

Commonwealth Small Pelagic Fishery: Fishery Assessment Report 2018

SOUTH
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RESEARCH &
DEVELOPMENT
INSTITUTE
PIRSA

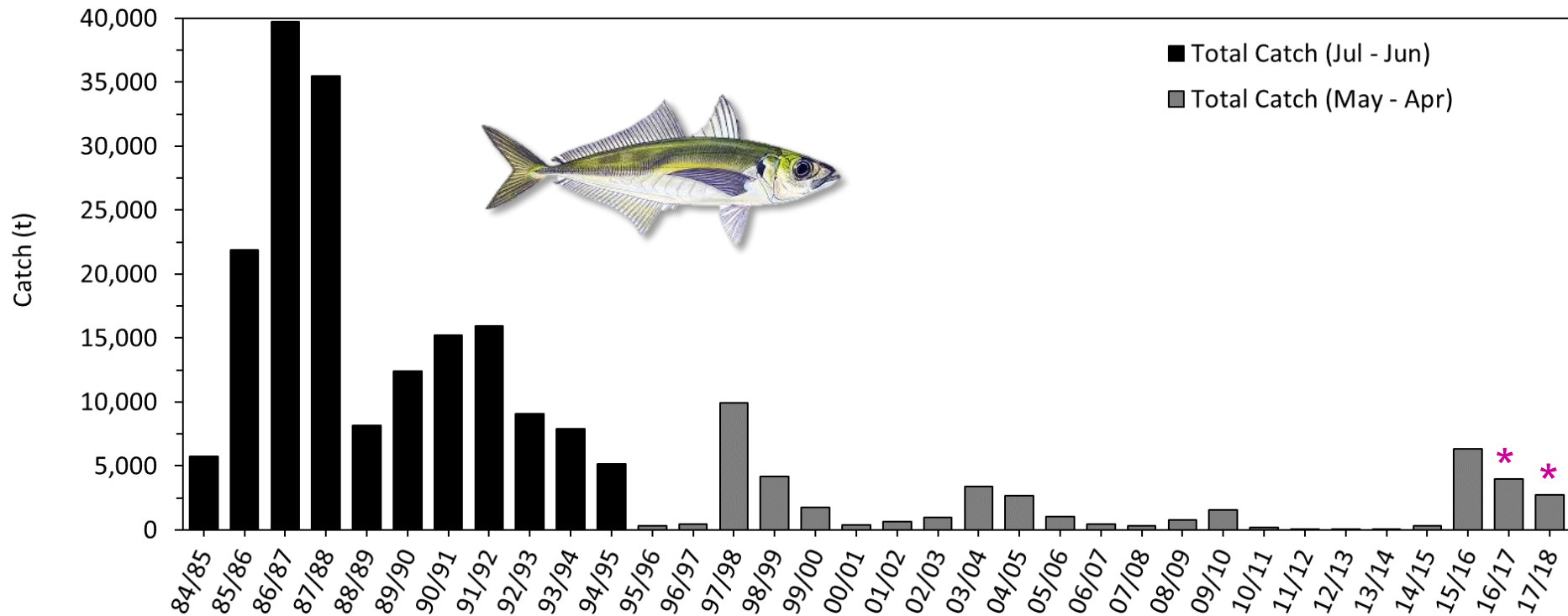
T. M. Ward and G. L. Grammer

November 2018



Jack Mackerel (East)

Total Catch

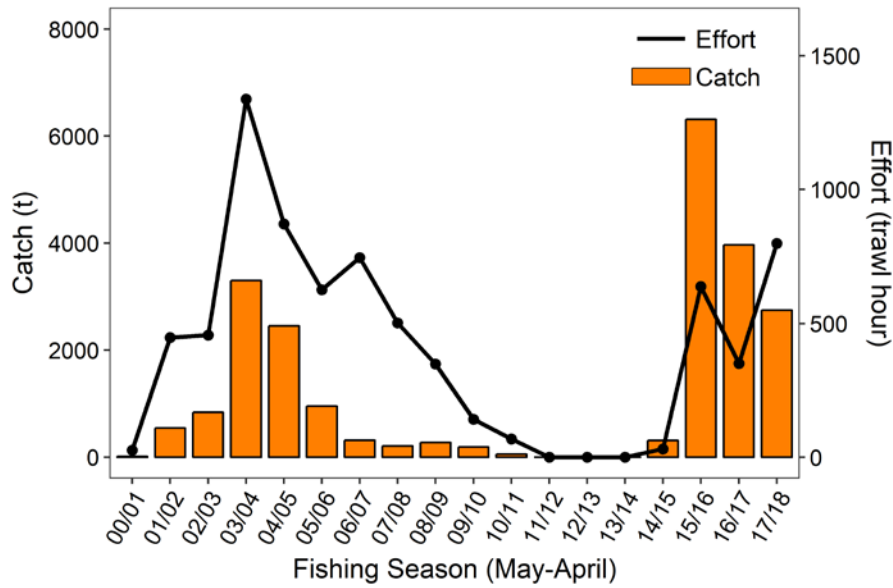


- Total Catch: peaked at ~39,700 t in 1986/87
- Principal Fishery: Commonwealth JMK/SPF
- Early 1990s: annual catch ↓ and averaged ~11,000 t·yr⁻¹
- Annual catch <4,500 t between 1997/98 & 2014/15
- Substantial ↑ in 2015/16 to 6,321 t
- Total catch in 2017/18: 2,751 t
- * VIC catch not included: confidential

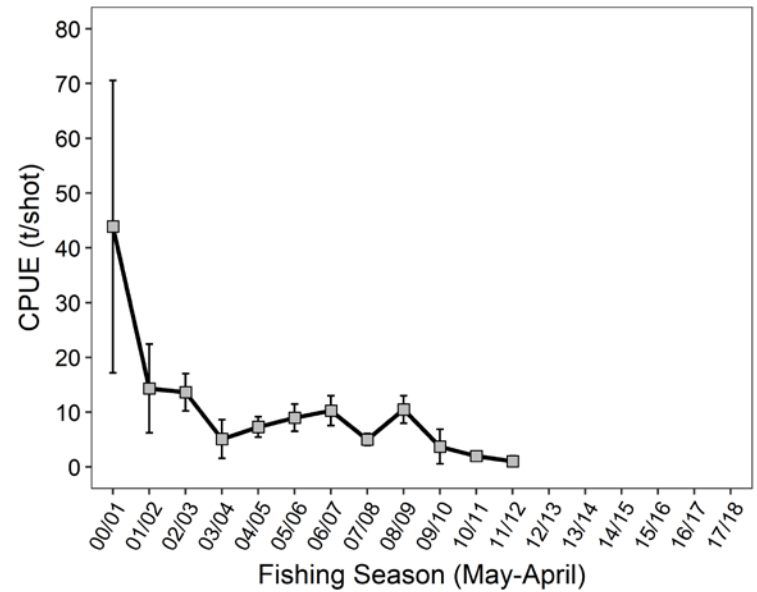
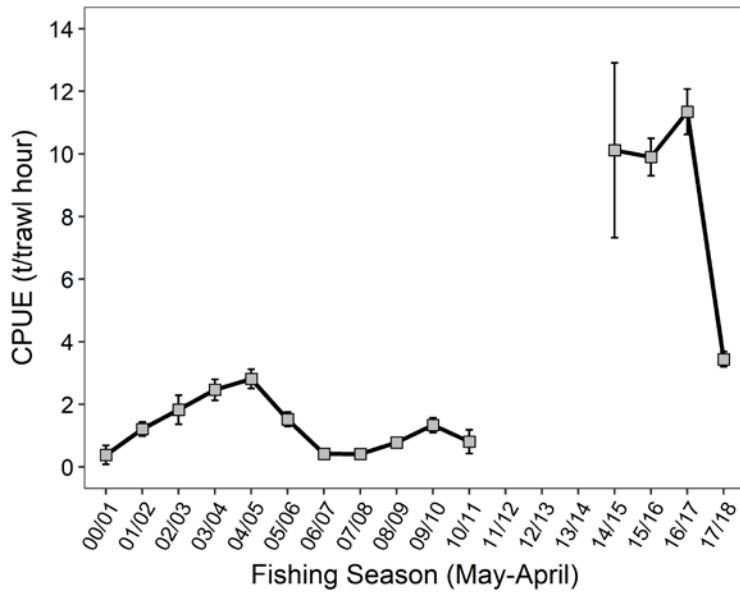
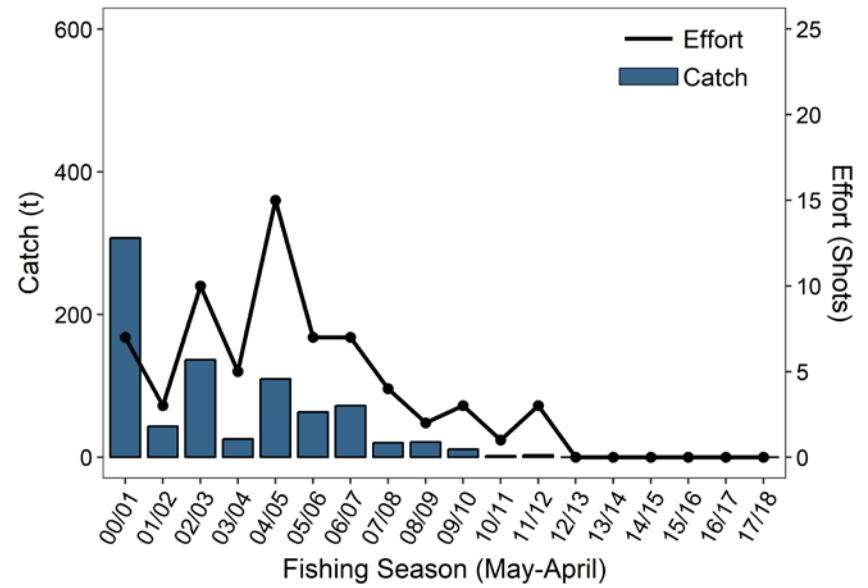


Jack Mackerel (East)

Commonwealth: Trawl

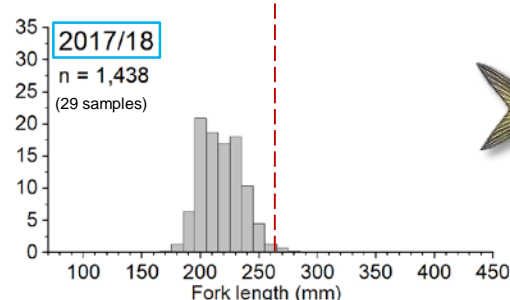
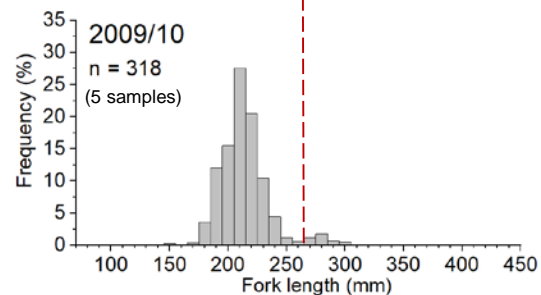
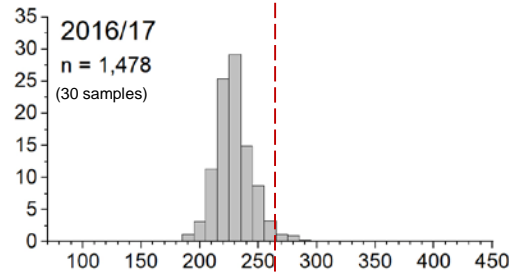
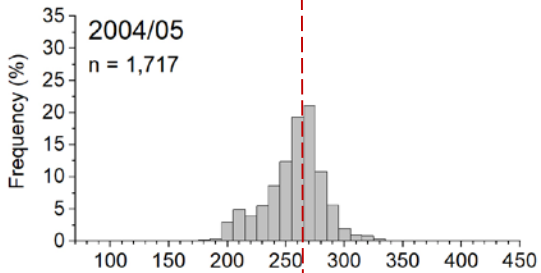
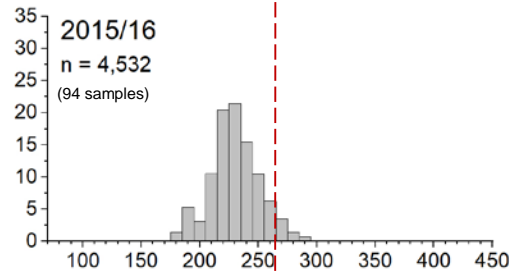
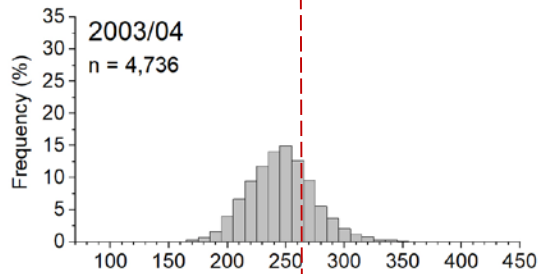
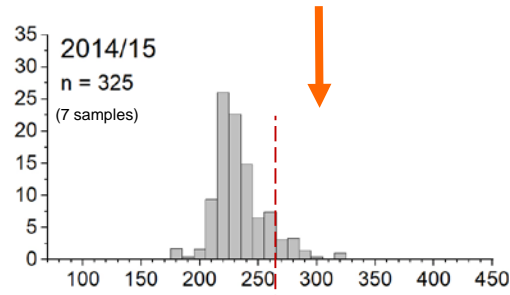
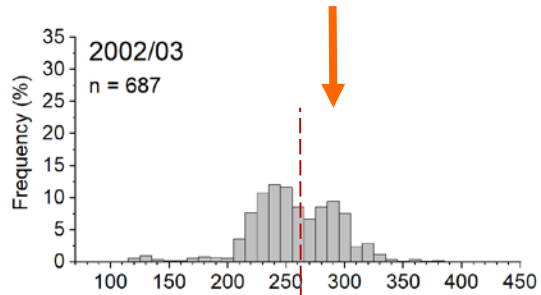


Commonwealth: Purse Seine



Commercial Mid-water Trawl: (2002/03 to 2017/18)

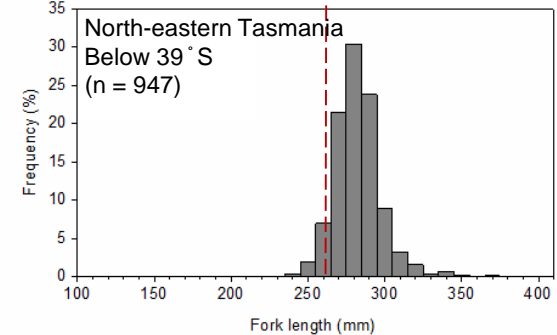
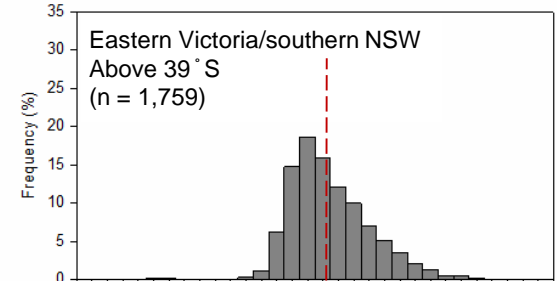
- Caught in the SPF
- Eastern TAS (Sub-zone 5)
- Data: TAFI/AFMA
- 2014-2018 (catch weighted)
- Off southern NSW (Sub-zone 6)
- Data: SARDI (SPF Fishing Season)



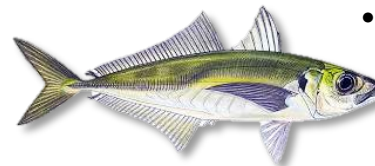
Jack Mackerel (East)

