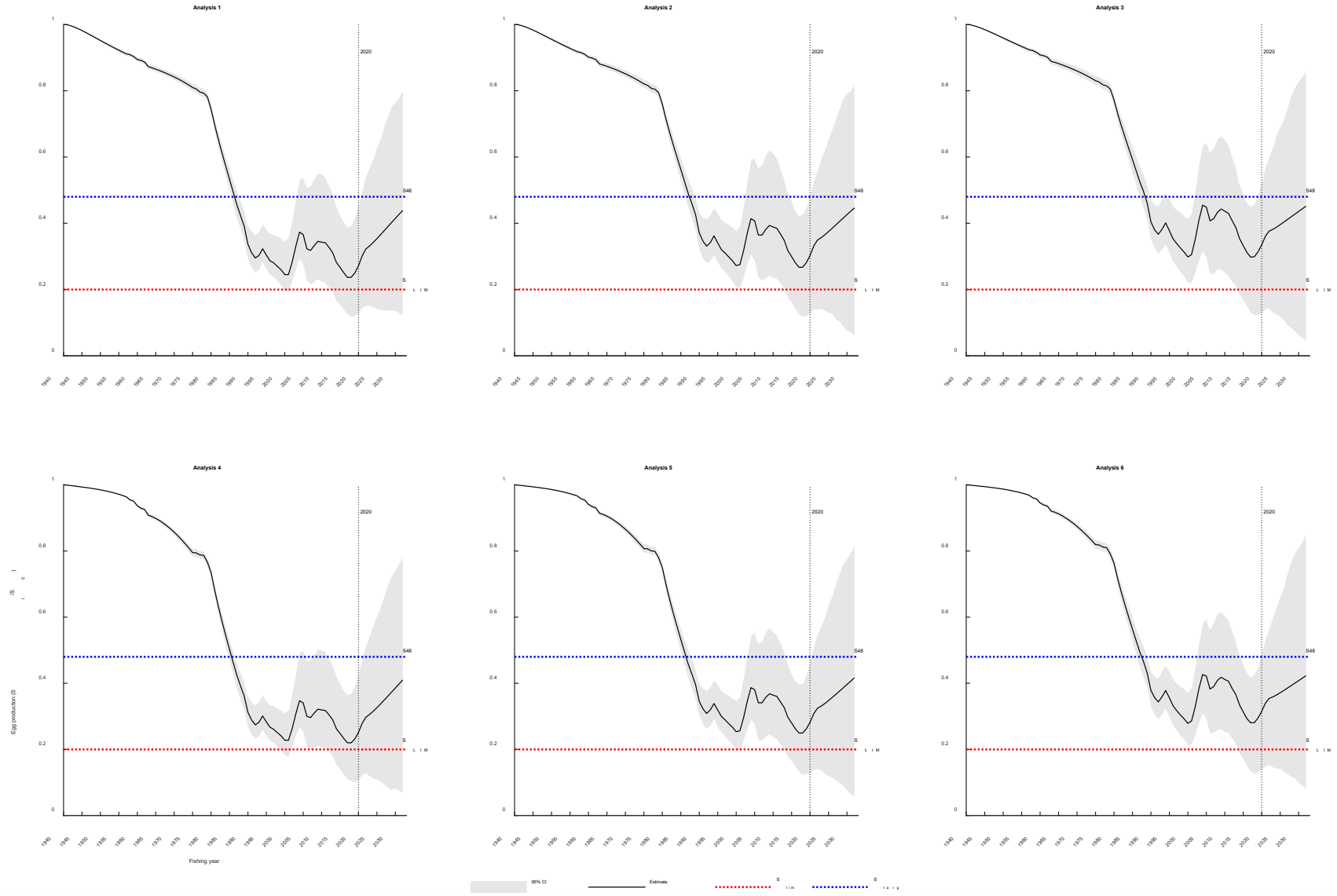
Spawning biomass forecast for the RBC = 129 t



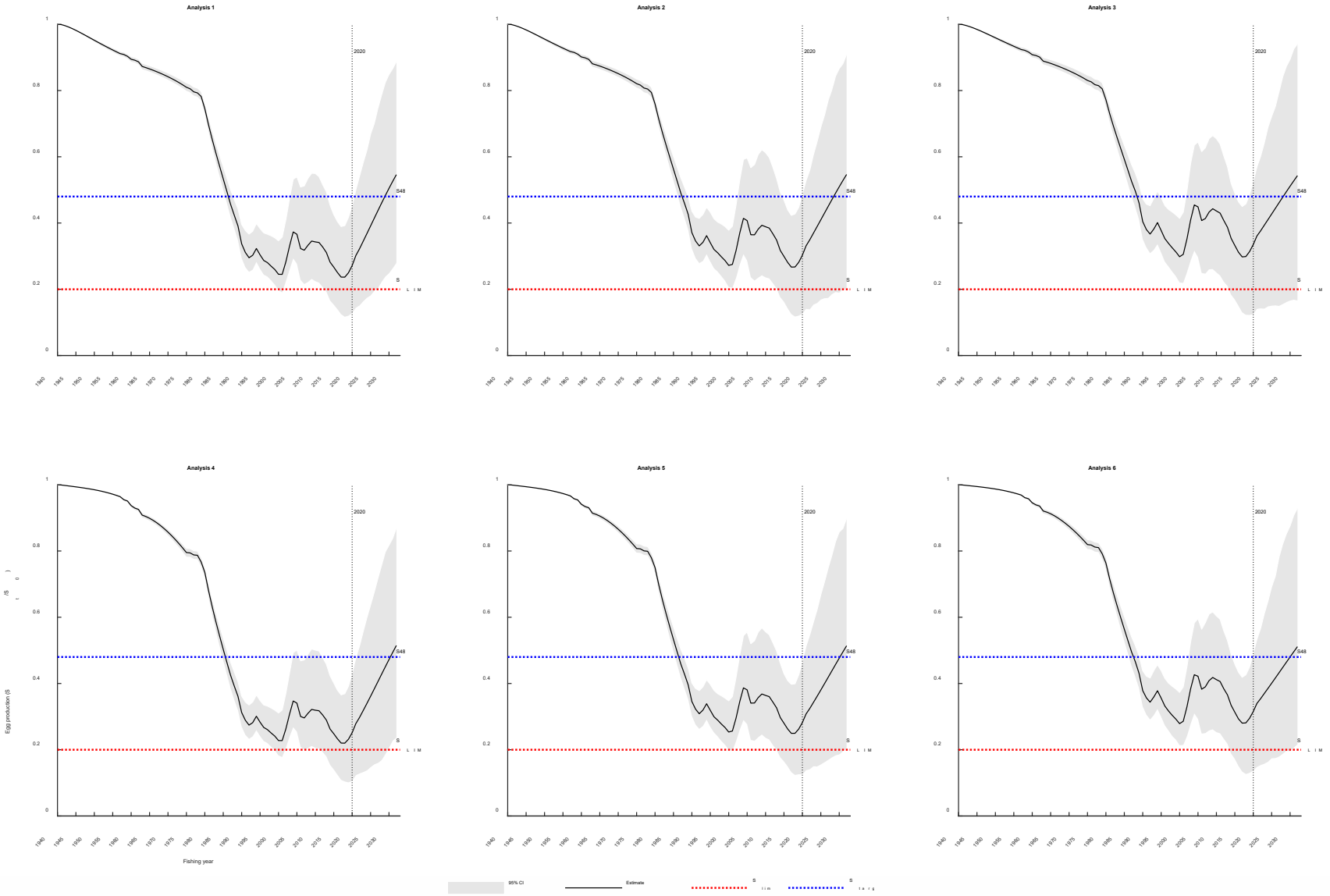


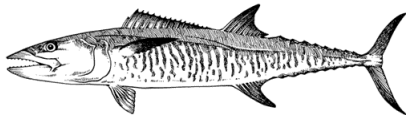
Spawning biomass forecast for the RBC = 102 t





Spawning biomass forecast for the RBC = 68 t



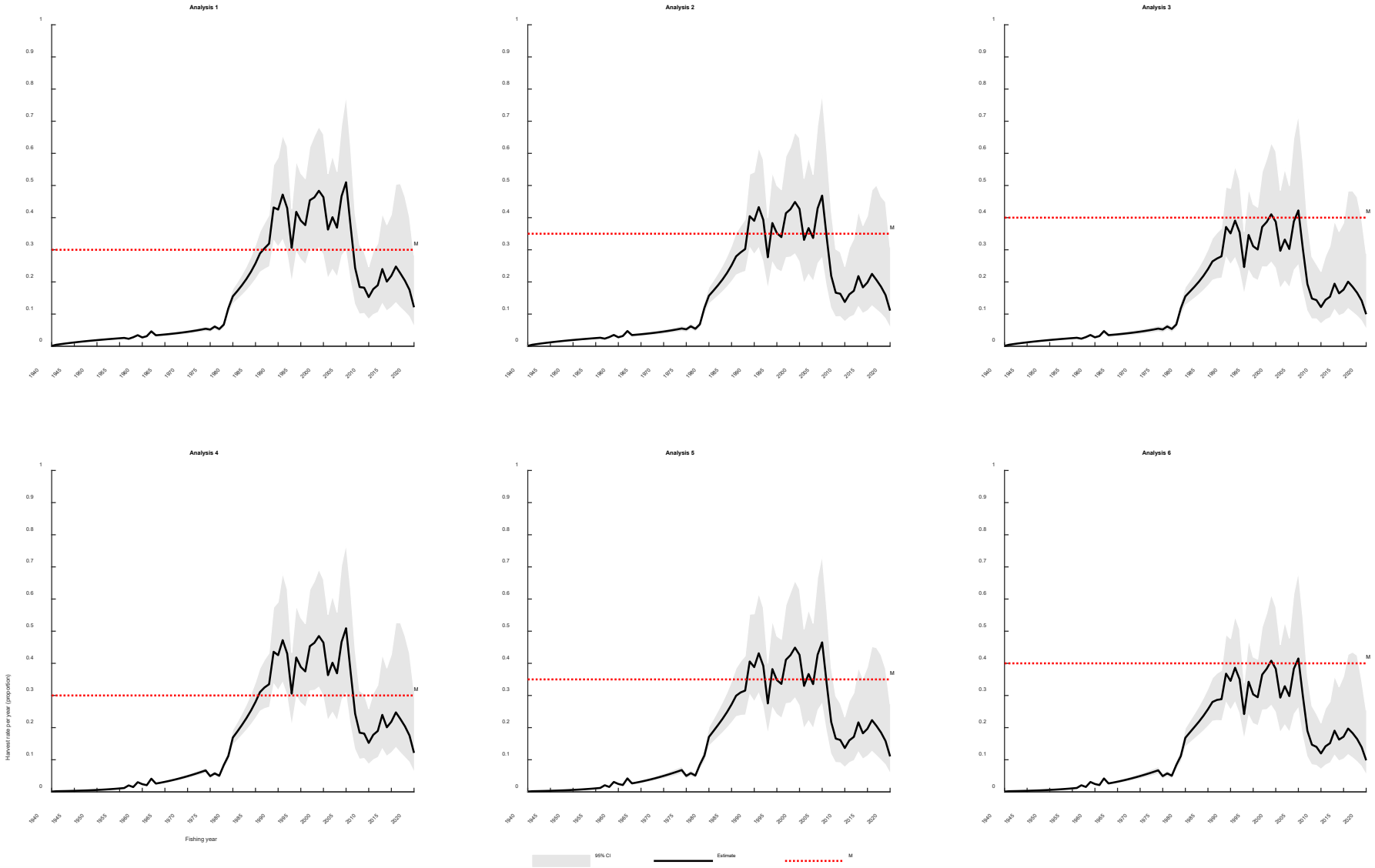


Summary of estimates.

