Commonwealth Small Pelagic Fishery (SPF): Fishery Assessment Report 2023

Presentation to SPFRAG 7 December 2023 (No confidential data)

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Jack Mackerel Fishery and SPF



Source: Bulman et al. (2008), Expert Panel Report (2014) *2007 data incomplete



- Jack Mackerel Fishery (purse-seine) off Tasmania up to 2000
- Highest total catch of ~39,700 t in 1986/87
- SPF established in 2001
- JMK rules (TAC, zones, input controls, etc) up to 2008/09
- Mid-water trawling began in 2001/2002
- Harvest Strategy (2008, last revised 2017)
- Management Plan (2009)

Three SPF sub-areas: Western, Eastern and Sardine



Target species: Jack Mackerel, Blue Mackerel, Redbait. Sardine in Sardine Sub-area only (Total Allowable Catches)

Seven sub-zones, catch grids, trawl closures and MPAs



Catch grids established to control spatial/temporal concentration of effort

Catch and effort data

- SPF 2000/01 to 2022/23 (AFMA) Blue Mackerel, Jack Mackerel, Redbait, Sardine
- NSW Purse-seine Blue Mackerel, Sardine (Many thanks to John Stewart)

Not included in estimates of total catch: SESSF, WTBF, ETBF, state line-fisheries, recreational catches*RBCs to TACs (AFMA)

Catch Sampling 2022/2023



Catch Sampling Summary 2022/23

Species	SppCat	Samples	Fish	Otoliths Weighed	Otoliths Read
ВМК	ВМК	24	246	234	118
ВМК	BMK Targeted large fish	8	121	115	59
ЈМК	ЈМК	25	288	287	120
RBT	RBT	20	237	234	95

Sampling targets and budgeted (Jack Mackerel and Blue Mackerel only, no RBT or Sardine)

- 30 samples
- 10 lengths and otolith weights per sample (300 fish)
- 5 otoliths sectioned and read (150 otoliths)

Targeted sampling of large Blue Mackerel to address uncertainties in age, growth and reproduction

Tom Alderson M.Sc. thesis – also using samples from Blue Mackerel Spawning Fraction Stage 1 and 2

Historical data from SARDI (all species for Harvest Control Rule Project funded by SPFIA)

Total SPF Catch 2000/01 to 2022/23



Total SPF Trawl Catch, Effort and CPUE 2000/01 to 2022/23



Jack Mackerel: Eastern Sub-area





Commonwealth: Purse-seine



Total trawl catch in 2022/23 highest in SPF history

Second highest 2019/20: 7,868 t

Decline in CPUE from 2003/04 to 2010/11 (Tas RBT)

High CPUE 2014/15 to 2016/17

Current operation: 4.6-7.9 t.trawl hr-1

5.8 t.trawl hr-1 in 2022/23

Jack Mackerel: Eastern Sub-area







Jack Mackerel: Eastern Sub-area (Sub-zone 6)



Length frequency distributions for mid-water trawl from Grammer et al. (2022)

Majority of the catch less than size of 50% maturity and not part of the spawning biomass

Jack Mackerel: Eastern Sub-area (Sub-zone 6)





Consolidate data for final report. Establish SPF database?



Age frequency distributions from mid-water trawl Grammer et al. (2022)



Jack Mackerel: Eastern Sub-area

Key Findings of DEPM

- Eggs widespread between Jervis Bay and south-eastern Tasmania, especially in Bass Strait
- Survey area refined in 2019 compared to 2014 (extended into Bass Strait)
- New spawning habitat discovered in Bass Strait
- Egg densities and mean daily egg production lower in 2019 than 2014
- Spawning fraction also lower in 2019 and than 2014
- Peak of spawning season may have occurred prior to 2019 survey (especially in the north)
- Likely mixing of Eastern and Western "stocks" in Bass Strait

Need to:

- Optimise timing of survey (start late December early January instead of mid January?)
- Improve adult sampling (faster trawler, other methods?)
- Obtain better estimates of spawning fraction and relative fecundity (alternative methods)
- Establish optimal model for estimating *P*₀

		Recommendations
Recommended Biological Catch (RBC)	2023-24	4 th season at Tier 1 156,292 x 12% = 18,755 tonnes

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 SPF Catch (t)	SPF Catch % Spawning Biomass	SPF Catch % RBC	SPF Catch % TAC
2019 (Jan)	156,292 t	18,755 t	18,720	SPF 9,341	6.0%	49.8%	49.8%
(Ward at al	(10 120-263 106 +)						