Length Frequency

Research Demersal Trawl (2014 DEPM survey)



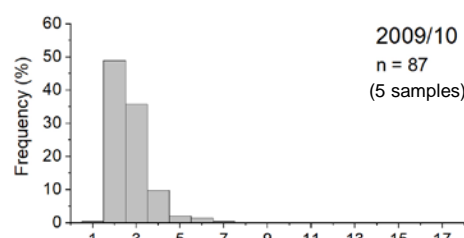
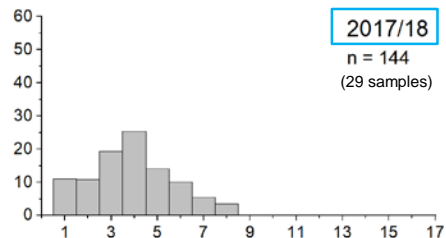
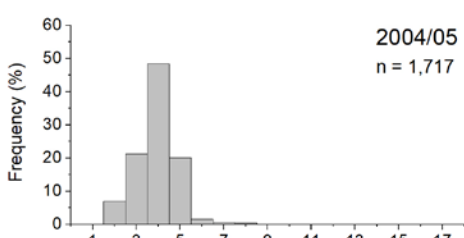
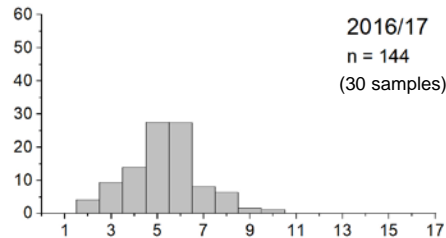
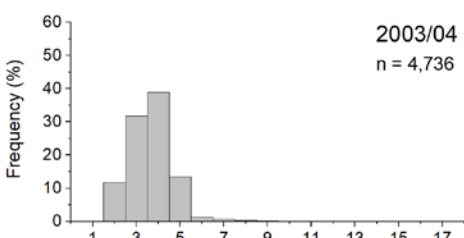
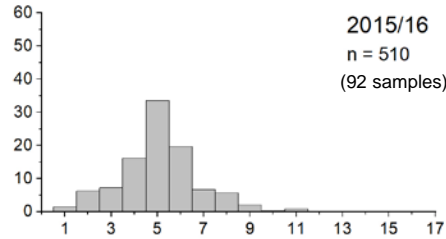
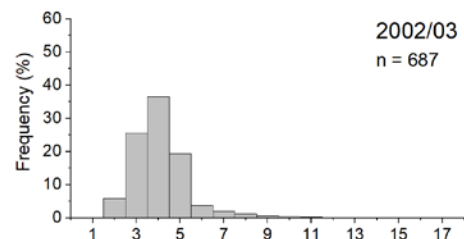
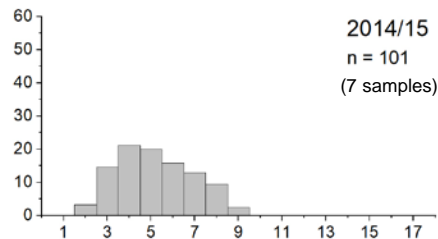
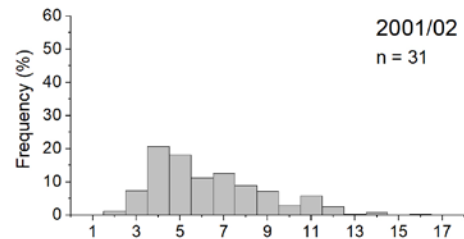
- January 2014
- Between St. Helens, TAS and Eden, NSW
- Data: SARDI



-- Female size at maturity
(~ 268 mm FL)

Jack Mackerel (East)

Age Frequency: Mid-water Trawl

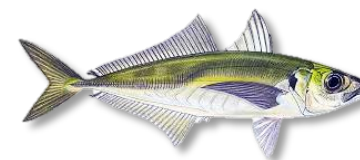


2001/02-2009/10

- Caught in the SPF
- Eastern TAS (Sub-zone 5)
- Data: TAFI/AFMA

2014/15-2017/18

- SPF Fishing season
- Catch-weighted
- Off southern NSW (Sub-zone 6)
- Data: SARDI



✦ Age at maturity: ~3 to 4 yrs

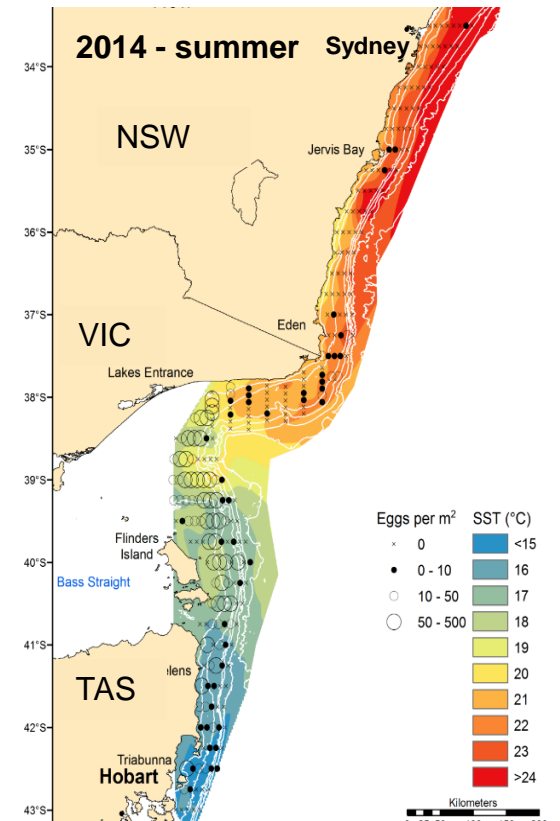
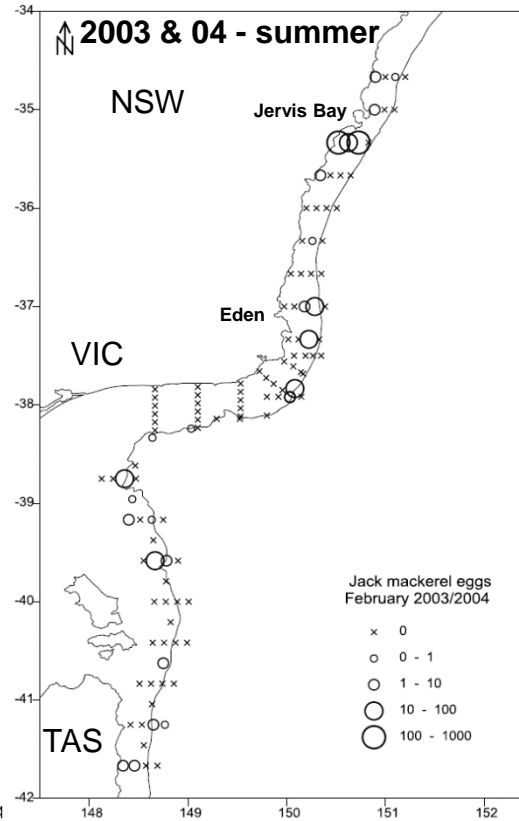
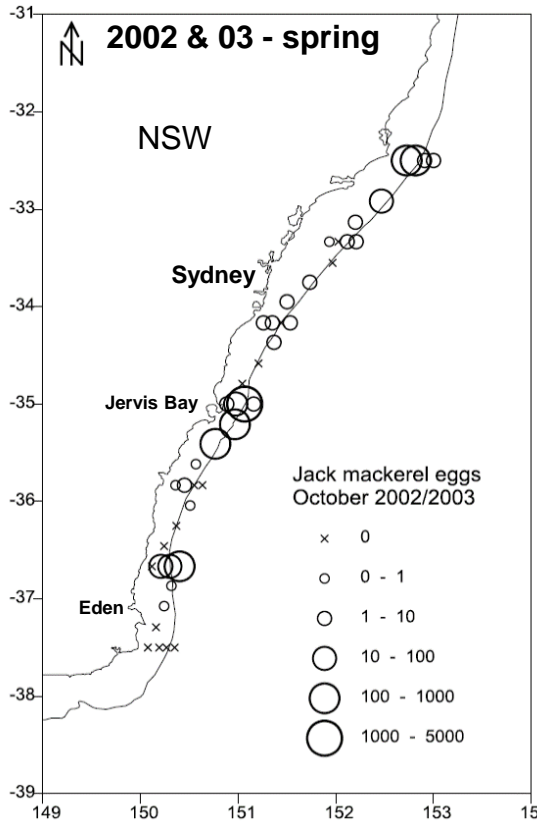
* **Note:** Ageing protocols use reference collections from IMAS

Jack Mackerel (East)

DEPM Surveys



Egg surveys



Adults:

- Collected off S.E. Australia (2001 to 2004)
- Purse seine and mid-water trawl
- Female n = 100

Adults:

- Collected off S.E. Australia (Jan 2014)
- Demersal trawl
- Female n = 1,285

Jack Mackerel (East)



% DEPM, RBC & TAC

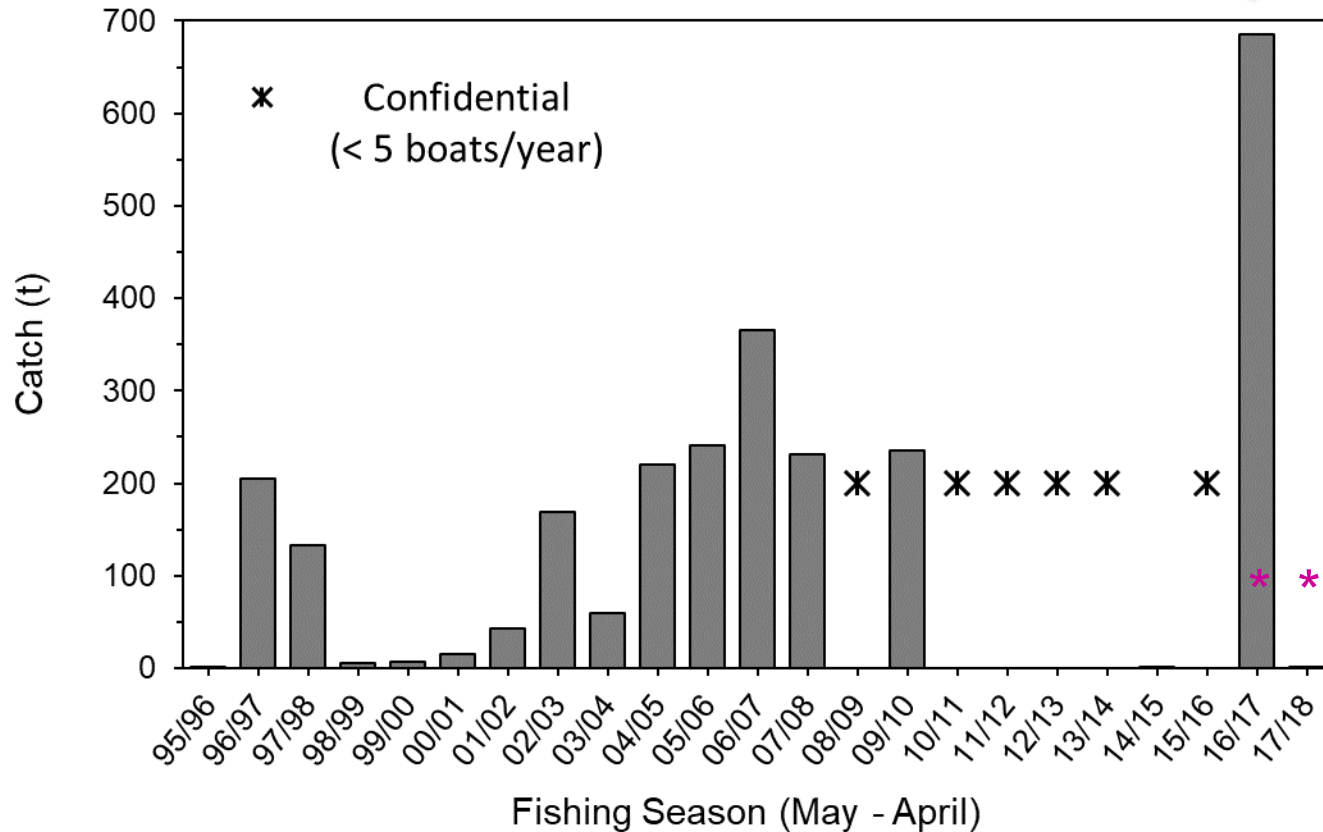
Zone	Date	DEPM Biomass Estimate (t) (95% CI)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East	2014 (Ward et al. 2015b)	157,805 (59,570 - 358,731)	18,936	18,880	Total: 2,751 SPF: 2,748	1.7	14.5	14.5

- SB Estimate (Jack Mackerel - East): considered robust
- Suitable for setting RBCs as outlined under the SPF HS

Jack Mackerel (West)



Total Catch

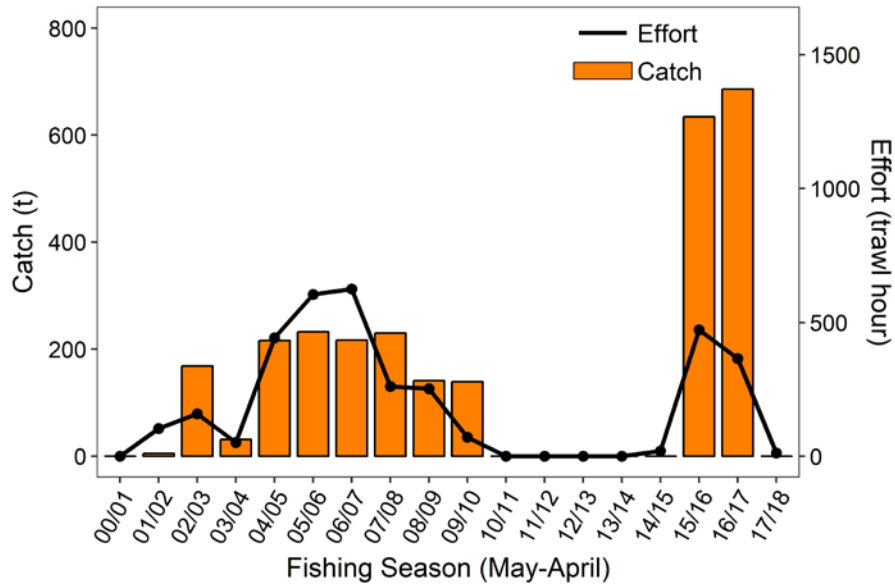


- Total Catch in 2017/18: <1 t
- Peaked at 686 t in 2016/17 (historical peak: 365 t in 2006/07)
- Principal Fishery: Commonwealth JMK/SPF
- From 2010/11 to 2014/15: annual catch was <2 t·yr⁻¹
- Substantial ↑ in 2015/16 & 2016/17
- * VIC catch not included: confidential