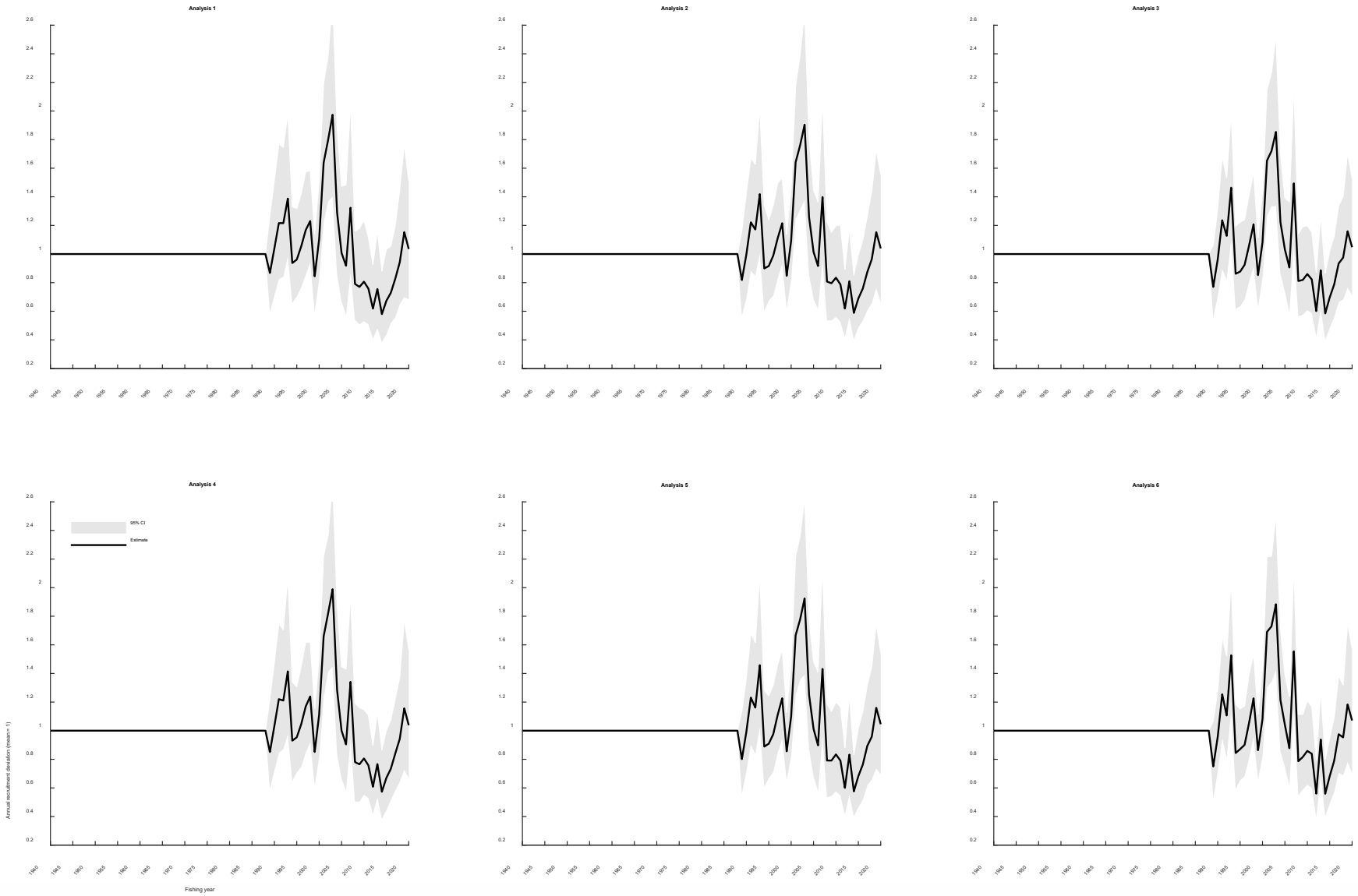
Confidence intervals are in parentheses (95%).

Data	Analysis 1	Analysis 2	Analysis 3	Analysis 4	Analysis 5	Analysis 6
Harvest	Polynomial, IUU	Polynomial, IUU	Polynomial, IUU	Logistic, IUU	Logistic, IUU	Logistic, IUU
Natural Mortality M	0.3	0.35	0.4	0.3	0.35	0.4
Steepness h	0.463 (0.416 : 0.514)	0.396 (0.358 : 0.439)	0.345 (0.315 : 0.38)	0.445 (0.404 : 0.489)	0.382 (0.346 : 0.424)	0.333 (0.307 : 0.365)
Unfished Recruitment R0 / 10^6	0.113 (0.101 : 0.126)	0.15 (0.133 : 0.17)	0.199 (0.174 : 0.23)	0.121 (0.11 : 0.133)	0.161 (0.143 : 0.182)	0.214 (0.189 : 0.243)
Vulnerability age 50%	1.775 (1.581 : 1.976)	1.778 (1.588 : 1.981)	1.779 (1.584 : 1.996)	1.775 (1.59 : 1.954)	1.775 (1.58 : 1.973)	1.768 (1.578 : 1.967)
Vulnerability age 95%	2.491 (2.201 : 2.803)	2.487 (2.209 : 2.78)	2.476 (2.199 : 2.757)	2.491 (2.235 : 2.766)	2.482 (2.201 : 2.787)	2.455 (2.2 : 2.728)
Log recruitment stddev (~CV)	0.295 (0.275 : 0.41)	0.283 (0.244 : 0.399)	0.281 (0.247 : 0.388)	0.3 (0.263 : 0.409)	0.291 (0.252 : 0.406)	0.298 (0.25 : 0.394)
Catch rate negLL	-42.418	-45.77	-50.277	-43.694	-47.739	-54.166
Fish age negLL	-177.2	-179.45	-180.9	-176.76	-178.67	-179.11
Fish age, annual eff sample size	147 (12 : 224)	143 (14 : 224)	141 (16 : 215)	145 (16 : 232)	141 (16 : 225)	138 (21 : 223)
Spawning ratio $S_{1989\text{-}90} / S_0$	0.391 (0.348 : 0.443)	0.426 (0.38 : 0.48)	0.461 (0.41 : 0.519)	0.361 (0.32 : 0.406)	0.396 (0.353 : 0.447)	0.431 (0.386 : 0.484)
Spawning ratio $S_{2020\text{-}21} / S_0$	0.272 (0.129 : 0.453)	0.303 (0.127 : 0.487)	0.335 (0.125 : 0.525)	0.251 (0.106 : 0.43)	0.282 (0.126 : 0.466)	0.315 (0.137 : 0.491)