(Ward et al. (49,120–263,496 t) 2020)



- Historically taken as by-catch off Tasmania
- Catch first increased in 2014/15 to 2016/17 (factory-trawler)
- Increased rapidly since 2017/18
- Highest catch ~10,007 t in 2021/22
- Total trawl catch in 2022/23 was <u>9,586 t</u>
- CPUE of ~5.7 t.trawl hr-1 in 2022/23

Blue Mackerel: Eastern Sub-area









Total catch 2022/23: ~9,814 t





Blue Mackerel: Eastern Sub-area (Sub-zone 6)





Length frequency distributions for mid-water trawl from Grammer et al. (2022)

 Majority of the catch less than size 50% maturity and not part of the spawning biomass

Blue Mackerel: Eastern Sub-area (Sub-zone 6)





Age frequency distributions from mid-water trawl Grammer et al. (2022)

Targeted sampling large Blue Mackerel



Tom Alderson's M.Sc.

Age, growth and reproductive maturity of Blue Mackerel off eastern Australia

Samples: BMK Spawning Fraction 1 and 2

Reanalysis:

Harvest Control Rules (SPFIA)

Re-run MSE (Smith et al 2015) using recent fishery data

All species: especially Blue Mackerel

ER in HS: 23% reduced to 15% (RAG)



Age (years)

Alderson et al. (2023), M.Sc. thesis





Key Findings of DEPM

- Similar egg distributions in 2014 and 2019
- Eggs widespread and abundant off northern NSW and southern Queensland
- Few eggs south of Sydney where fishery is located
- Spawning area 14% larger in 2019 than 2014
- Egg densities and mean daily egg production similar in 2014 and 2019 (data combined)
- Spawning fraction and other adult parameters estimated from South Australian samples

Need to:

- Estimate adult parameters of Blue Mackerel off east coast, especially spawning fraction
- Investigate potential latitudinal gradient in timing of spawning season
- Understand why no eggs collected off southern NSW? Does spawning occur later there?
- Establish optimal model for estimating P0

Recommendations						
Recommended Biological Catch (RBC)	2023-24	3 rd Season at Tier 1 (2019-20 DEPM) 80,000 x 15% = 12,000 tonnes				

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 Catch (t)	Catch % Spawning Biomass	Catch % RBC	Catch % TAC
2019 (Sept)	80,000	12,000 t	11,600	SPF E Trawl: 9,586 t SPF E Total: 9,637 t	12.0% 12.0%	79.9% 80.3%	82.6% 83.1%
(Ward et al. 2021)	88,265 t (33,320-143,209 t)			E Total: 9,814 t	12.0%	81.8%	84.6%

Redbait: Eastern Sub-area







- Trawl catch peak of 7,733 t in 2003/04
- 2019/20: 2,412 t
- 2021/22: 1,890 t
- 2022/23: <u>1,921 t</u>
- CPUE ~10 t.trawl hour-1 in 2001/02
- CPUE in last six years ~1.7–3.5 t.trawl hour-1

Redbait: Eastern Sub-area





Redbait: Eastern Sub-area (Sub-zone 6)





Redbait (East)

Age frequency: mid-water trawl catch samples



Redbait: Eastern Sub-area





Key Findings of DEPM

- Eggs on mid to outer shelf between Jervis Bay and south-eastern Tasmania
- Larger survey and spawning area in 2020 than in 2005 and 2006
- Improved estimates of adult parameters compared to previous surveys
- Estimating egg production is key challenge due to long duration of egg development (~4 days)
- Peak of spawning season may have ended soon after the egg survey was completed
- · Adult samples collected after the egg survey had low spawning fractions
- Population likely continuous around southern Tasmania

Need to:

- Optimise timing of egg and adult surveys
- Ideally conduct egg and adult sampling concurrently from two separate vessels
- Investigate spatial and temporal variation in spawning season and spawning fraction
- Establish optimal methods for estimating P0 that account for slow egg development rate

Recommendations					
Recommended Biological Catch (RBC)	2023-24	2 nd Season at Tier 1 54,000 x 10% = 5,400 tonnes			

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 SPF Catch (t)	SPF Catch % Spawning Biomass	SPF Catch % RBC	SPF Catch % TAC
2020 (Oct)	52,629 t	5,400 t	5,380 t	1,921 t	3.7%	35.6%	35.7%
Grammer et al. (2022)	(13,937–91.321 t)						