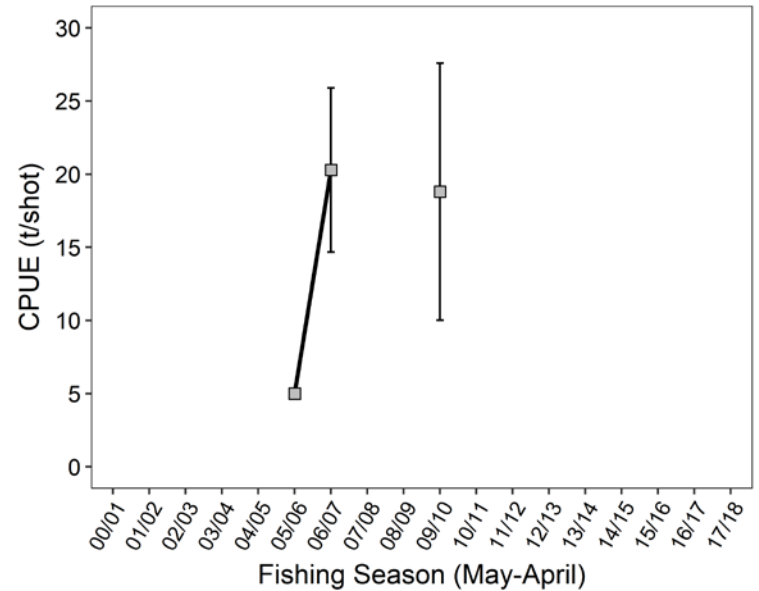
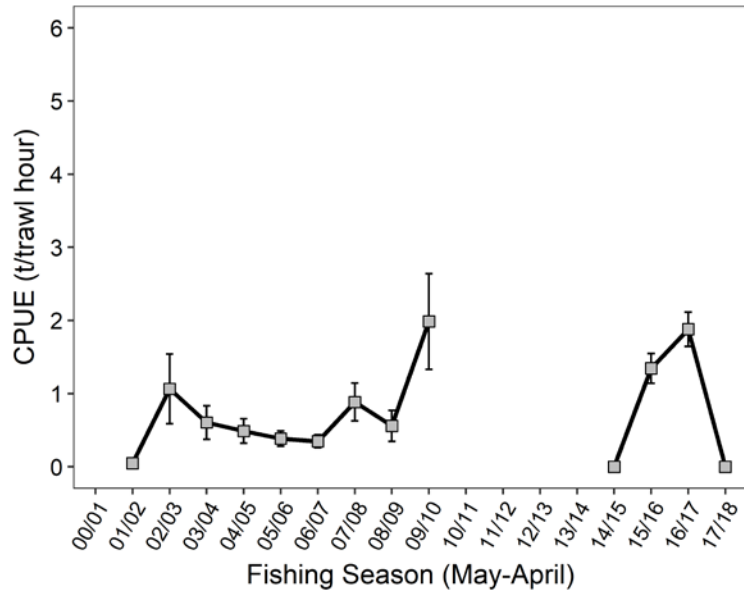
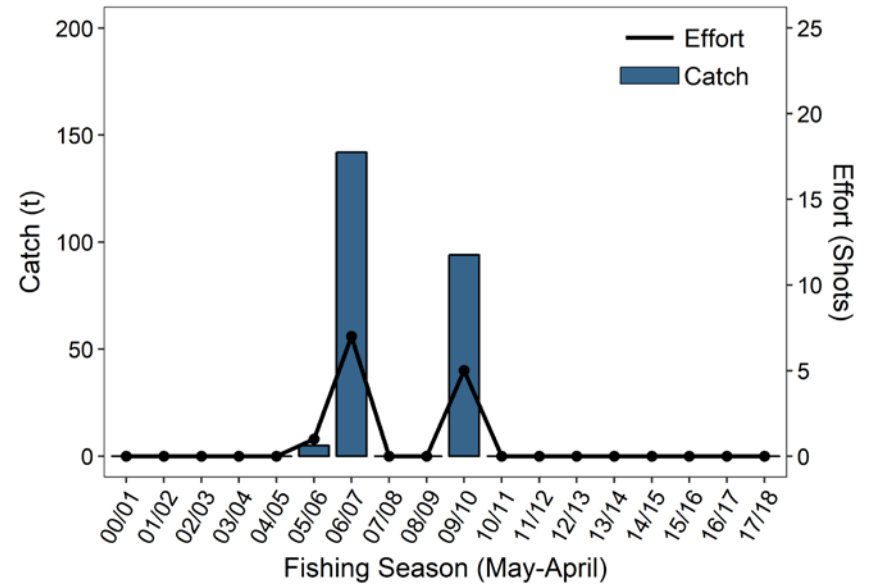
Jack Mackerel (West)



Commonwealth: Trawl



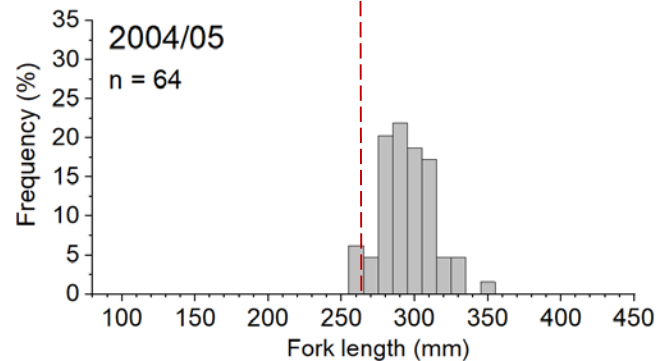
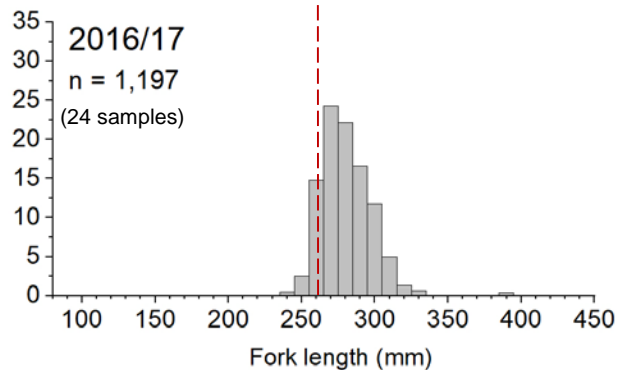
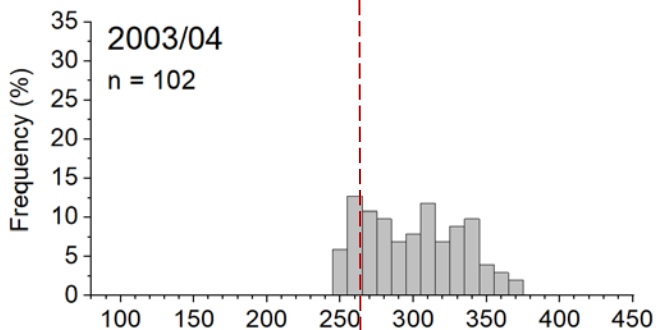
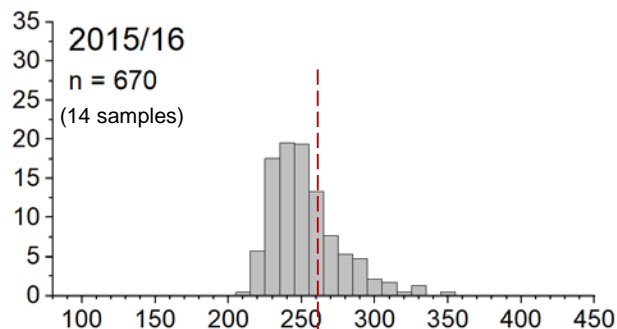
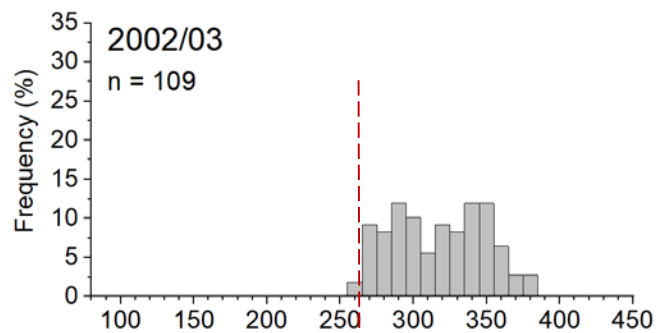
Commonwealth: Purse Seine



Jack Mackerel (West)



Length Frequency



Female size at maturity
(268 mm FL)

Mid-water Trawl Commercial Catches

2002/03–2004/05

- southwestern TAS
- Financial years
- Data: TAFI/AFMA

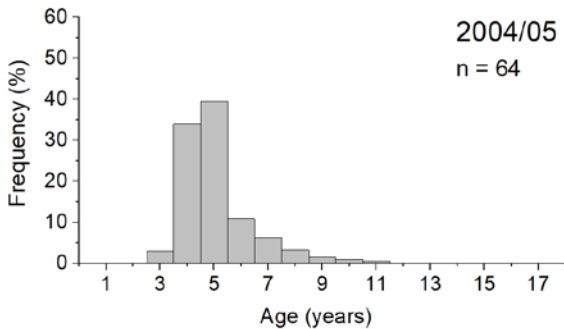
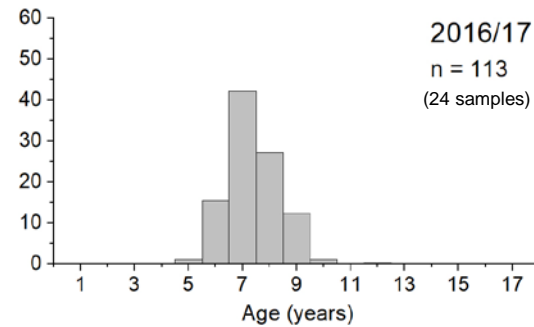
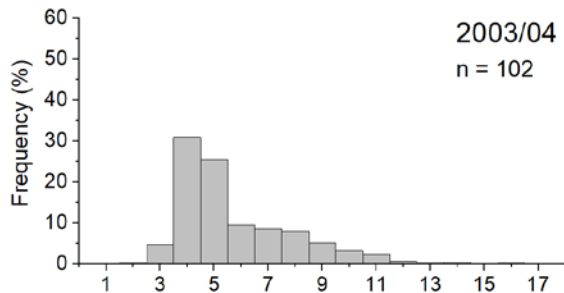
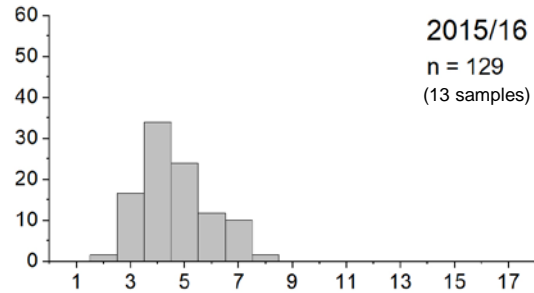
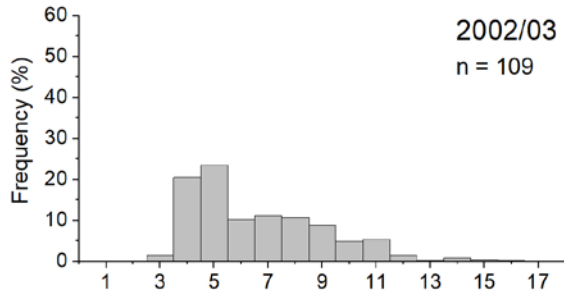
2015/16–2016/17

- SA & southwestern TAS
- Fishing season
- Catch weighted
- Data: SARDI

Jack Mackerel (West)



Age Frequency



◆ Age at maturity: ~3 to 4 yrs

Mid-water Trawl Commercial Catches

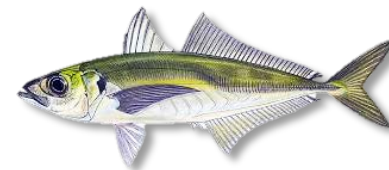
2002/03 - 2004/05

- southwestern TAS
- Financial years
- Data: TAFI/AFMA

2015/16-2016/17

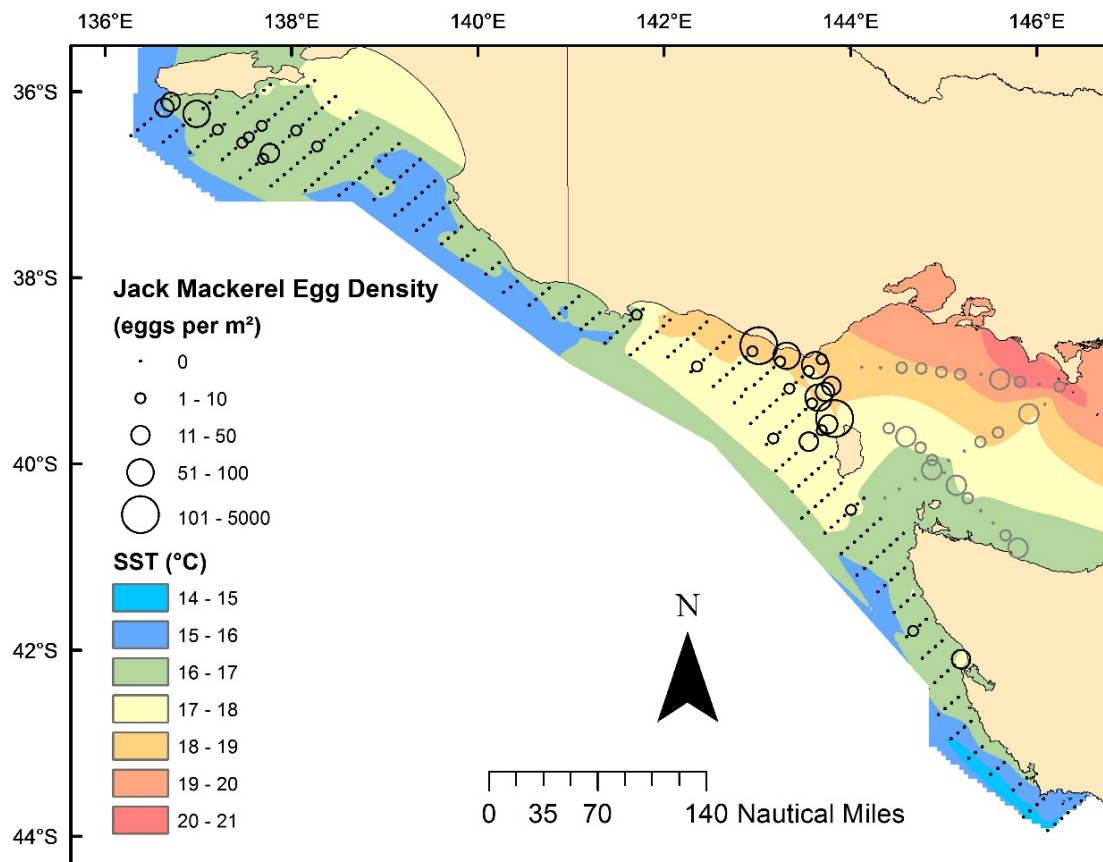
- SA & southwestern TAS
- Catch-weighted
- Fishing season
- Data: SARDI

Jack Mackerel (West)



DEPM Survey

Summer 2016/17



Adults:

- Minimal samples collected
- Used Jack Mackerel East adult parameters from 2014

Jack Mackerel (West)