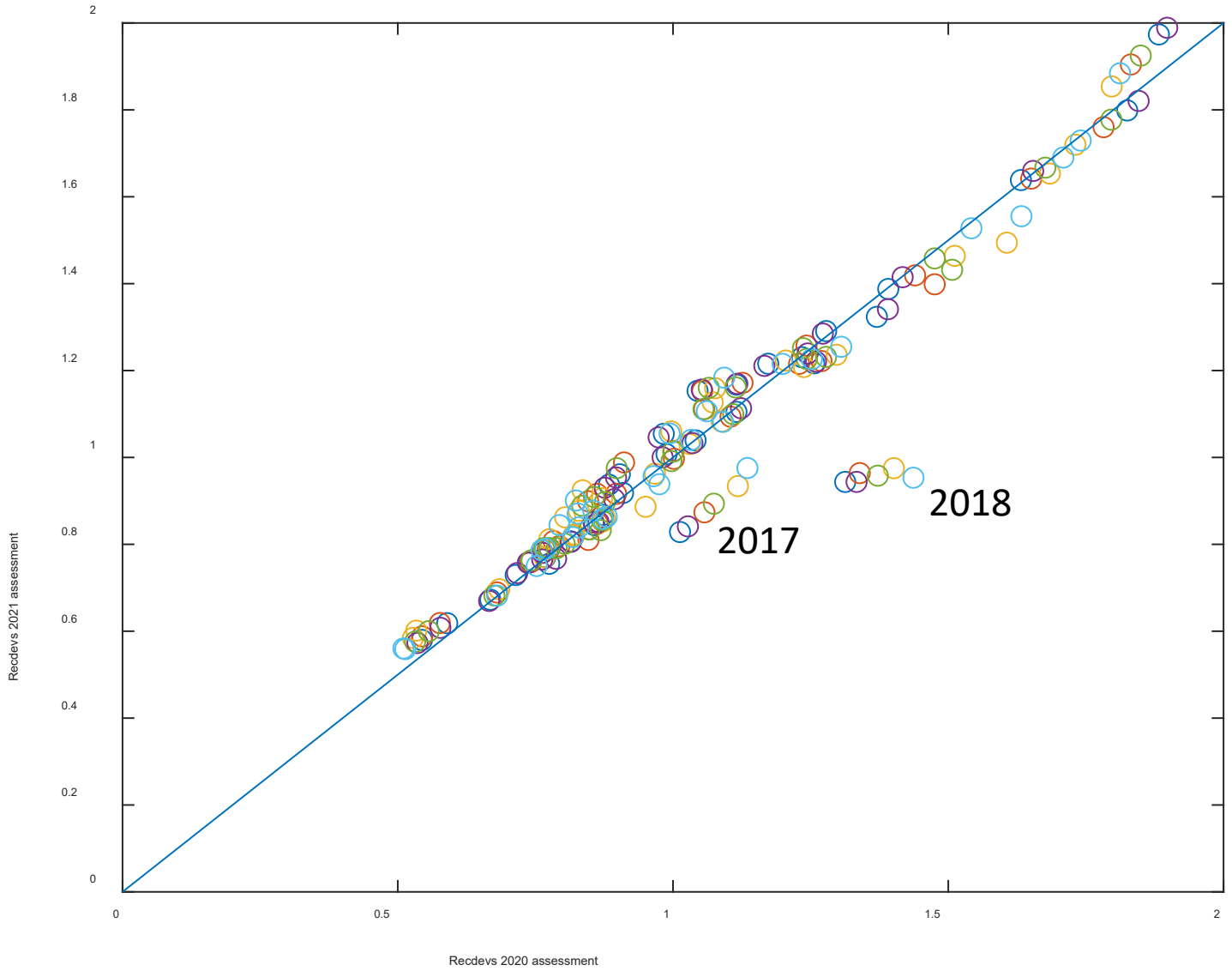
Harvest rates – catch / biomass



Recruitment deviations



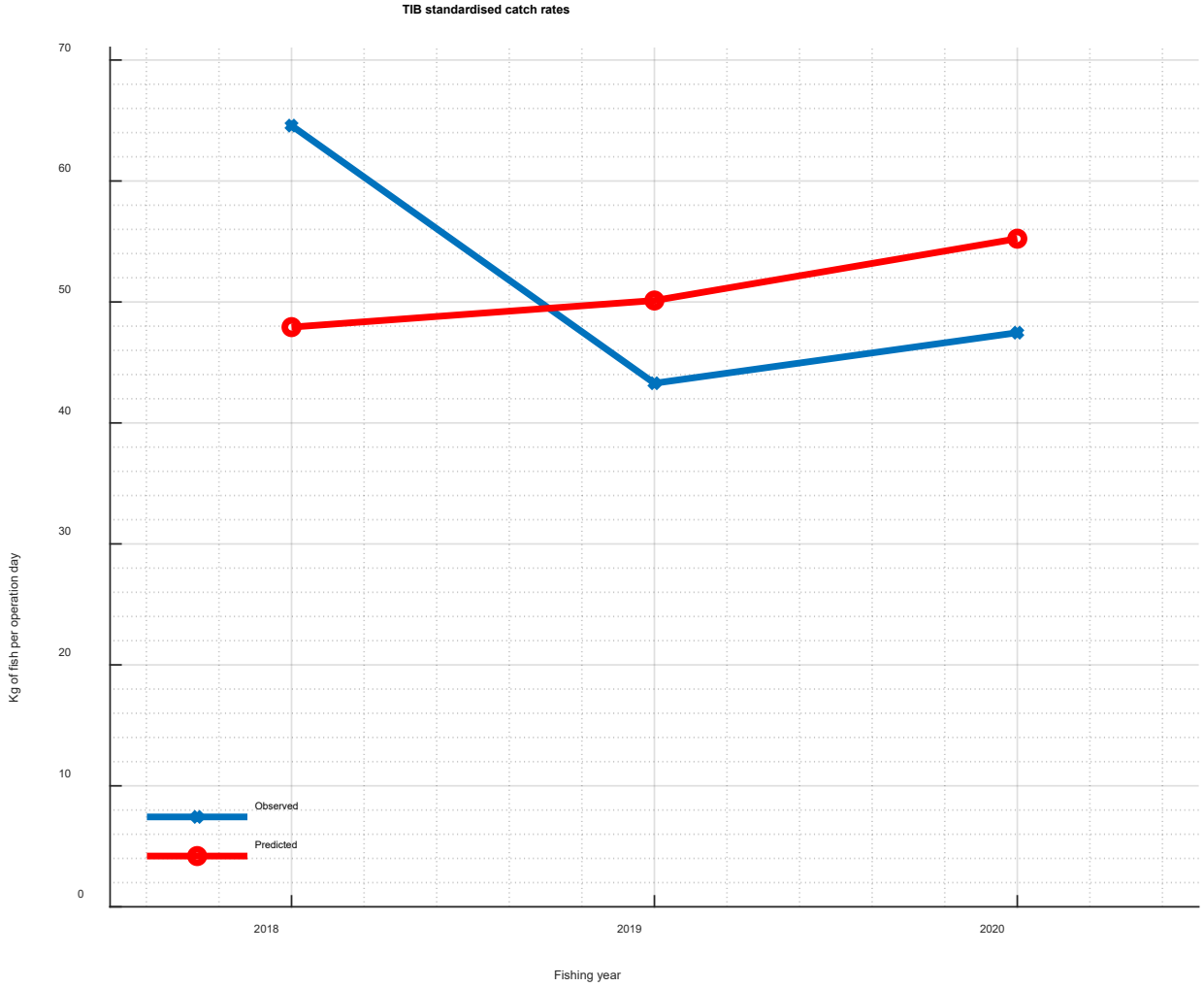
Comparing recruitment deviations between 2020 and 2021 stock assessment



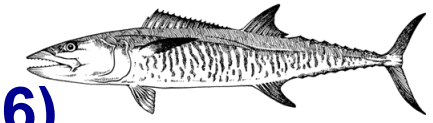
Supplementary slides

Section 2: Extra analyses

Data – TIB catch rates – analysis 11



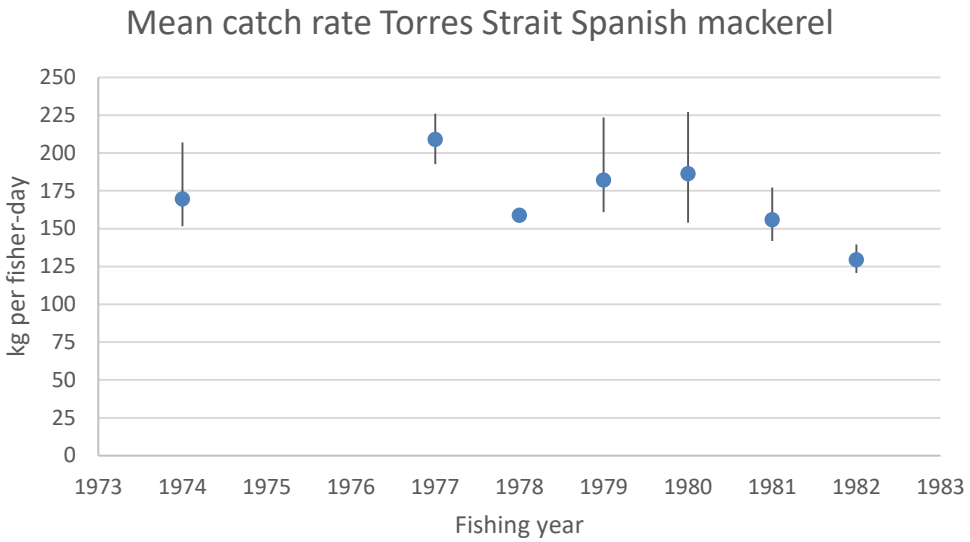
Historical catch rates old – McPherson, G. (1986)



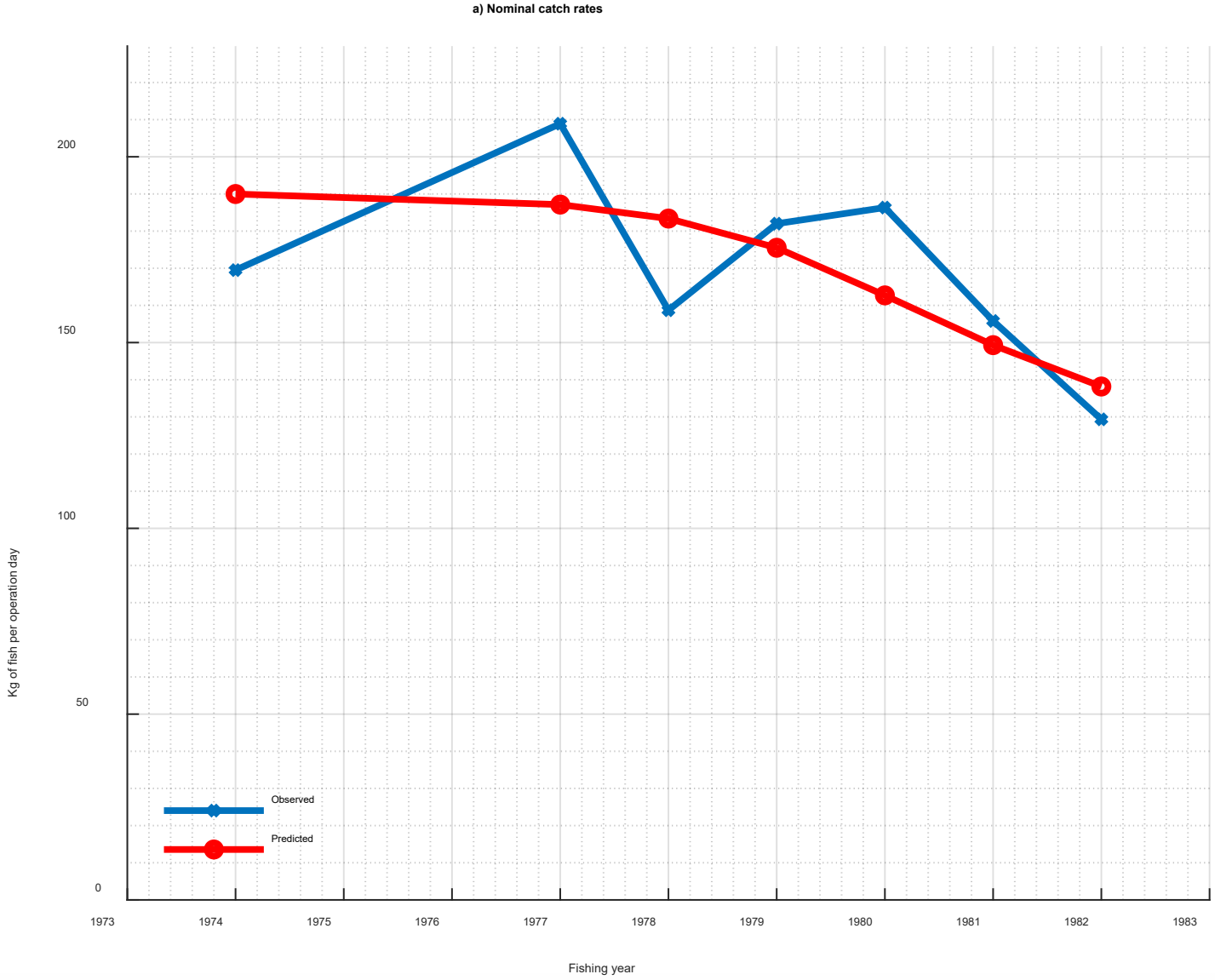
McPherson, G (1986). The Torres Strait Spanish mackerel fishery: A review of Australian development, production and research.

Comments from McPherson (1986):

- A study of catch per unit effort data for one vessel that consistently fished in the Torres Strait region from 1968 to 1983 showed:
  - there has been a decline in fish numbers landed per fisher per day on an annual basis.
  - The decline was evident after 1980.
  - These changes coincided with an illegal Taiwanese gillnet fishery that entered TSPZ waters.