Total catch in 2022/23: 345 t

Includes 14 t in SPF trawl





Key Findings of DEPM

- Eggs patchily distributed along the east coast
- Patches off southern Queensland, northern NSW and southern NSW
- Few eggs collected between 30°S (Coffs Harbour) and 33°S (Newcastle)
- Spawning area fell from 22,400 km² in 2014 to 14,281 km² in 2019
- Driven by reduction in eggs between Coffs Harbour and Newcastle
- Spawning biomass fell from 49,575 t to 42,724 t

Need to:

Estimate adult reproductive parameters robustly

Recommendations						
Recommended Biological Catch (RBC)	2023-24	3 rd Season at Tier 1 (2019-20 DEPM estimate) 42,724 x 20% = 8,454 tonnes				

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 Catch (t)	Catch % Spawning Biomass	Catch % RBC	Catch % TAC
2019 (Sep)	42,724 t	8,454t	7,970 t	SPF: 70 t	0.2%	0.8%	0.9%
Ward et al. (2021)				Total: 345 t	0.8%	4.1%	4.3%

Jack Mackerel: Western Sub-area



Jack Mackerel: Western Sub-area

Key Findings of DEPM

- Presence of Jack Mackerel eggs in Bass Strait established
- Jack Mackerel from Eastern and Western Sub-areas may mix in Bass Strait
- Discontinuity in egg distributions off Bonney Coast suggests potential separation between South-eastern Australia and Great Australian Bight
- Spawning biomass of south-western Tasmania and in western Bass Strait may be smaller than off south-eastern Australia
- Best estimate of biomass of 34,978 tonnes is 31,069 t plus Bass Strait

Need to:

- Ensure future surveys include Bass Strait
- RAG recommended limiting catches off south-west coast of Kangaroo Island (G54, G55)

Recommendations					
Recommended Biological Catch (RBC)	2023- 24	1 st Season at Tier 2 34,978 x 6% = 2,099 tonnes			

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 SPF Catch (t)	SPF Catch % Spawning Biomass	SPF Catch % RBC	SPF Catch % TAC	
2016/17 (Dec-Feb)	34,978 t	2,099 t	2,100 t	2 t	0.0%	0.1%	0.1%	-
Ward et al. (2018)								







Key Findings of DEPM

- Eggs found in eastern and western Great Australian Bight
- Few eggs found in eastern part of Western Sub-area
- Comprehensive survey of stock has not been conducted
- Potentially large unfished stock in western GAB and off southern WA

Potential to:

• Coordinate DEPM survey off WA with DEPM survey for SA Sardine and Blue Mackerel

Recommendations					
Recommended Biological Catch (RBC)	2023-24	7 th Season at Tier 3 86,500 x 3.75% = 3,244 tonnes			

Source: AFMA SPF Species Summary 2023

Year	DEPM Spawning Biomass	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 SPF Catch (t)	SPF Catch % Spawning	SPF Catch	SPF Catch
(Source)	(95% CI)				Biomass	% RBC	% TAC
2006	86,500 t	3,244t	3,240 t	13 t	0%	0.4%	0.4%
Ward et al.							

(2007, 2009)

Redbait: Western Sub-area



Redbait: Western Sub-area



Key Findings of DEPM

- Eggs widespread and abundant on outer shelf and upper slope waters in the eastern portion of the Western Sub-area
- No eggs collected in Bass Strait
- Distribution appears to continuous around southern Tasmania
- Spawning area 28,365 km²
- Redbait also occur west of the survey area
- Robust estimates of adult parameters, especially spawning fraction
- Main challenge is estimating P0

Need to:

- Establish reliable method for estimating P0
- Understand distribution and abundance west of the survey area

Recommendations					
Recommended Biological Catch (RBC)	2023-24	5 th season at Tier 1 66,787 x 10% = 6,678 tonnes			

Source: AFMA SPF Species Summary 2023

Year (Source)	DEPM Spawning Biomass (95% CI)	2021/22 RBC (t)	2021/22 TAC (t)	2022/23 SPF Catch (t)	SPF Catch % Spawning Biomass	SPF Catch % RBC	SPF Catch % TAC
2017 (Oct)	66,678 t	6,678 t	6,680 t	25 t	0%	0.4%	0.4%
Ward et al. (2019)							