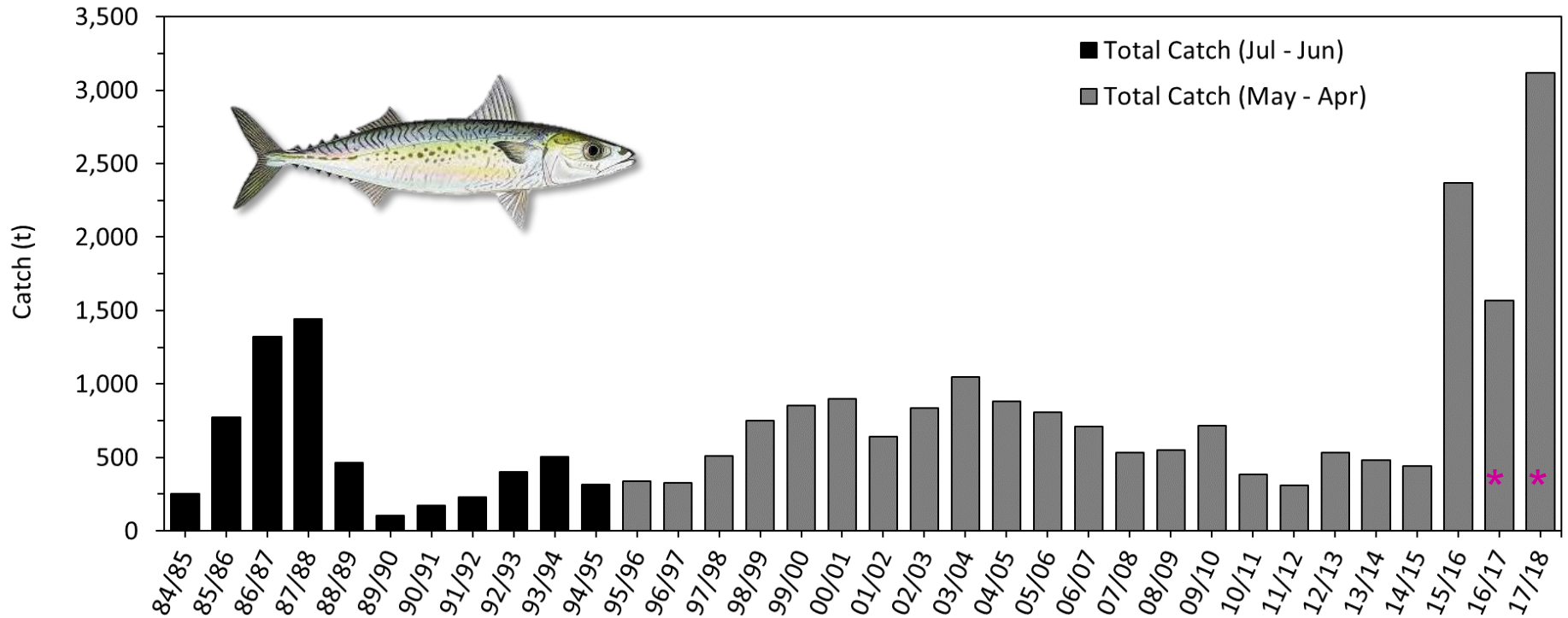
% DEPM, RBC & TAC

Zone	DEPM Date	DEPM Biomass Estimate (t) (model range)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
West	2016/17 <small>(Ward et al. 2018)</small>	31,069 (28,553-33,601)	930	920	Total: 0.2 SPF: 0	<0.1	<0.1	0

→ 2016/17 SB Estimate (Jack Mackerel - West): likely to be an underestimate as spawning likely occurred in areas of Bass Strait not surveyed

Blue Mackerel (East)

Total Catch



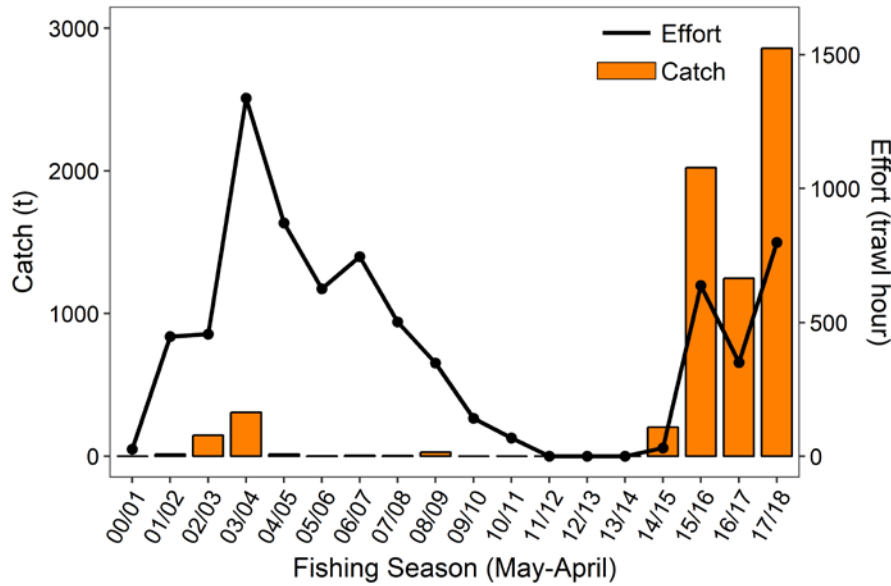
- Total Catch: peaked at 3,119 t in 2017/18 (previous peak at 2,368 t in 2015/16)
- Principal Fisheries: NSW Ocean Hauling; Commonwealth JMK/SPF
- From 1988/89 to 2014/15: annual catch \leq ~1000 t (mean: ~530 t·yr⁻¹)

* VIC catch not included: confidential

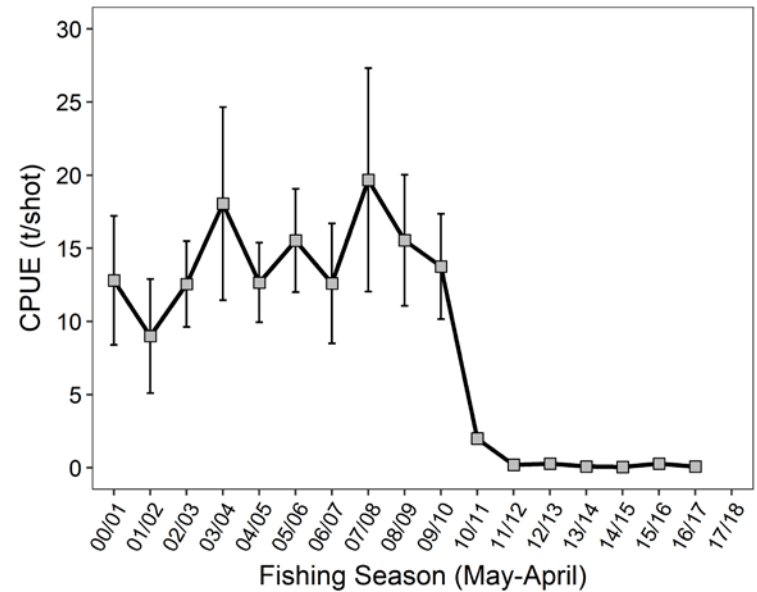
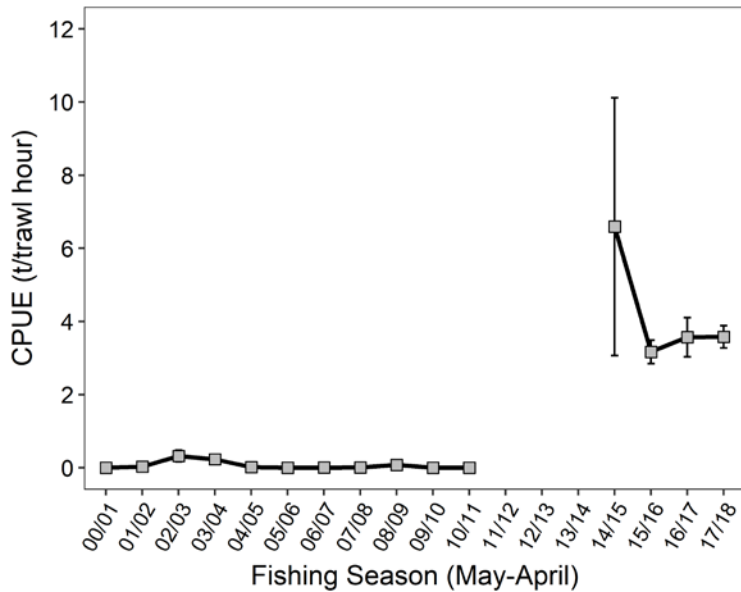
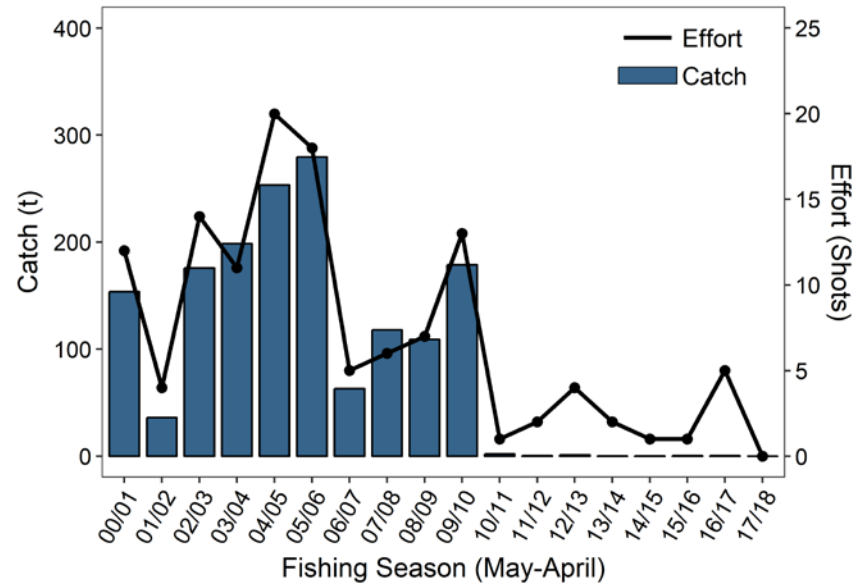
Blue Mackerel - East



Commonwealth: Trawl

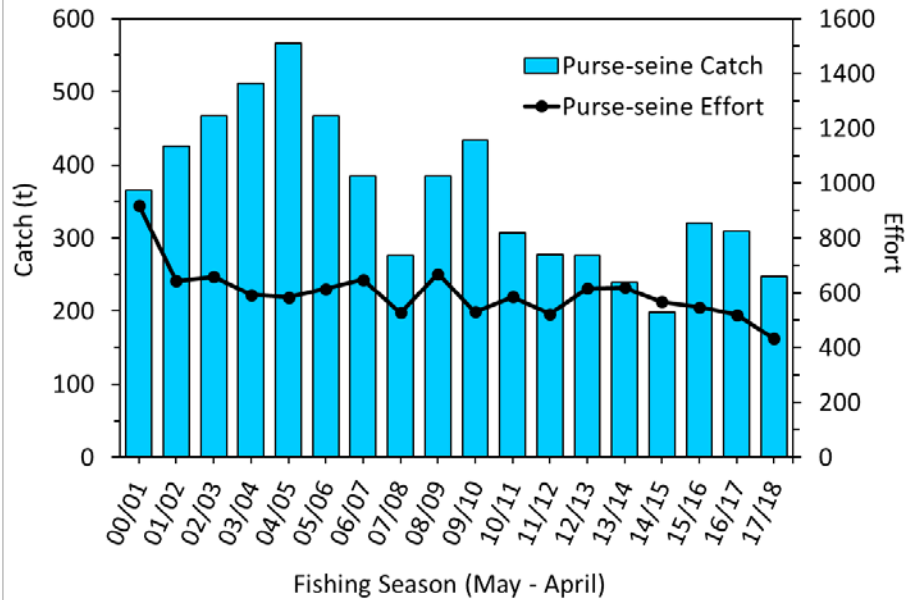


Commonwealth: Purse Seine



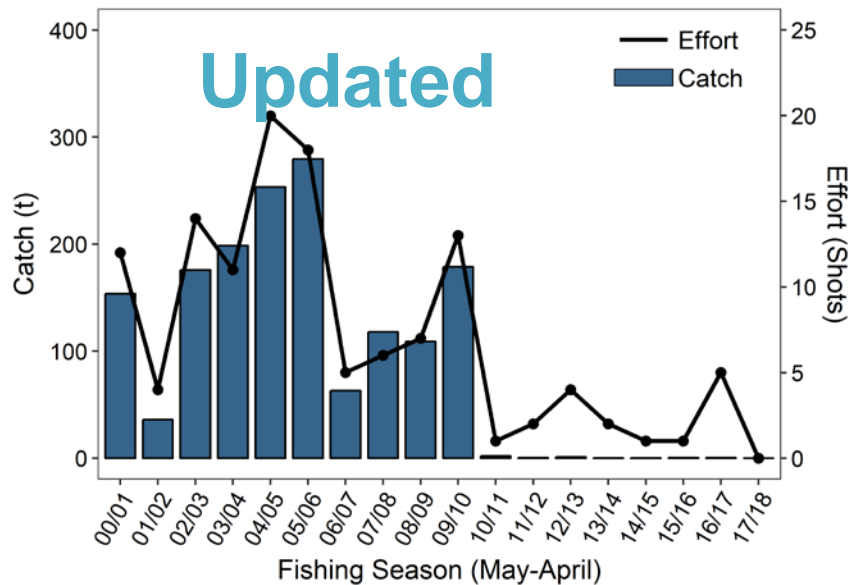
Blue Mackerel - East

Other Major Jurisdictional Catches



NSW PS Catch/Effort

- 8% of total catch
- Effort: tonnes/boat day/year
- 2017/18: 247 t
- Mean catch 2000/01-2017/18: 359 t



Commonwealth PS Catch/Effort

- Effort: tonnes/shot/year
- 2017/18: 0 t
- Mean catch 2000/01-2009/10: 157 t
- Mean catch 2010/11-2017/18: <1 t

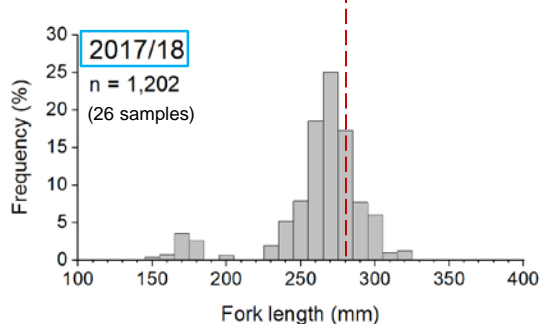
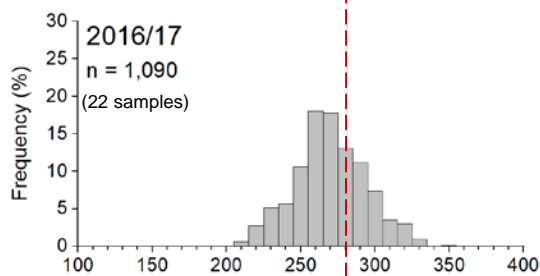
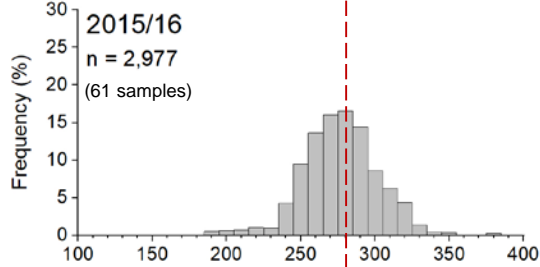
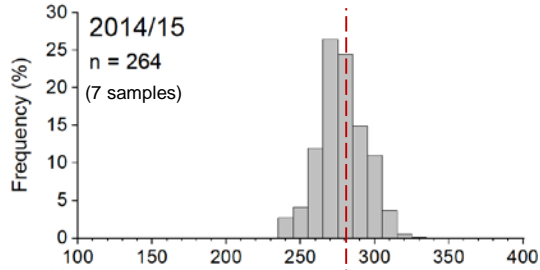
Blue Mackerel - East