Historical catch rates old – analysis 6, not fitted



Attachment C

Table 1: Six agreed model analyses performed during the *2021 Torres Strait Spanish Mackerel Fishery Stock Assessment.*

Label	Fish weights	Catch rate series	Natural mortality rate (M)	Steepness parameter	Harvest pre-1989	Ageing data	Start year for data
1	Weighted average	No tender data. Fishing power included.	0.3	Estimated	Historic catches actual + polynomial model + IUU tapered	All years	1940
2	Weighted average	No tender data. Fishing power included.	0.35	Estimated	Historic catches actual + polynomial model + IUU tapered	All years	1940
3	Weighted average	No tender data. Fishing power included.	0.4	Estimated	Historic catches actual + polynomial model + IUU tapered	All years	1940
4	Weighted average	No tender data. Fishing power included.	0.3	Estimated	Historic catches actual + logistic model + IUU tapered	All years	1940
5	Weighted average	No tender data. Fishing power included.	0.35	Estimated	Historic catches actual + logistic model + IUU tapered	All years	1940
6	Weighted average	No tender data. Fishing power included.	0.4	Estimated	Historic catches actual + logistic model + IUU tapered	All years	1940

Trevor Hutton (CSIRO)

Updates on Coral Trout
Based on work by UQ and DAF (in 2019)

Acknowledge – Matt Holden (UQ) and George Leigh (QDAF)

Rick Stuart-Smith www.reeflifesurvey.com

John E. Randall

G. McDonald http://cookislands.bishopmuseum.org

Torres Strait finfish: Coral trout assessment

March 2019

Graham Edgar
www.reeflifesurvey.com

Queensland Government

Previous stock assessment

Estimates population parameters

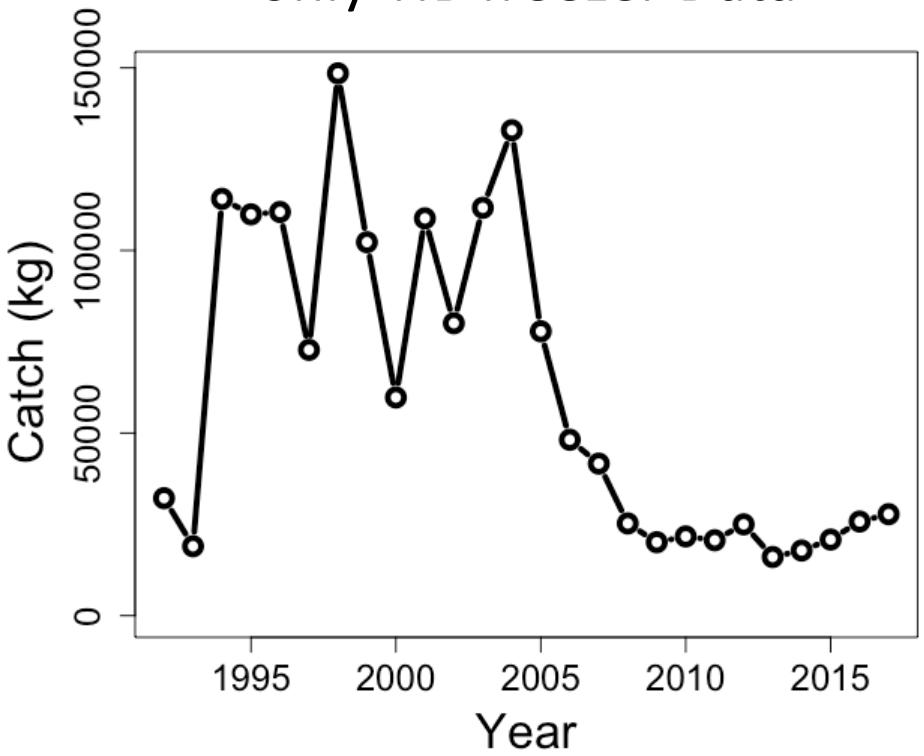
Stock assessment of the Queensland east coast common coral trout (*Plectropomus leopardus*) fishery

George M. Leigh[1], Alexander B. Campbell[1], Chad P. Lunow[2,3] and Michael F. O'Neill[1]

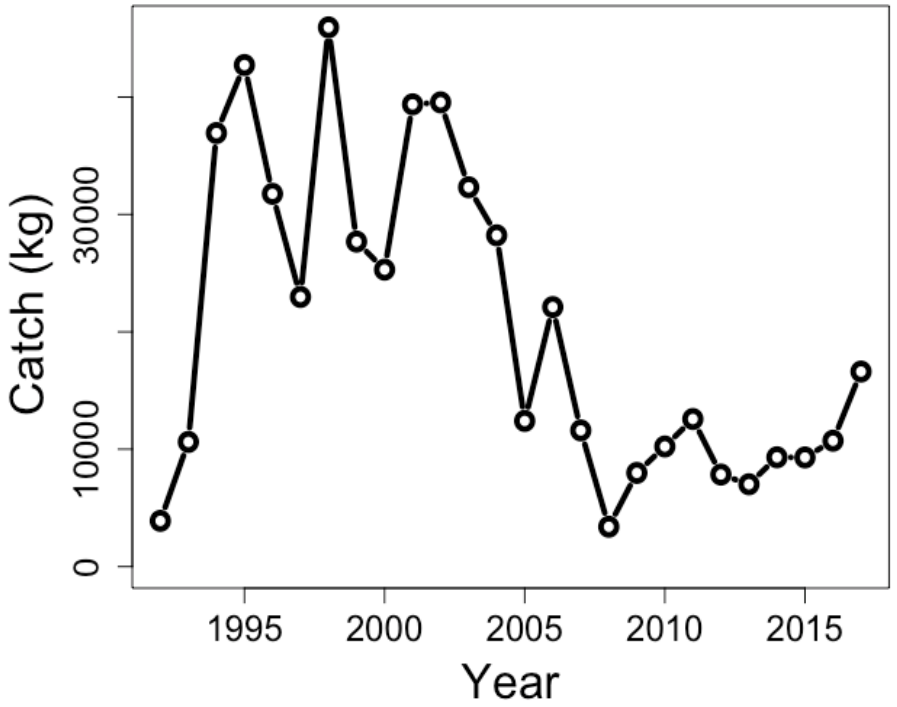
[1]Agri-Science Queensland; Department of Agriculture, Fisheries and Forestry
[2]Fisheries Queensland; Department of Agriculture, Fisheries and Forestry
[3]Current affiliation: Western Australian Fishing Industry Council; Fremantle WA

Queensland Government

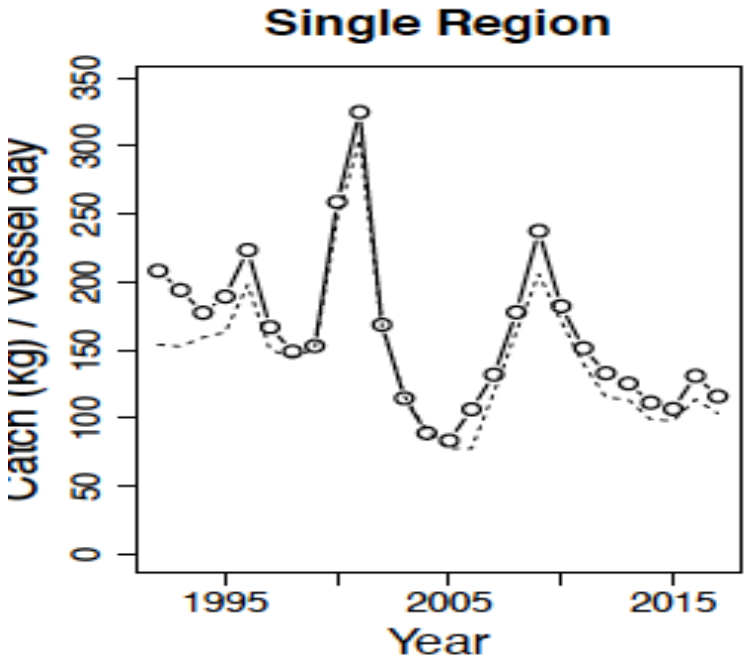
Total Catch in TS5 with only TIB freezer Data

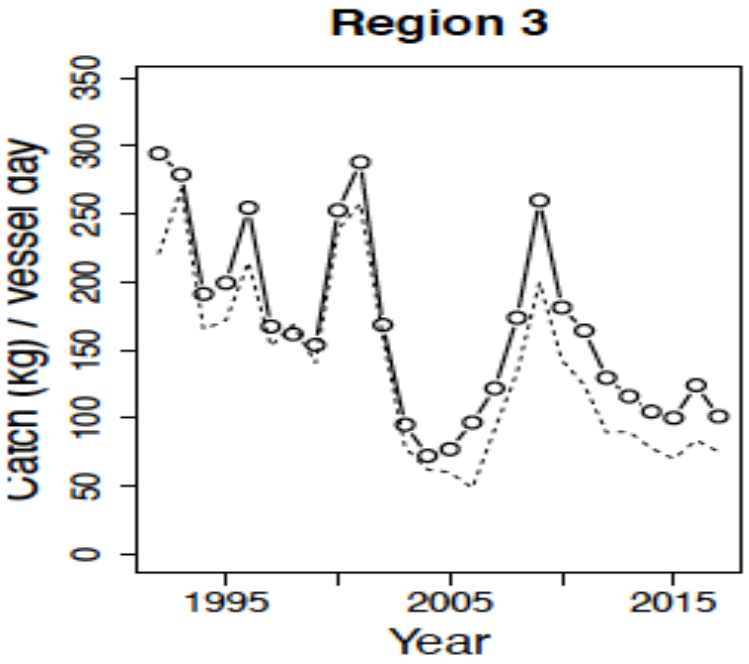


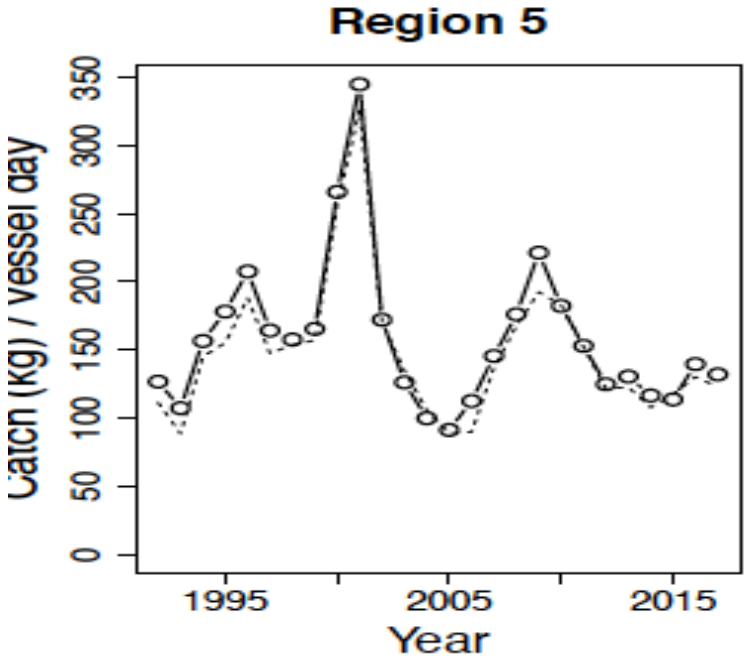
Total Catch in TS3 with only TIB freezer Data