Length Frequency

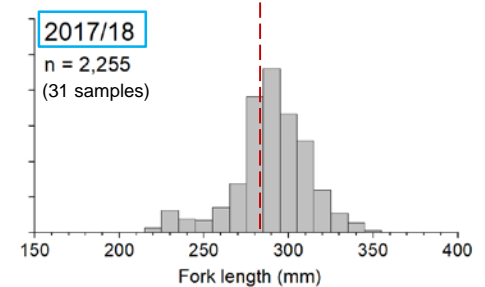
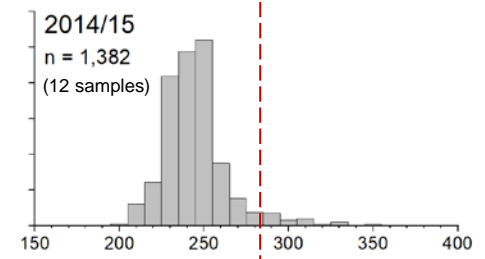
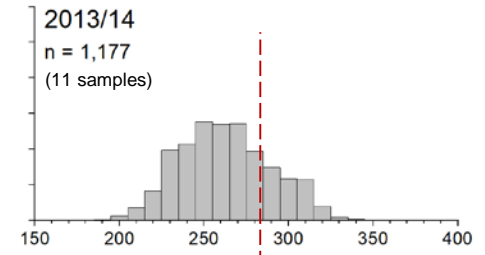
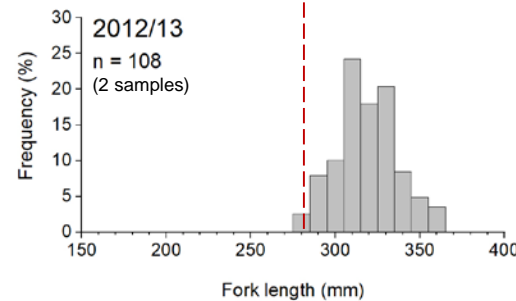
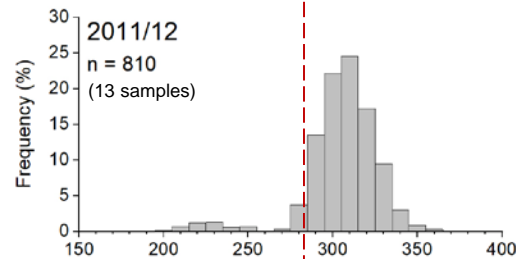
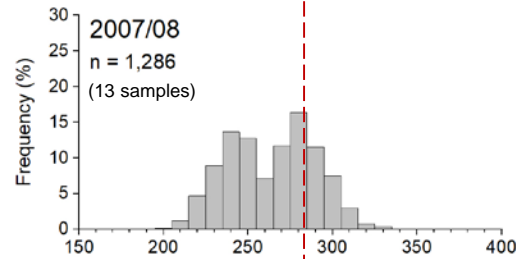
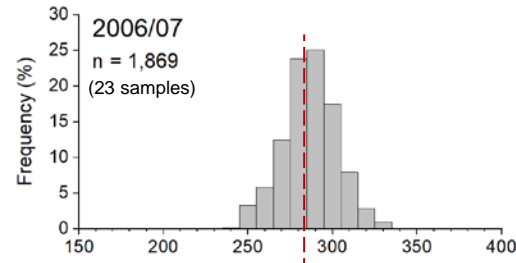
Mid-water Trawl Catches

- Commonwealth (catch weighted; Fishing season)
- Off southern NSW (Sub-zone 6); Data: SARDI



Purse Seine Catches

- NSW Commercial catches - entire NSW fishery
- 2011/12 - 2017/18 (Fiscal Years)
- Data: NSW DPI



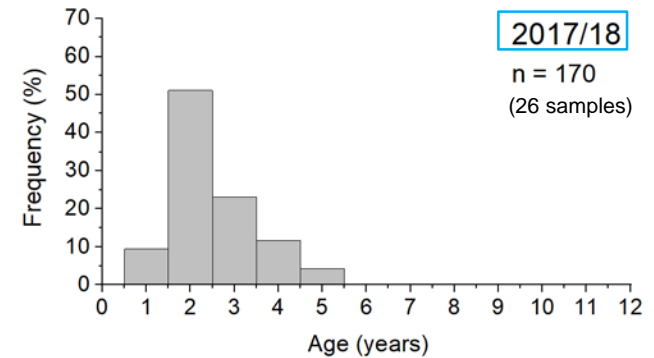
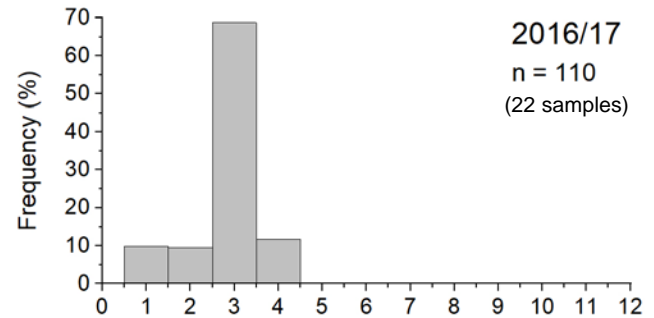
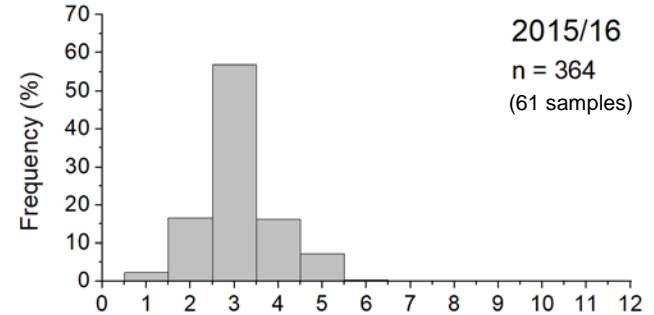
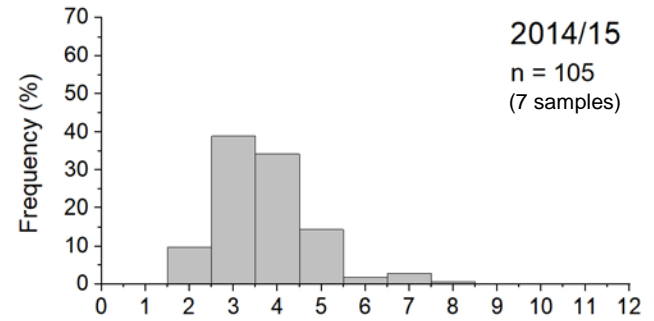
Blue Mackerel - East

Age Frequency: Mid-water Trawl



- 2014/215–2017/18
- Commonwealth (Fishing season)
- Catch weighted
- Off southern NSW (Sub-zone 6)
- Data: SARDI

✦ Age at maturity: ~2 yrs

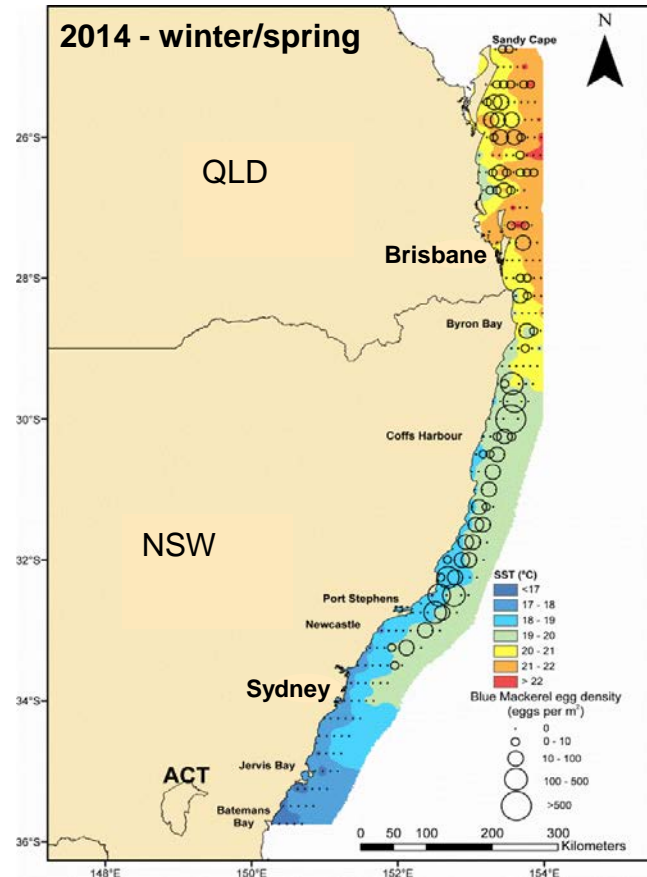
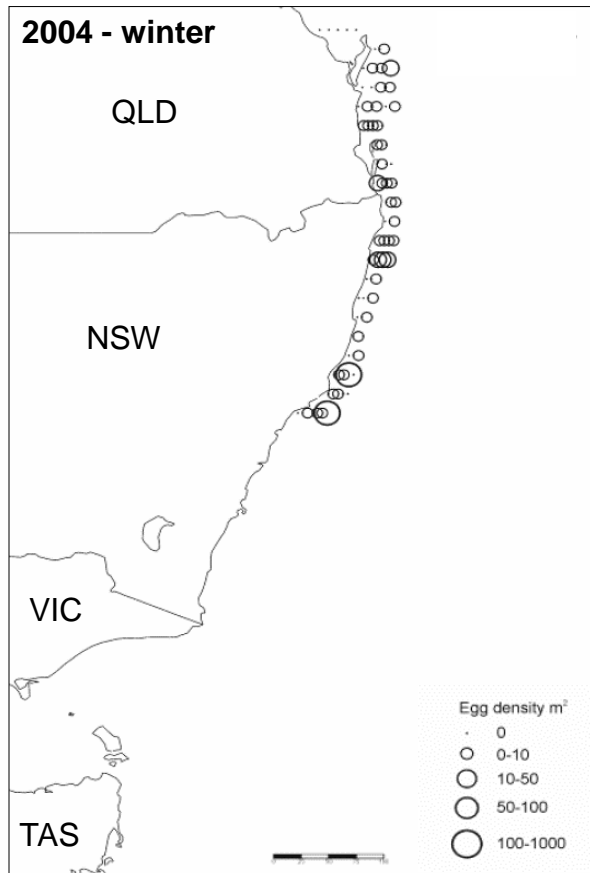


Blue Mackerel (East)

DEPM Surveys



Egg surveys



Adults:

- Collected off eastern Australia (2001 to 2006)
- Used SA adult parameters from 2001 to 2006: more robust estimates

Adults:

- Mature fish not captured during survey
- Used SA adult parameters collected in 2001 to 2006

Blue Mackerel (East)



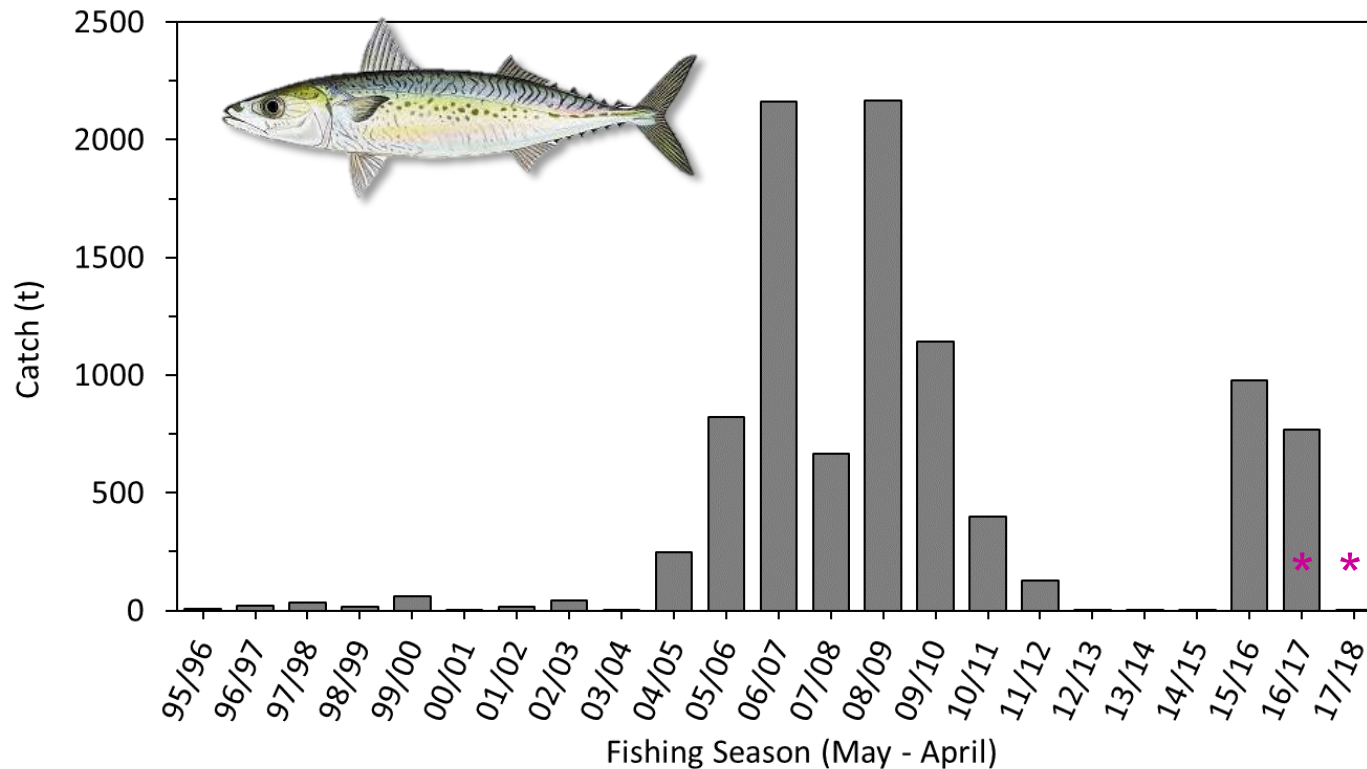
% DEPM, RBC & TAC

Zone	Date	DEPM Biomass Estimate (t)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East	2014 (Ward et al. 2015a)	83,304	12,495	12,090	Total: 3,119 SPF: 2,858	3.7	25.0	23.6

- 2014 SB estimate (Blue Mackerel - East): use with caution
- Robust estimates of egg production and spawning area, but no adult parameters collected during survey

Blue Mackerel (West)

Total Catch



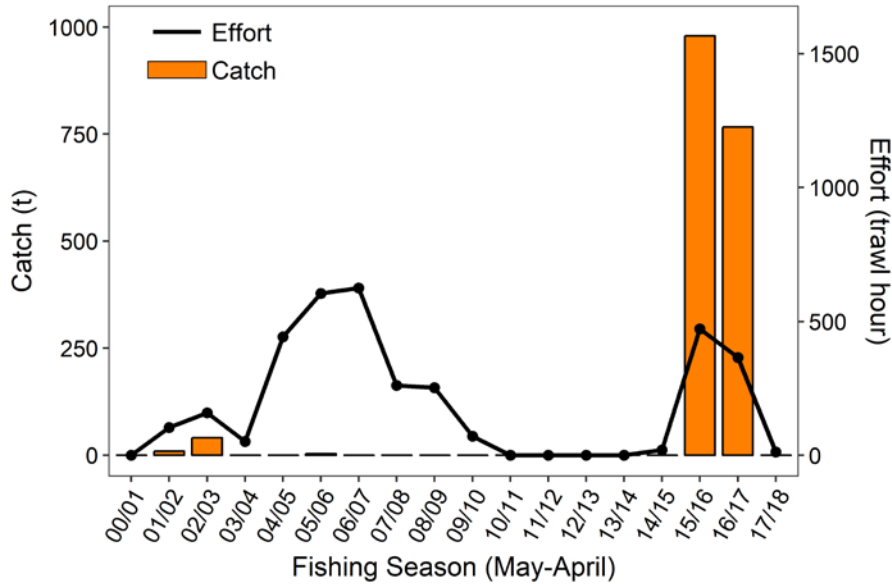
- Total Catch: peaked at 2,168 t in 2008/09
- Principal Fishery: Commonwealth JMK/SPF
- From 2012/13 to 2014/15: annual catch was <2 t·yr⁻¹
- ↑ in 2015/16: 979 t