But we can add in TIB docket book data for TS5 …







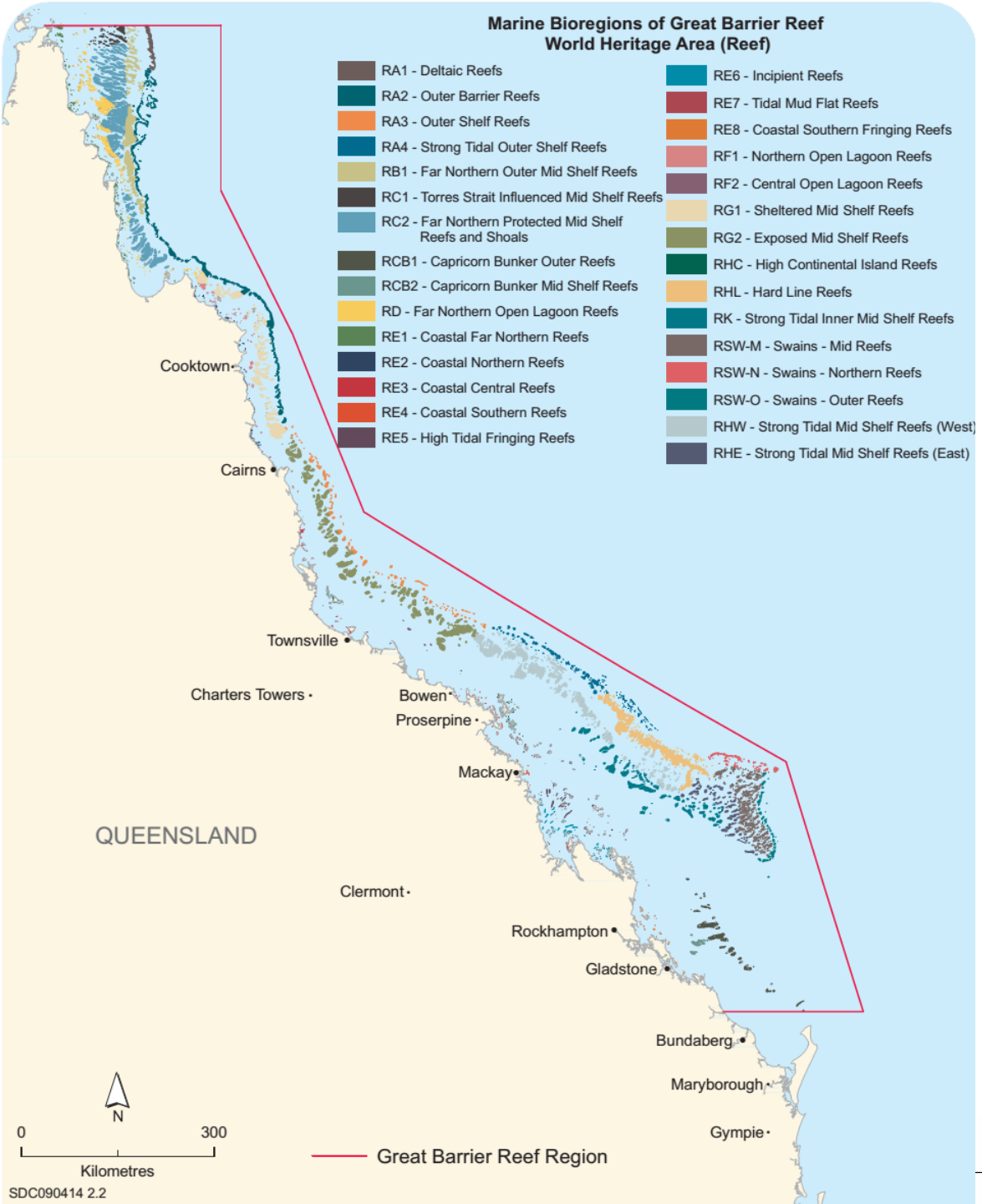
Standardised CPUE

Dashed lines = model 1

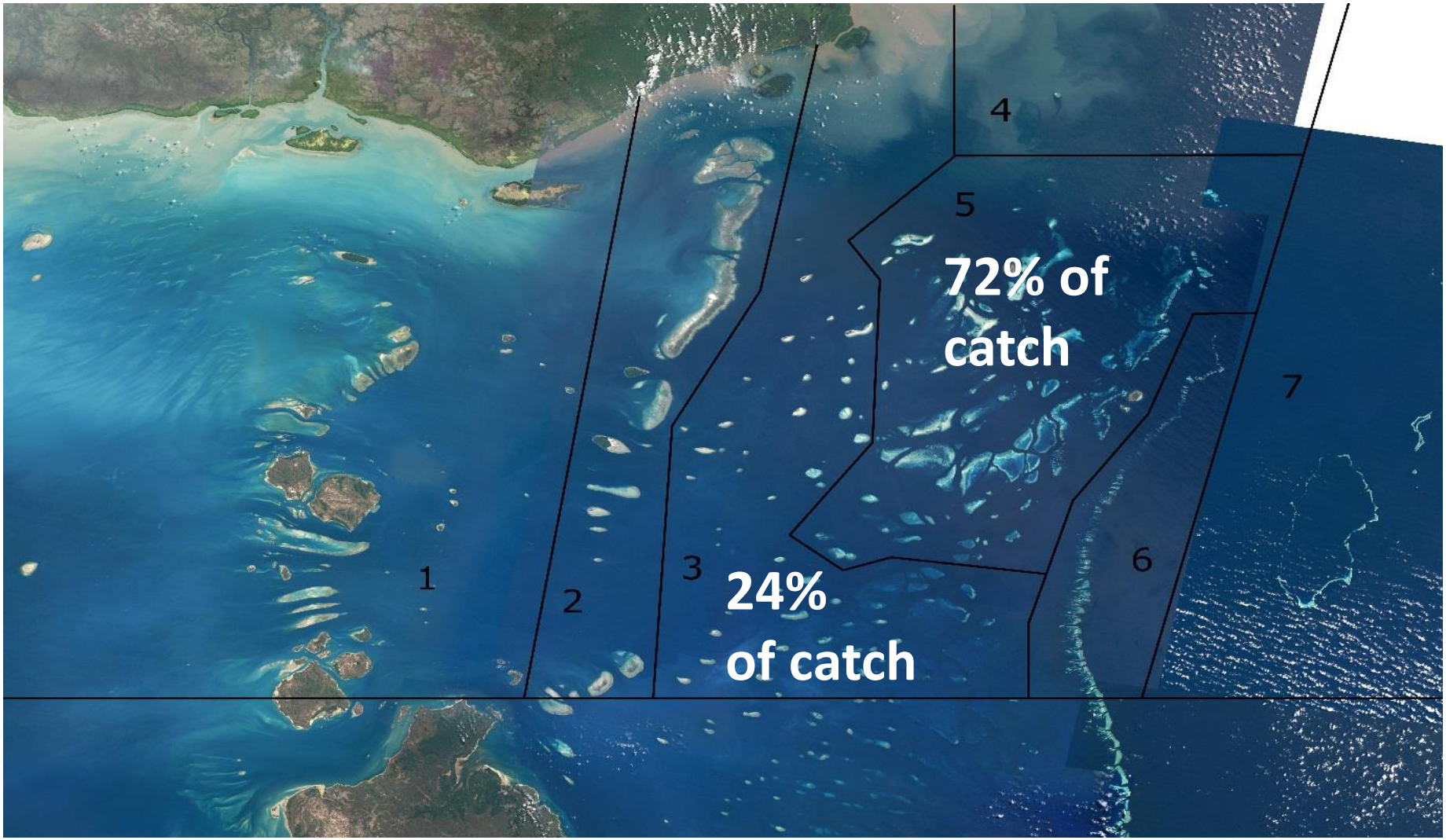
Solid lines = model 2

GBR Bioregions

- Each Bioregion is modelled separately in the GBR coral trout assessment.



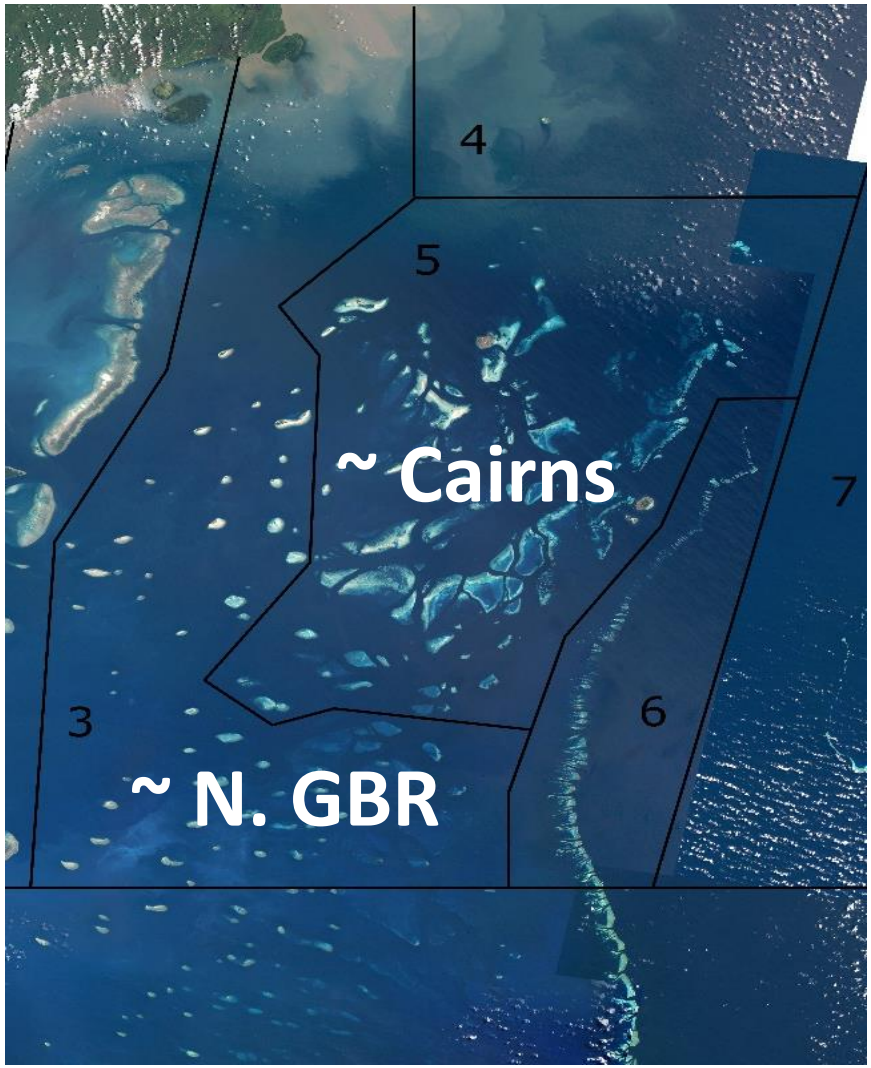
- For Torres Strait we have added two extra regions to the GBR model.