- Total catch in 2017/18: <1 t
- * VIC catch not included: confidential

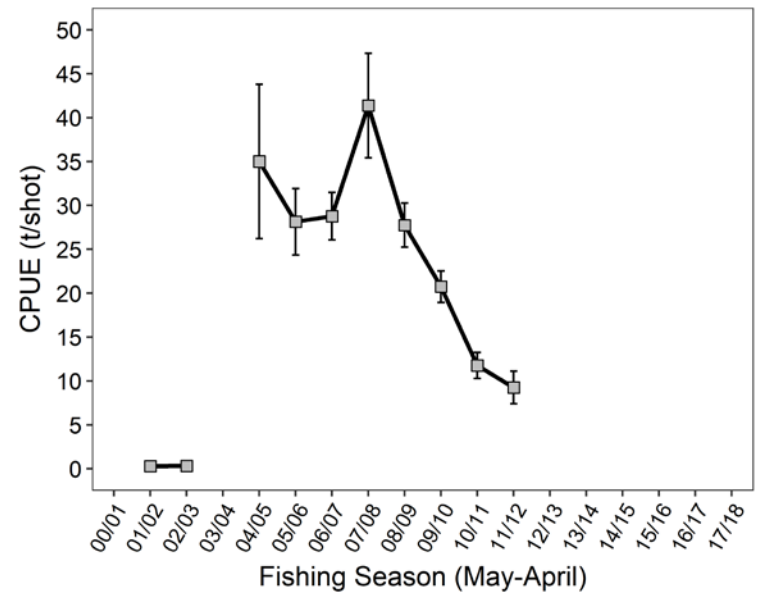
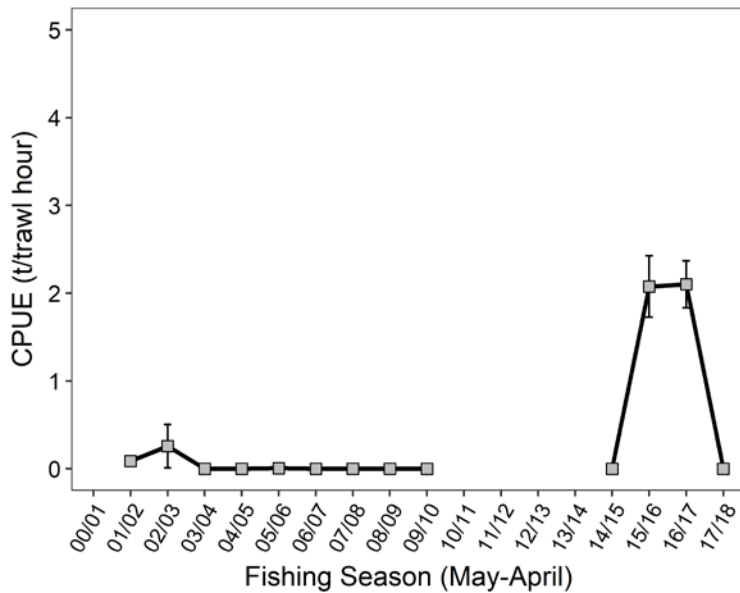
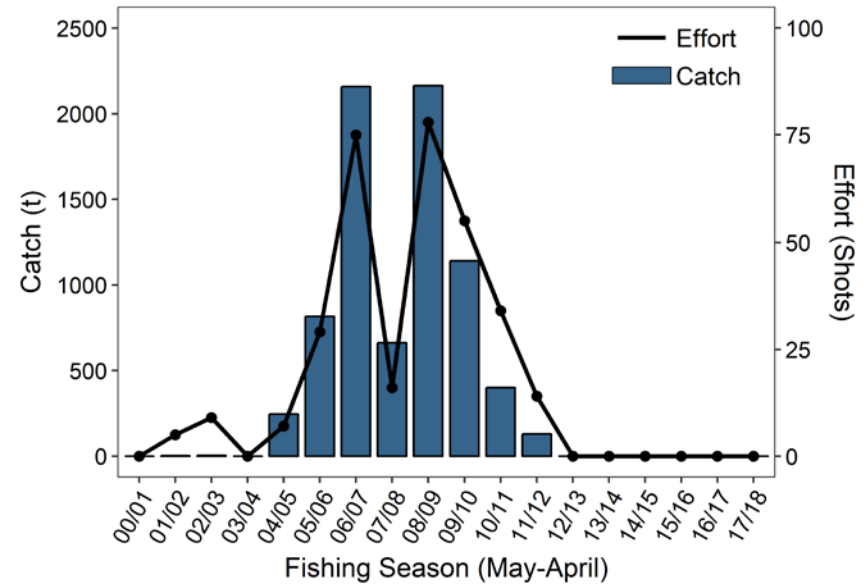
Blue Mackerel - West



Commonwealth: Trawl



Commonwealth: Purse Seine



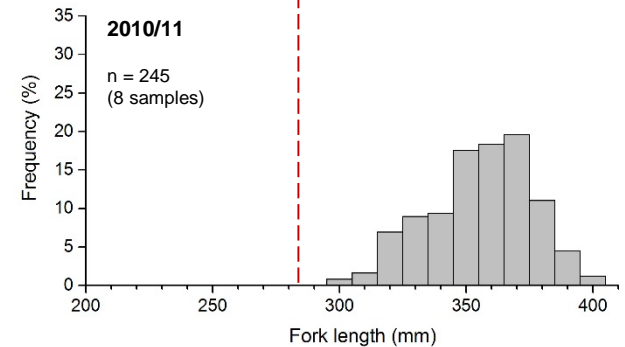
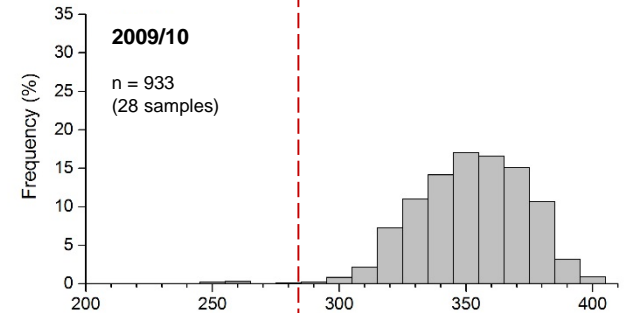
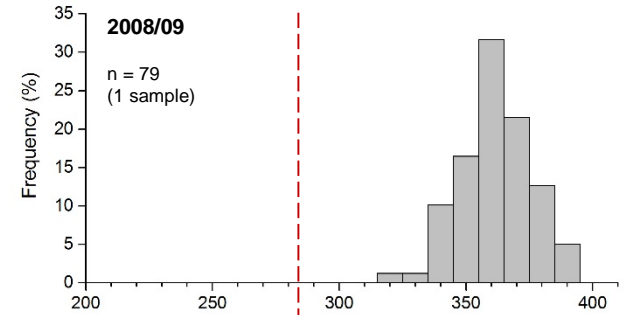
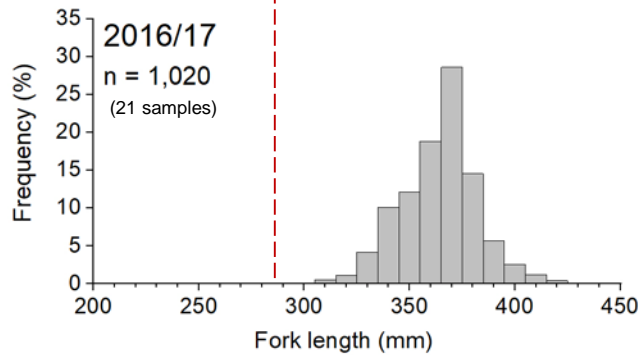
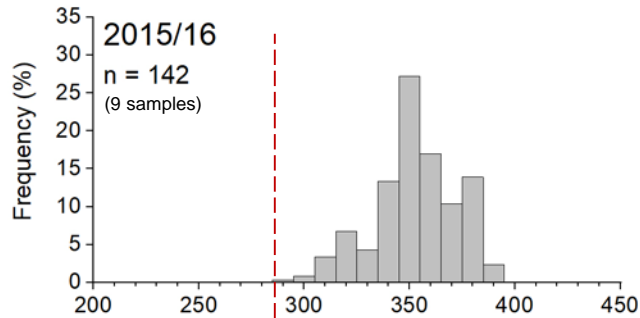


Blue Mackerel - West

Length Frequency

Purse Seine Catches

Mid-water Trawl Catches



- Commonwealth (Fishing season)
- Off SA (Sub-zone 3)
- Catch weighted
- Data: SARDI

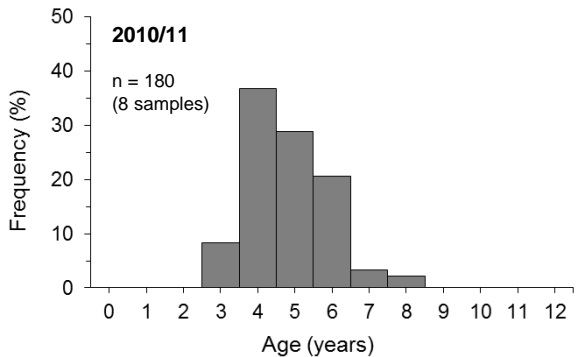
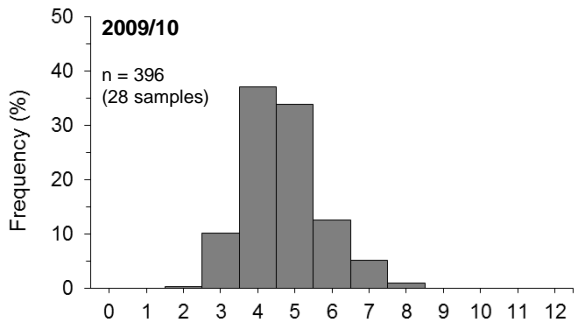
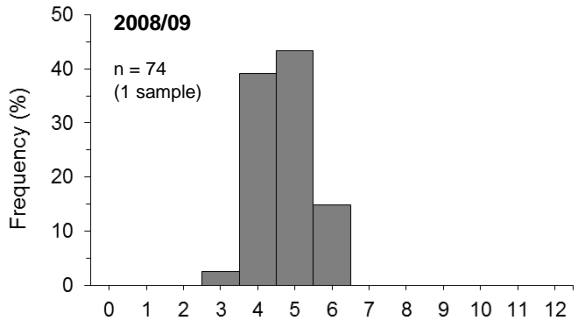
- SA Commercial catches
- 2008/09 to 2010/11 (FY)

--- Female size at maturity
(287 mm FL)

Blue Mackerel - West



Age Frequency

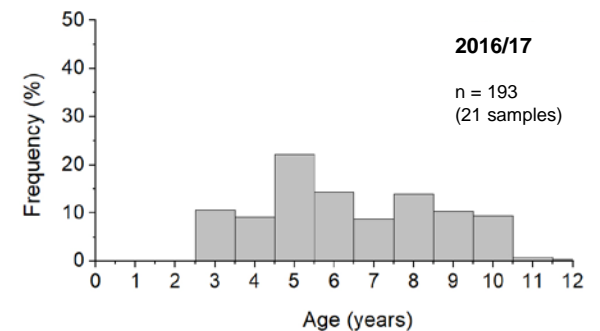
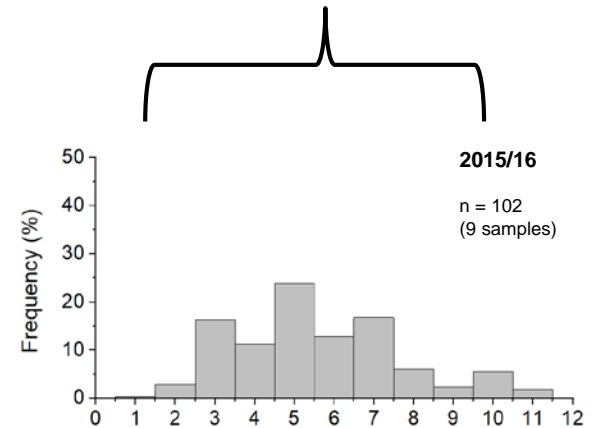


Purse Seine

- SA Commercial catches
- 2008/09 to 2010/11 (FY)

Mid-water Trawl

- Commonwealth (Fishing season)
- Catch weighted
- Off SA (Sub-zone 3)
- Data: SARDI



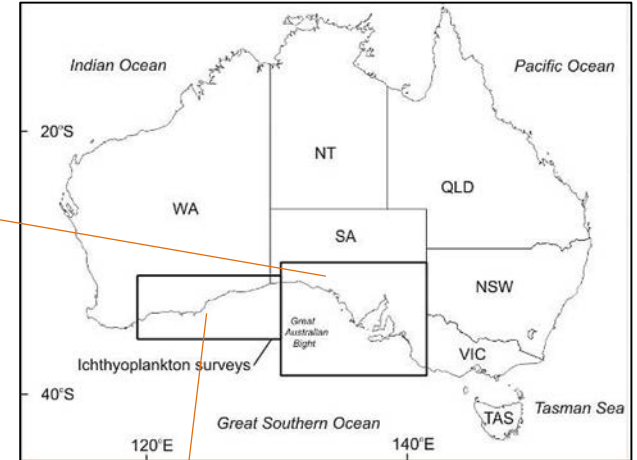
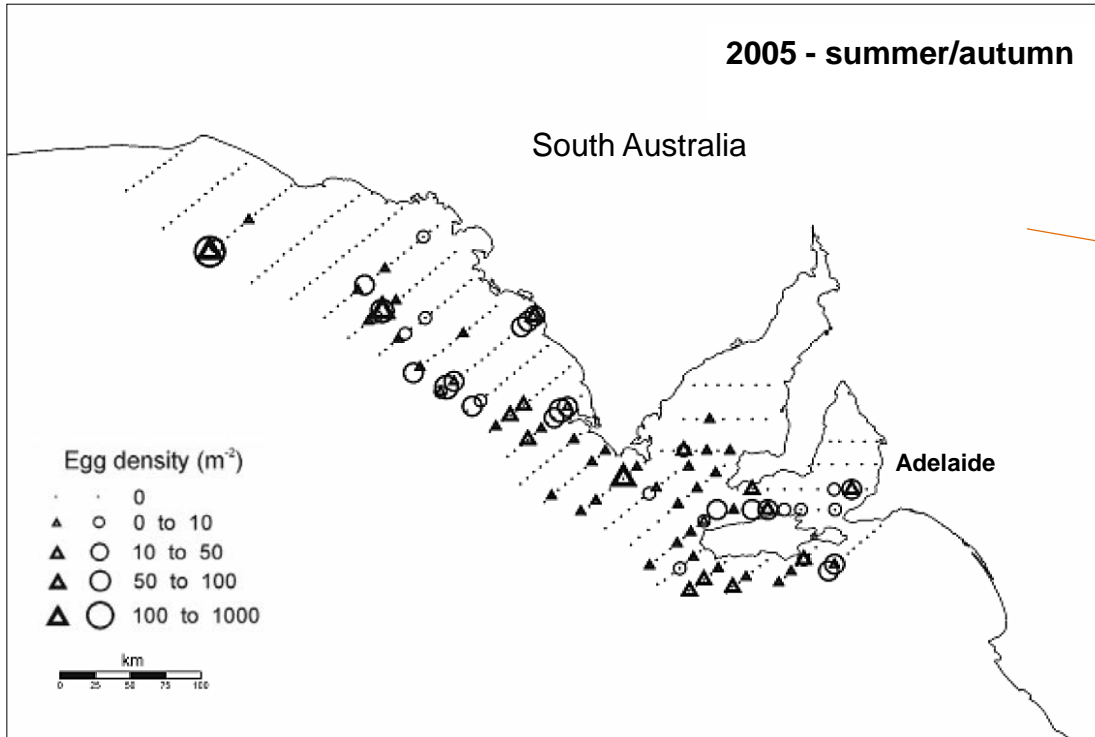
✦ Age at maturity: ~2 yrs