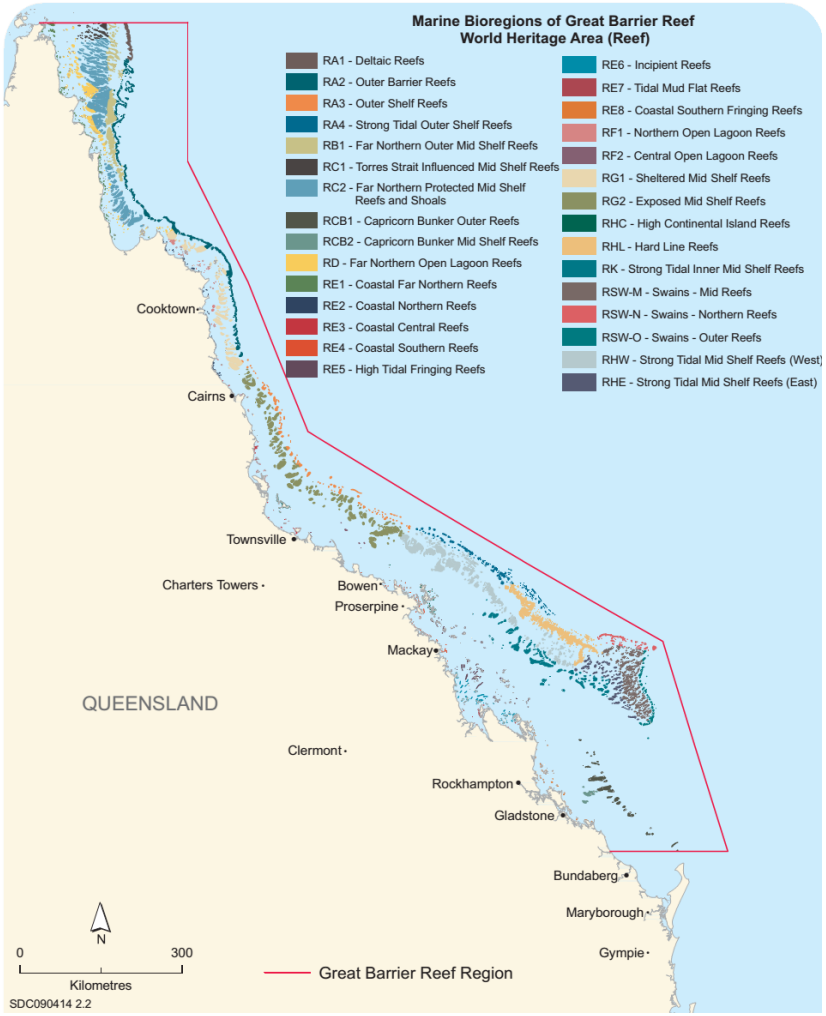


Underwater visual survey data from GBR

- Extensive series of surveys carried out 1983–1986, funded by GBRMPA
- Extremely valuable resource
- Provides number of adult fish per hectare of habitat.
- Especially valuable because it was undertaken prior to the major growth phase of the fishery
- Measure of *absolute abundance*
- Need to find similar regions from GBR to transfer information into Torres Strait regions.

- Similar regions from GBR





Inputs in model:

TS5 = Cairns

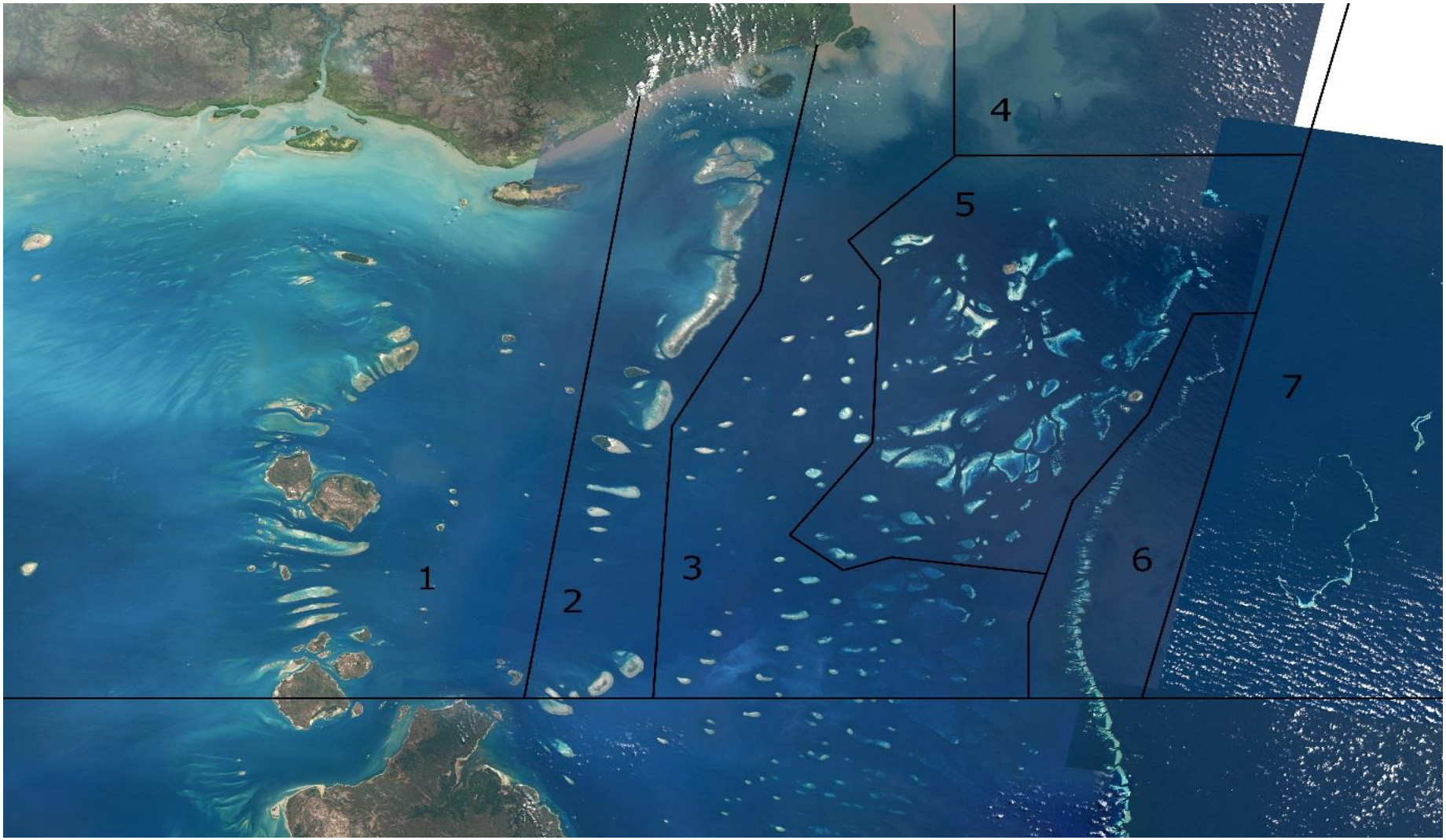
TS3 = Cape York

CpueMat[, 1] = CPUE.TS5.r

CpueMat[, 2] = CPUE.TS3.r

```
> head(CpueMat.GBR)
        Cairns Cape York Capricorn-Bunker  Cooktown Lockhart River    Mackay Princess Charlotte Bay    Swains
1992 0.7961137  1.122521        0.4331848 1.2216130      0.7612445 1.3177974               1.005820 0.9416550
1993 0.9083815  1.736435        0.3757893 1.2962389      1.7442753 0.9801108               1.680100 1.1089374
1994 0.8784611  1.718204        0.4458345 1.0211086      1.3979371 0.8508293               1.238731 0.8457863
1995 0.7899446  2.513793        0.5005222 0.8203356      1.4925455 1.1452780               1.339459 1.4428090
1996 0.7684892  1.654568        0.6932957 0.8777823      1.6081995 1.1601963               1.245527 1.3269990
1997 0.7431368  1.428319        0.6759553 0.9282617      1.1978232 0.7281171               1.320629 0.9617560
```

Estimated suitable habitat



Typical estimates for GBR

Table 23: Habitat area (equivalent reef slope, ha), abundance (fish ≥ 38 cm total length per hectare) and population size estimates of common coral trout **P. leopardus**, *by Subbioregion and zoning. Cells labelled NS correspond to Bioregions that were not surveyed; bioregion RHL was important but not surveyed, and was assigned the average abundance of the two neighbouring Bioregions RHW and RA4. Subbioregions designated high-catch are marked *.*

Subregion	Subbioregion	Habitat area		Abundance	Population size	
		Blue	Green		Blue	Green
Cape York	RE1 North	3088	387	1.03	3169	397
	RD North	985	4078	5.95	5862	24275
	RC1*	3065	1195	9.38	28733	11200
	RC2 North*	8036	15210	10.38	83409	157875
	RB1 North	3120	3625	16.98	52967	61553
	RA1	2893	2582	5.92	17139	15293
	RA2 North 1	0	2597	8.71	0	22617
Lockhart River	RE1 Central	2093	1442	1.03	2148	1480
	RD Central*	14702	4203	5.95	87515	25017
	RC2 Central*	15580	4115	10.38	161715	42717
	RB1 Central*	19440	2138	16.98	330055	36304
	RA2 North 2	3811	6262	8.71	33188	54523
Pr. Char. Bay	RE1 South	2475	576	1.03	2540	591
	RD South	2123	800	5.95	12635	4764
	RC2 South*	13446	8050	10.38	139572	83558
	RB1 South	2353	1397	16.98	39950	23727
	RA2 North 3	3474	2644	8.71	30252	23020
Cooktown	RE2	1161	1358	8.49	9852	11529
	RF1 North*	2656	1819	9.23	24520	16792
	RG1*	24680	7518	13.52	333702	101657
	RA2 South*	8699	7318	8.71	75751	63724

Habitat area and UVS fish density

- Examined only the two major Regions: TS3 and TS5.
- Habitat area estimates (equivalent reef slope):
  - TS3: 19,721 ha
  - TS5: 35,574 ha (using Cairns–Townsville Bioregion RG2)
  - TS5 alternative: 30,735 ha (using Cooktown Bioregion RG1)
- Virgin fish density (adult coral trout):
  - TS3: 32.73 fish per ha
  - TS5: 35.65 fish per ha
  - TS5 alternative: 53.19 fish per ha