Blue Mackerel (West)

DEPM Surveys

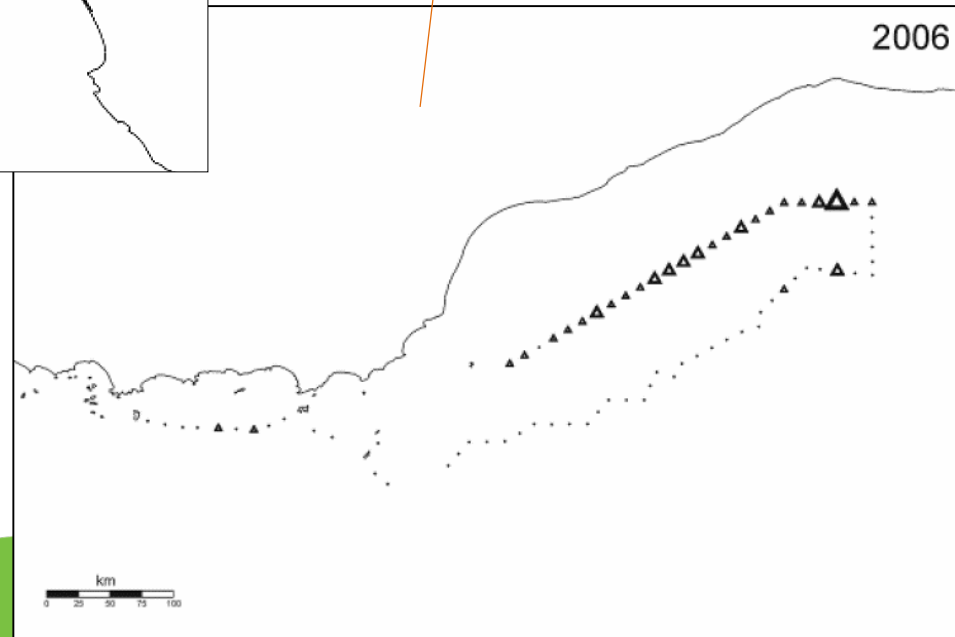


Egg survey



Adults:

- Collected off South Australia (2001 to 2006)
- Lines, jigs and gillnetting
- Female $n = 812$



Blue Mackerel (West)



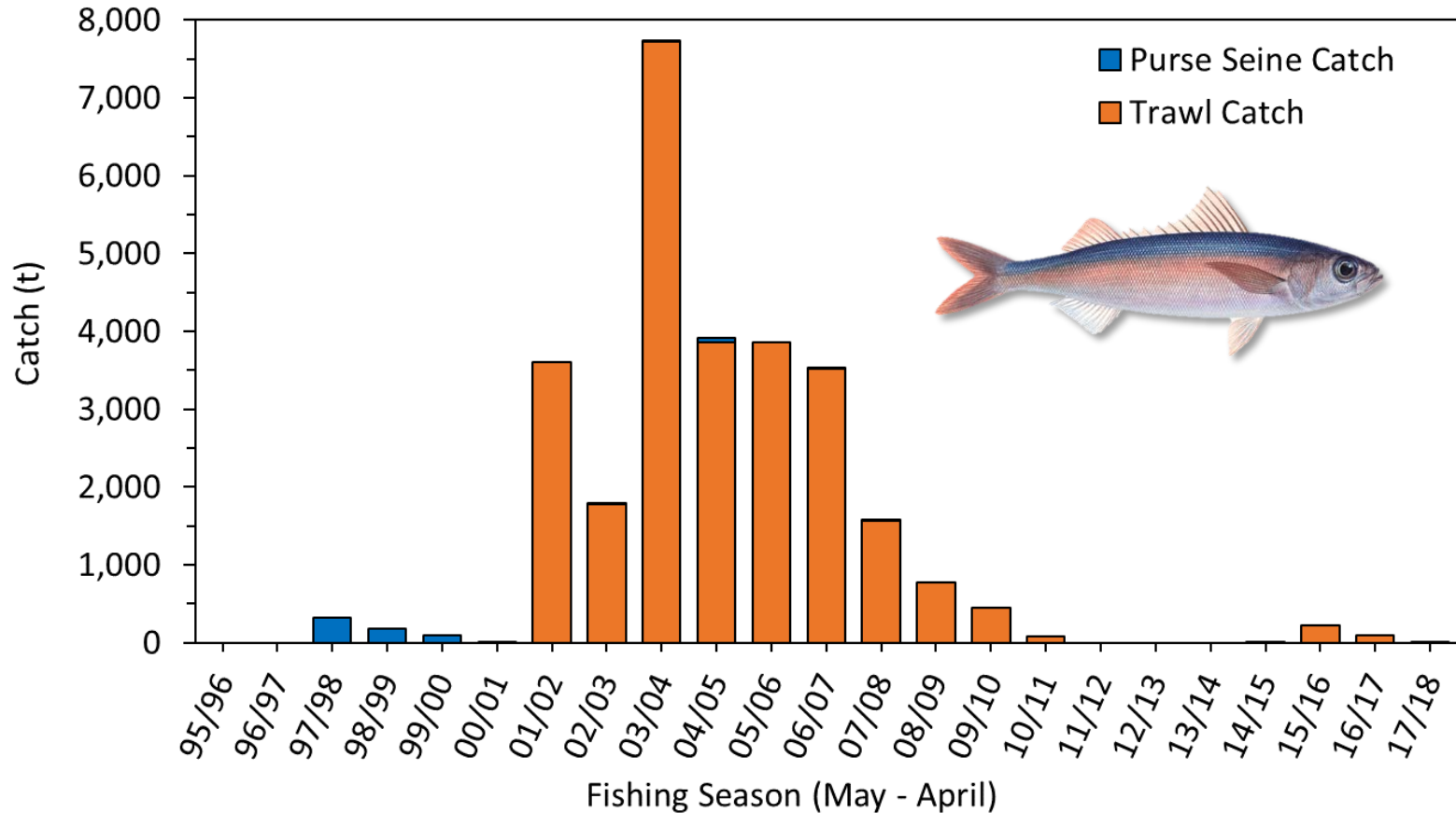
% DEPM, RBC & TAC

Zone	Date	DEPM Biomass Estimate (t) (95% CI)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
West	2005 (Ward & Rogers 2007)	56,228 (10,993–293,456)	3,243	3,230	Total: 0.2 SPF: 0	<0.1	<0.1	0

- 2005 SB estimate (Blue Mackerel - West): use with caution (negatively biased)
- Uncertainty in estimate of spawning area

Rebait (East)

Commonwealth Total Catch

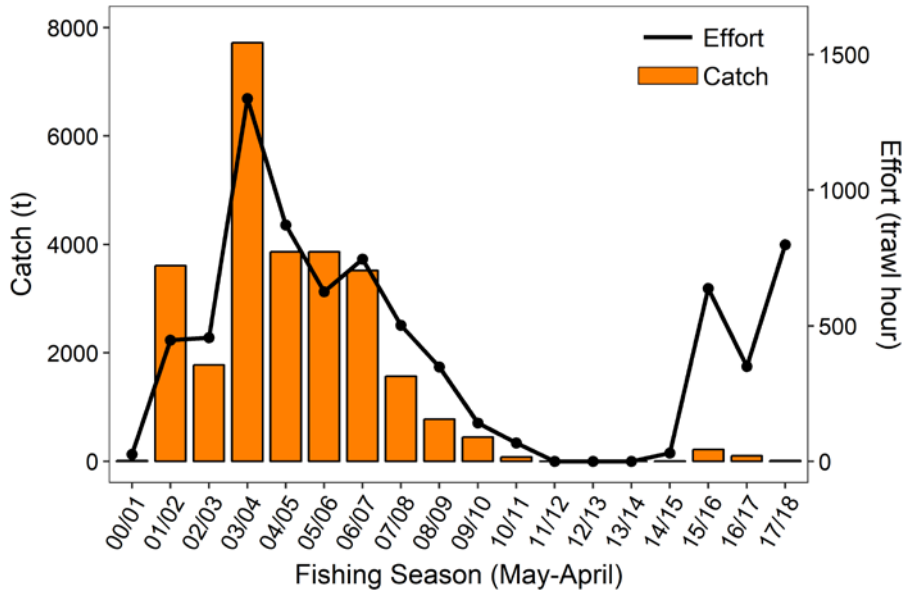


- Total Catch: peaked at 7,736 t in 2003/04
- Fishery: Commonwealth JMK/SPF
- Annual catches prior to 2000/01: bycatch of JMK fishery
- ↑ 2001/02: mid-water trawl trial off TAS
- Targeted catches 2001/02 to 2006/07
- From 2011/12 to 2014/15: annual catch was ≤ 2 t·yr⁻¹
- ↑ in 2015/16: 217 t
- Total catch in 2017/18: 10 t

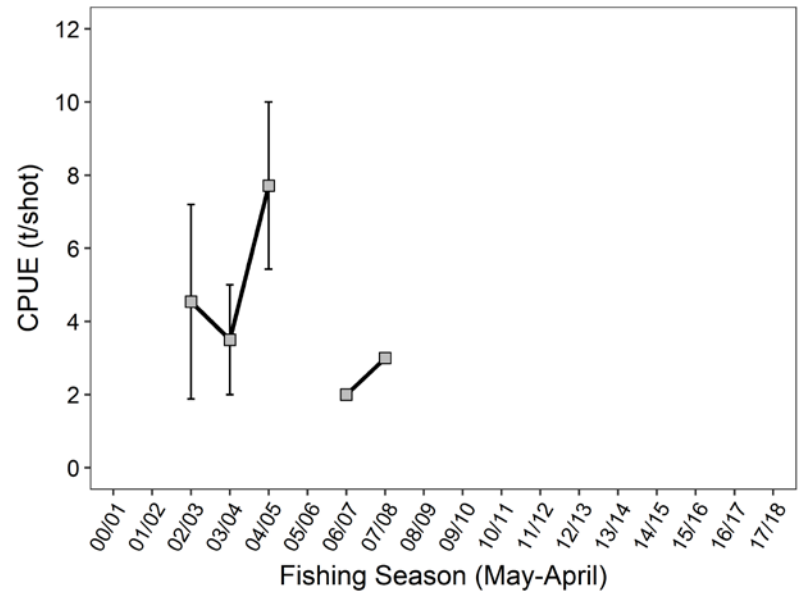
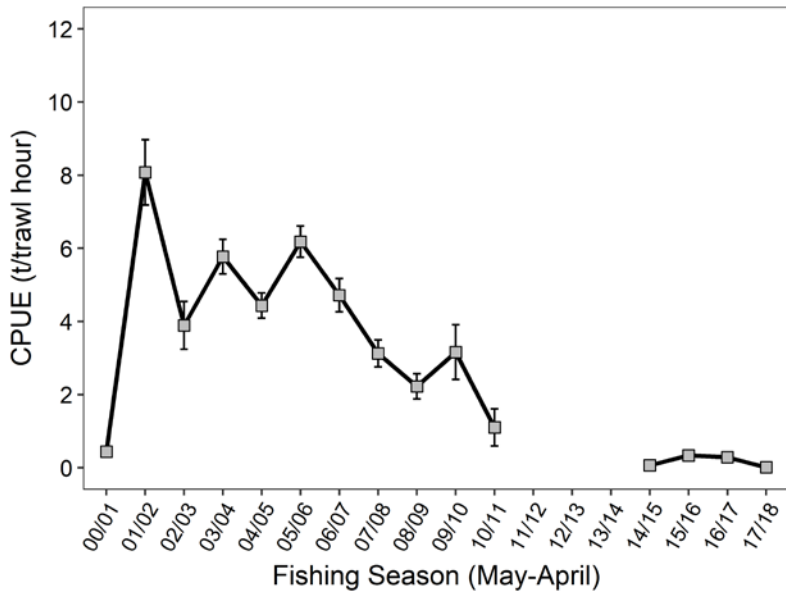
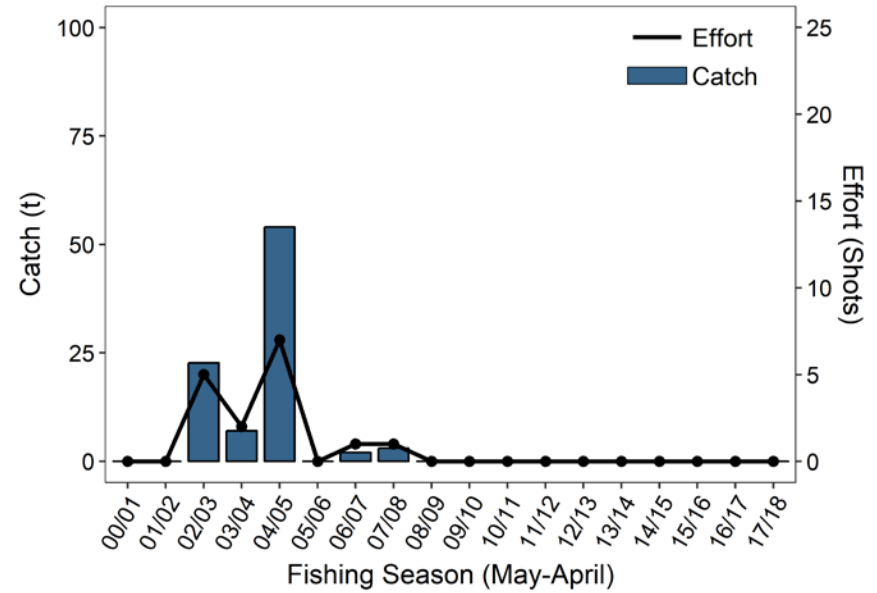
Redbait (East)