Old fish survey

CSIRO

MARINE RESEARCH

INFLUENCE OF COASTAL PROCESSES ON

LARGE SCALE PATTERNS IN REEF FISH COMMUNITIES

OF TORRES STRAIT, AUSTRALIA

David A. Milton

Brian G. Long

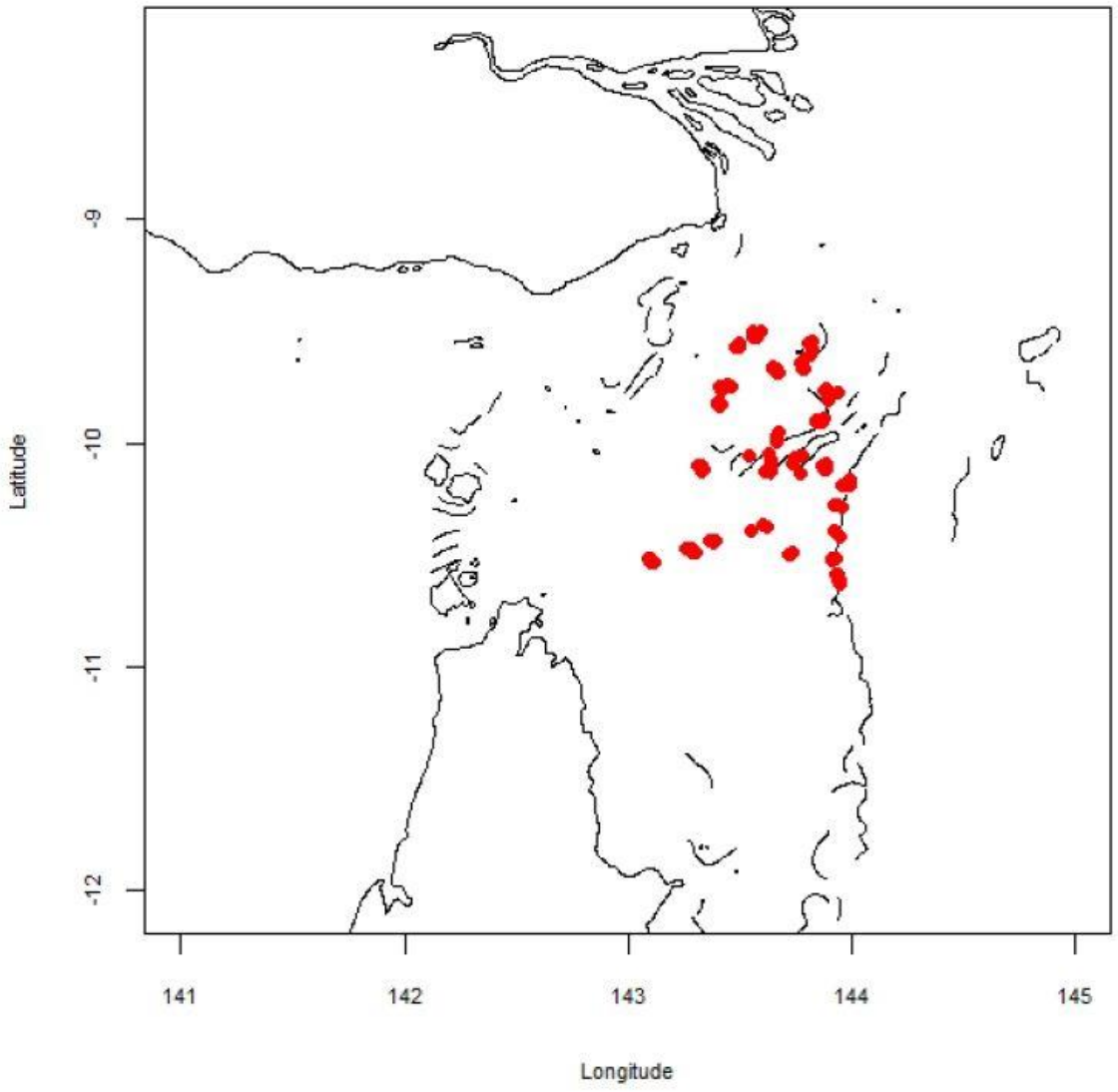
June 1997

REPORT MR-GIS 97/6

Old fish survey

The fish fauna of the edge of coral reefs in Torres Strait was investigated by underwater visual transects at 276 sites on 41 reefs between August 1995 and January 1996. The fish community contained most common families of tropical Indo-Pacific coral reefs. Acanthurids, Chaetodontids, Pomacentrids and Labrids were the most widespread and speciose families observed. The relative abundance of each species at each site was used to classify sites with multi-dimensional scaling (MDS). The species composition varied

Old fish survey - sites



Old fish survey – species split

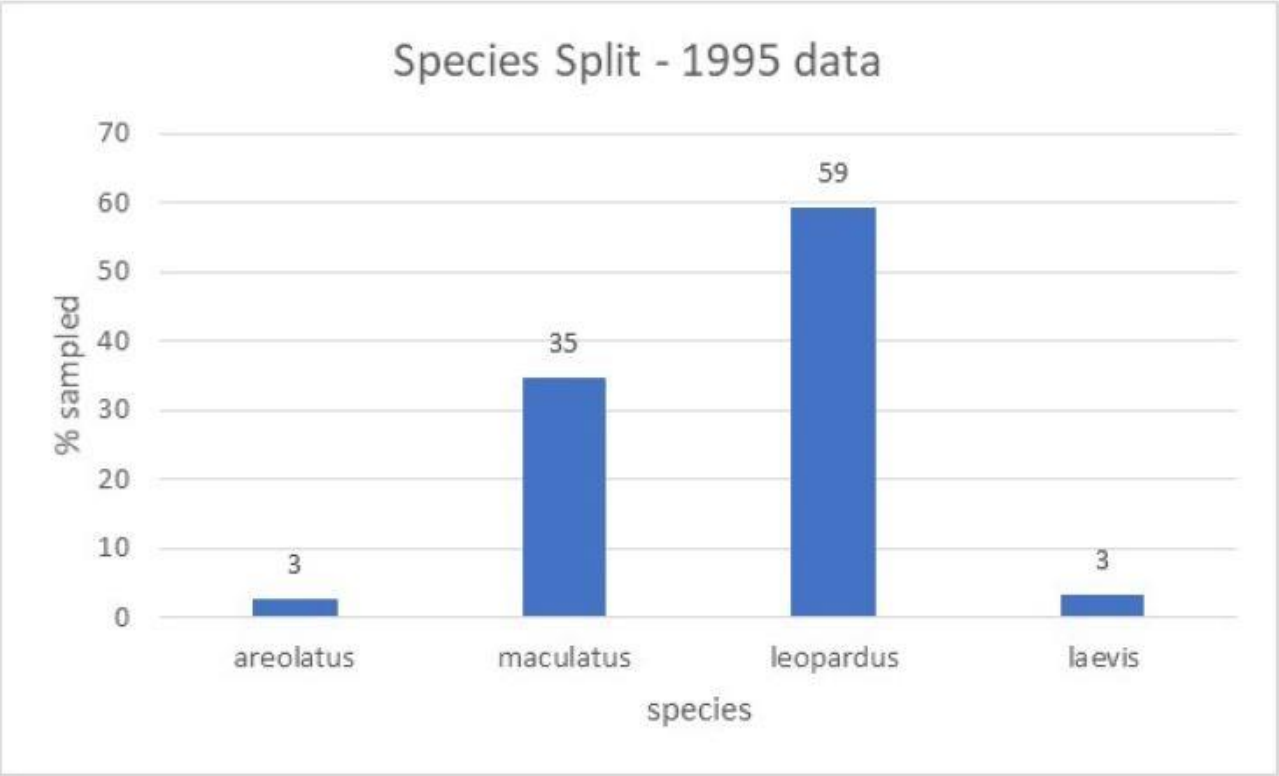


Figure 1. The species split across the four species within category of "Coral Trout" using 1995 data.

Table 1. Count of fish for each species of the group "Coral trout"

Year	areolatus	maculatus	leopardus	laevis
1995	19	249	427	24
1996	0	124	0	0
Grand Total	19	373	427	24

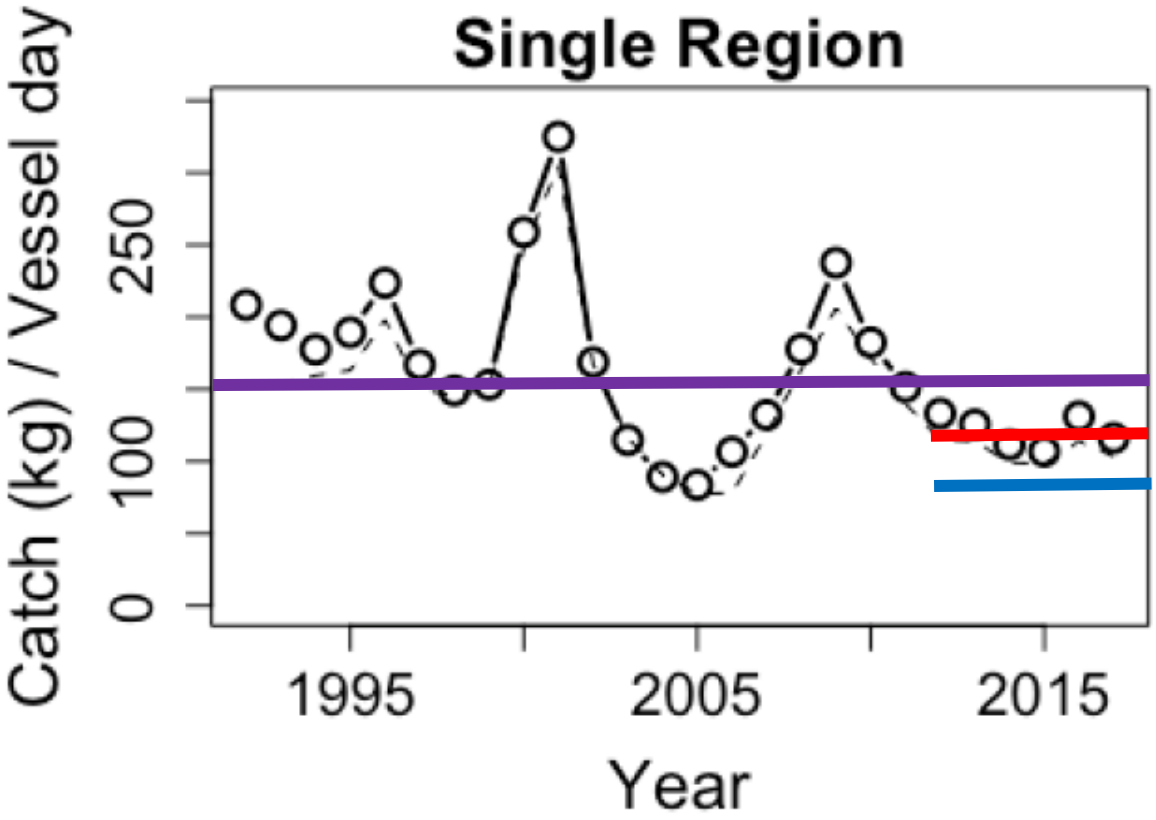
Density estimates

Four sp		per 1/10 H	per H
areolatus	1.58	1000	10000
laevis	1.6		
leopardus	5.55		
maculatus	3.45		
	3.045		**30.45**

TS3: 32.73 fish per ha
TS5: 35.65 fish per ha

Comparable

Previous discussions



Red line about 120 kg/Vessel day – B80

Don’t want to drop below B60 (0.75 x 120 = 90kg/Vessel day)

Update to time series

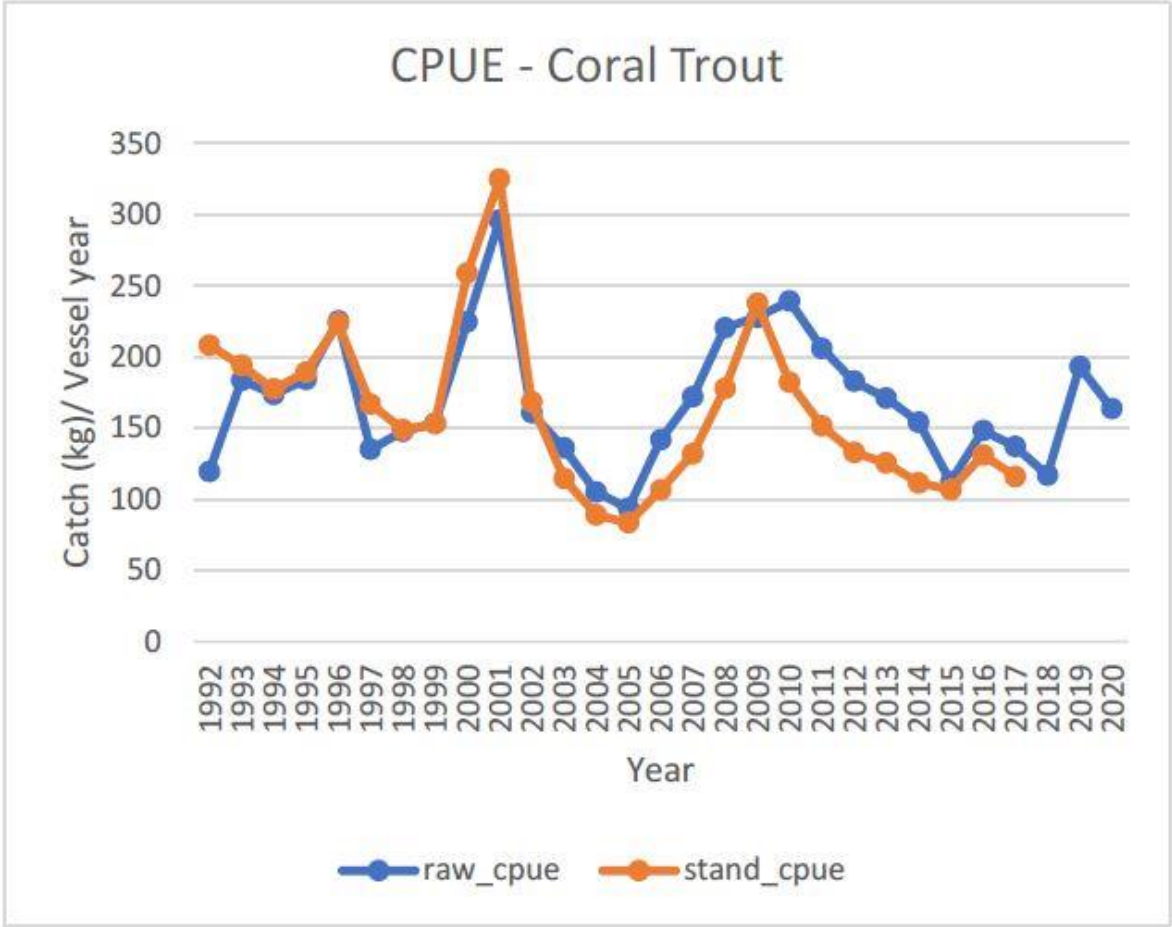
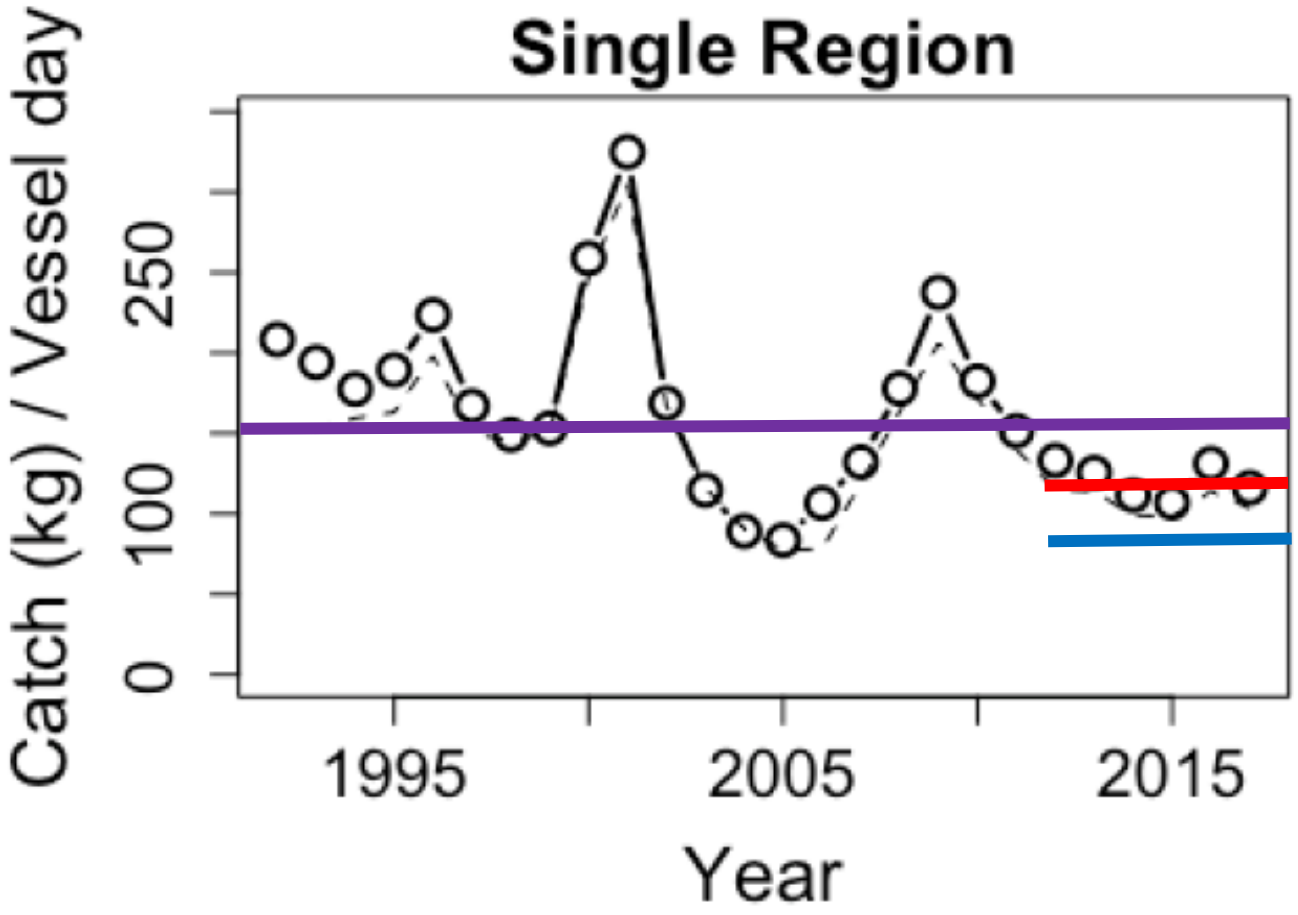


Figure 1. CPUE (not standardised) till 2020 and standardised CPUE till 2017 for Coral Trout (all four species; all areas).

Do we update (and when)



Reference points derived from parameter estimates in the model (TIB estimated catch – with recruitment deviations)

Quantity Estimated From Model	Region 3	Region 5	Total Regions 3 & 5
Virgin Exploitable Biomass (t)	1,476	1,448	2,924
Yield (tonnes) [at B20]	106	104	211
Yield (tonnes) [at B40]	129	127	256
Yield (tonnes) [at B50]	123	121	244
Yield (tonnes) [at B60]	109	107	216
Yield (tonnes) [at B80]	100	98	198
Yield (tonnes) [at MSY]	129	127	256

Conservative Biological Catch – 149 Tonnes (Y_{B60} in TS5 * 1/.72)

RBC setting and TAC

- Current status 80% of B_{virgin} (preliminary assessment)
- Current constant catch is 134.9 tonnes
- Assessment given preliminary is to stick with 134.9 tonnes
- Reason – all the estimates RBC from preliminary assessment is >> 134.tonnes
- Future: monitor catch rates (TIB data very valuable)

Summary

Real issue – when do we modify HS, think about an assessment and do CPUE standardisation again?

Other issues:

- TIB catch data
- By year
- By species
- What about length frequency etc.

Attachment E

Torres Strait Finfish Fishery: ***Management Strategy Evaluation of Spanish mackerel for the Torres Strait Finfish Fishery***

A Harvest Strategy for the Torres Strait Spanish Mackerel Fishery (TSSMF) is required to guide future decisions on sustainable commercial catch limits and potential expansion of the fishery using indicators of stock status. The strategy will help the fishery achieve its ecological, economic and cultural management objectives consistent with the *Torres Strait Fisheries Act 1984, Torres Strait Finfish Fishery Management Plan 2013* and the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines*.

A Harvest Strategy for the Spanish mackerel will also guide future investment on finfish research, assessment, data collection and monitoring to make sure the interests of Torres Strait Traditional Owners are considered in developing biologically, culturally and economically sustainable fishing opportunities.

An AFMA-funded project, led by CSIRO, titled: *Harvest Strategies for the Torres Strait Finfish Fishery* was funded in 2017/18 and 2018/19. Under this project guiding principles and key fishery attributes for developing a harvest strategy for Spanish mackerel have identified, together with operational objectives, an interim target reference point, an aspirational future target reference point and limit reference point.

The Finfish Fishery Resource Assessment Group (FFRAG) has recommended that a Management Strategy Evaluation now be undertaken to finalise a harvest strategy for Spanish mackerel that meets Traditional Owner objectives and are robust to uncertainties.

Desired outcomes:

In consultation with AFMA and the FFRAG, the project team will use Management Strategy Evaluation to quantitatively evaluate the performance of candidate Harvest Control Rules to meet the stakeholder objectives and complete the elements of a fisheries harvest strategy.

Applicants wishing to submit a proposal can contact AFMA for further information.

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