Commonwealth: Trawl

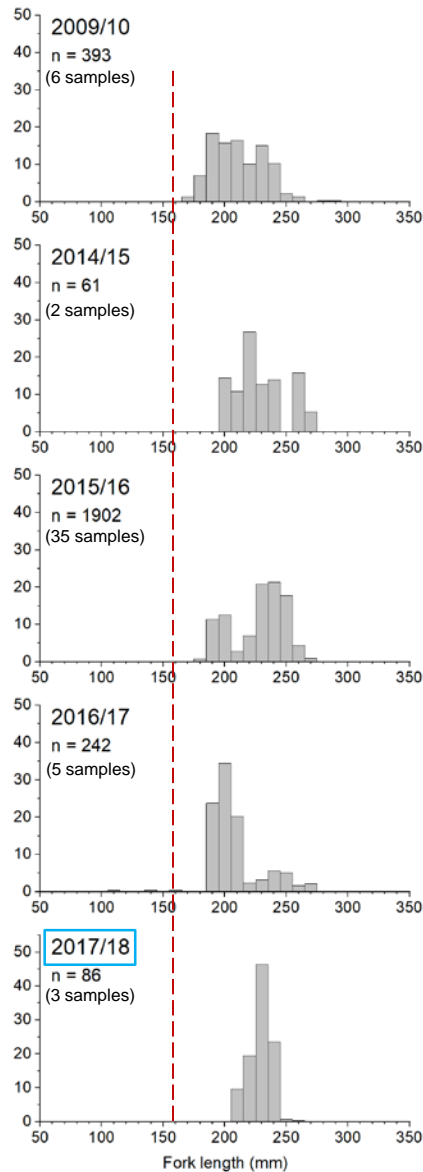
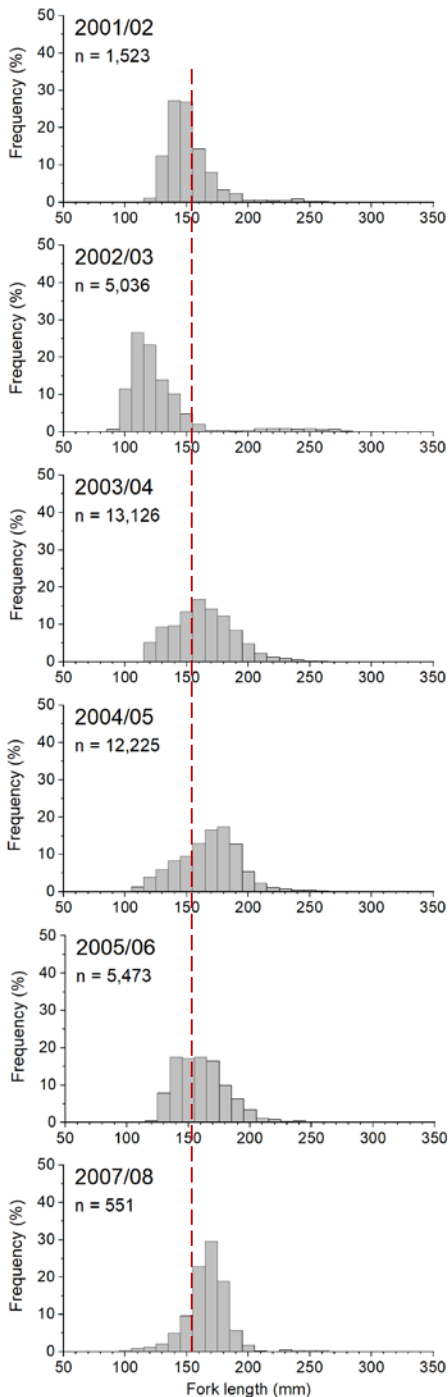


Commonwealth: Purse Seine



Rebait (East)

Length Frequency Mid-water Trawl

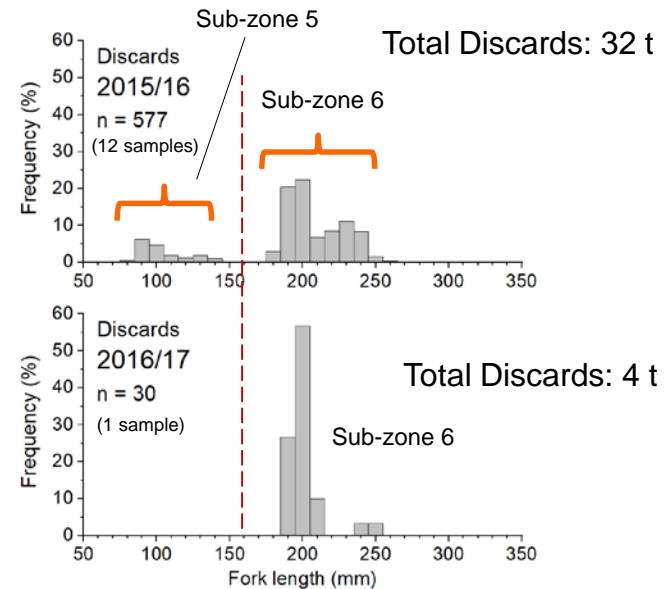


2001/02-2009/10

- Commercial sampling (FY)
- southeastern TAS
- Data: TAFI/AFMA

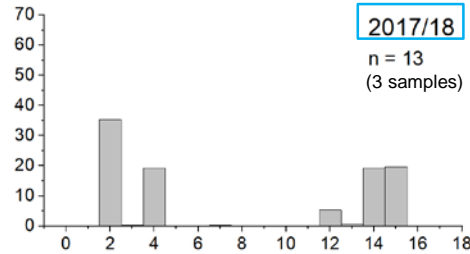
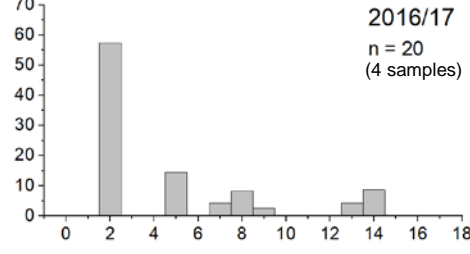
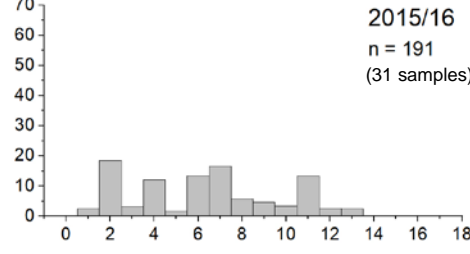
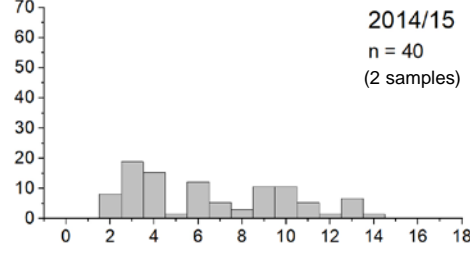
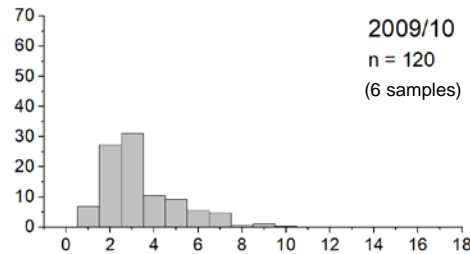
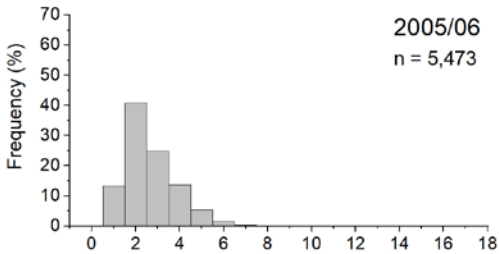
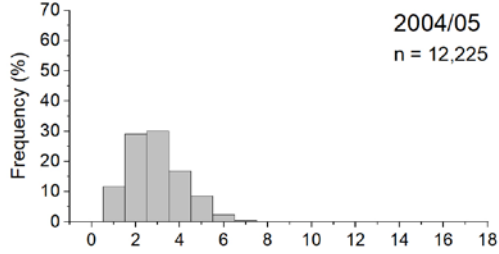
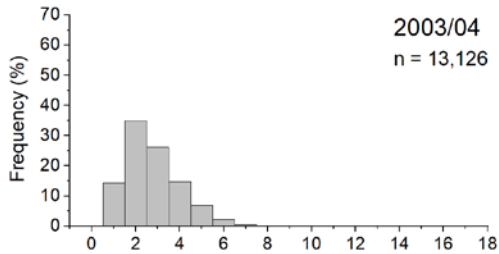
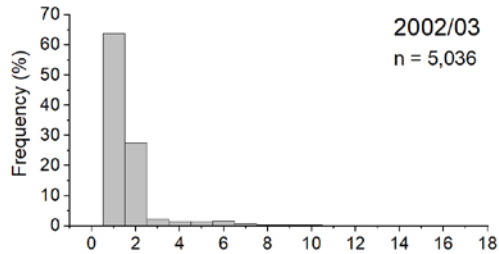
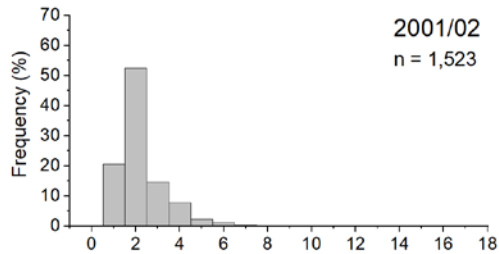
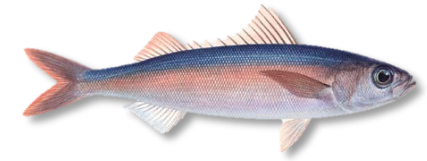
2014/15-2017/18

- Commonwealth SPF (Fishing season)
- 14/15-17/18: catch weighted
- southern NSW (Sub-zone 6)
- Data: SARDI



Redbait (East)

Age Frequency: Mid-water Trawl

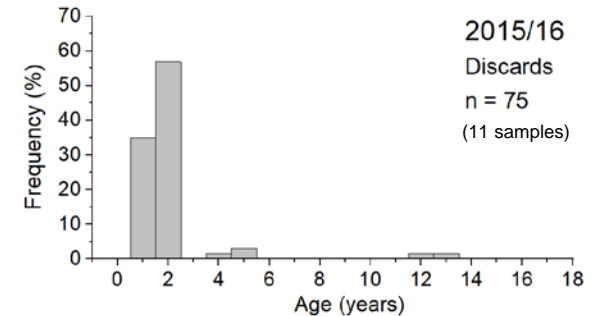


2001-2010

- Commercial sampling (FY)
- southeastern TAS
- Data: TAFI/AFMA

2014/15-2017/18

- Commonwealth SPF (Fishing season)
- Catch weighted
- southern NSW (Sub-zone 6)
- Data: SARDI



✦ Age at maturity: ~2 yrs

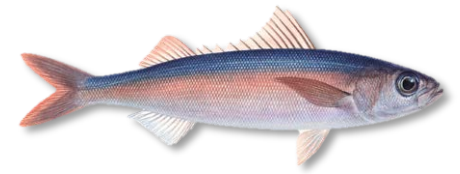
Redbait (East)

DEPM Survey Parameter Estimates (2005 & 2006)



	Input data	October 2005		October 2006	
A	DEPM survey area/spawning area (km ²)	15,650 / 13,220		12,924 / 8,695	
W	Mean weight female (W)	71.7 (0.20)		78.3 (0.06)	
	Variance W	196.2		22.3	
F	Mean fecundity (F)	10,894 (0.24)		11,441 (0.09)	
	Variance F	7,084,349		1,004,943	
R	Sex ratio (R)	0.30 (0.19)		0.44 (0.05)	
	Variance R	0.0034		0.001	
S	Spawning fraction (S)	0.32 (0.23)		0.32 (0.14)	
	Variance S	0.005		0.002	
	Data scenario	All data	No extremes	All data	No extremes
Model 1: Non-linear least squares					
P₀	Weighted P_0 (eggs/0.05 m ² day ⁻¹)	3.83	6.66	3.41	3.81
	Total egg production (eggs x 10 ¹²)	1.20	2.08	0.88	0.98
	Spawning biomass (tonnes) (CV)	82,648 (0.45)	143,434 (0.47)	42,802 (0.47)	47,792 (0.51)
	Standard deviation	37,624	67,971	19 810	24,505
Model 2: GLM - negative binomial error distribution					
P₀	Weighted P_0 (eggs/0.05 m ² day ⁻¹)	3.08	4.04	4.60	4.04
	Total egg production (eggs x 10 ¹²)	0.96	1.26	1.19	1.05
	Spawning biomass (tonnes) (CV)	66,276 (0.37)	86,994 (0.37)	57,808 (0.20)	50,782 (0.21)
	Standard deviation	24,439	32,592	11,331	10,939

Redbait (East)



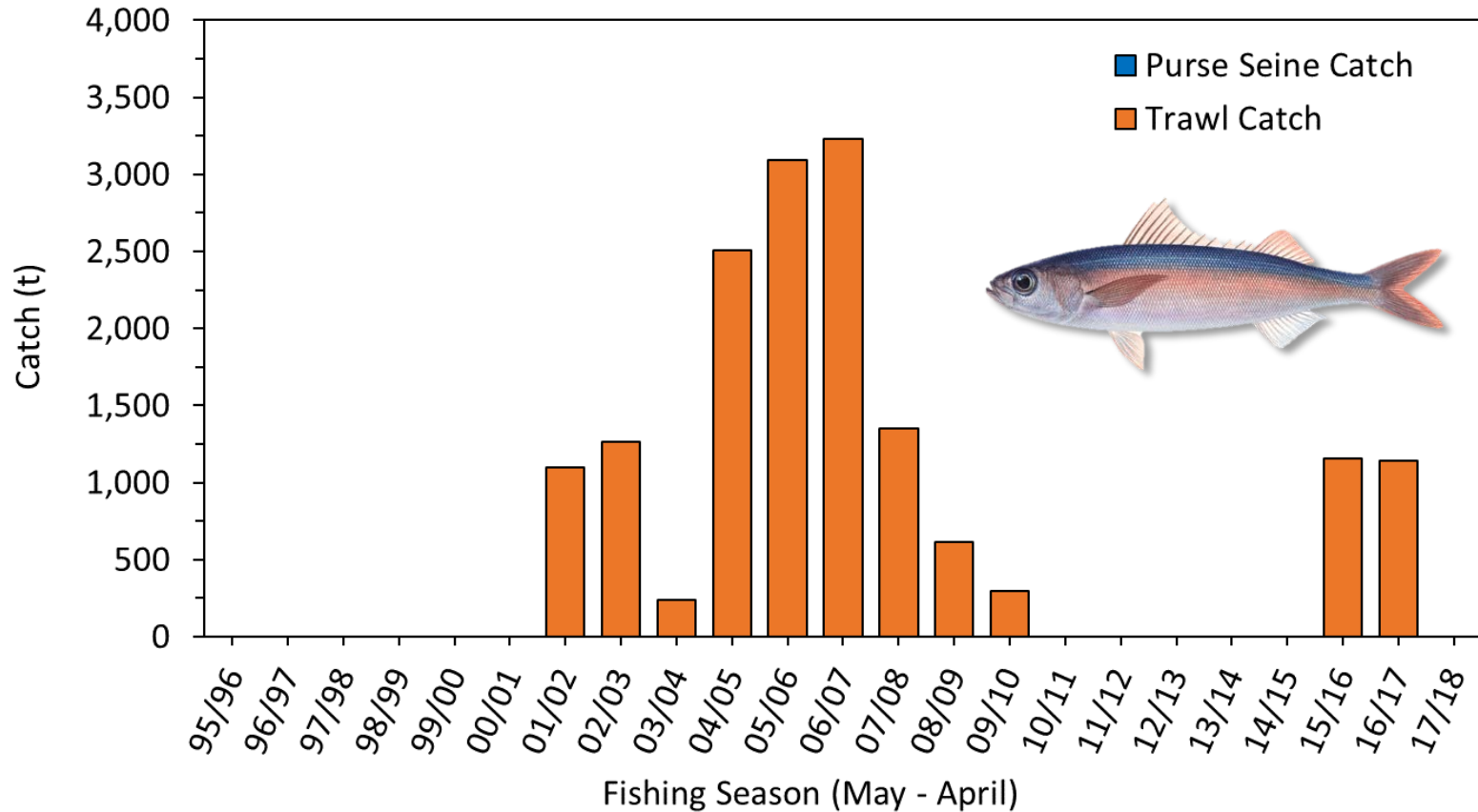
% DEPM & TAC

Zone	Date	DEPM Biomass Estimate (t) (95% CI)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East	2005 (Neira & Lyle 2011)	86,994	3,444	3,410	Total: 10 SPF: 10	<0.1	0.3	0.3
	2006 (Neira & Lyle 2011)	50,782				<0.1		

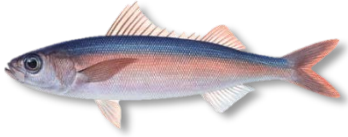
→ SB estimates likely derived from only half of actual spawning area in S.E. Australia

Rebait (West)

Commonwealth Total Catch

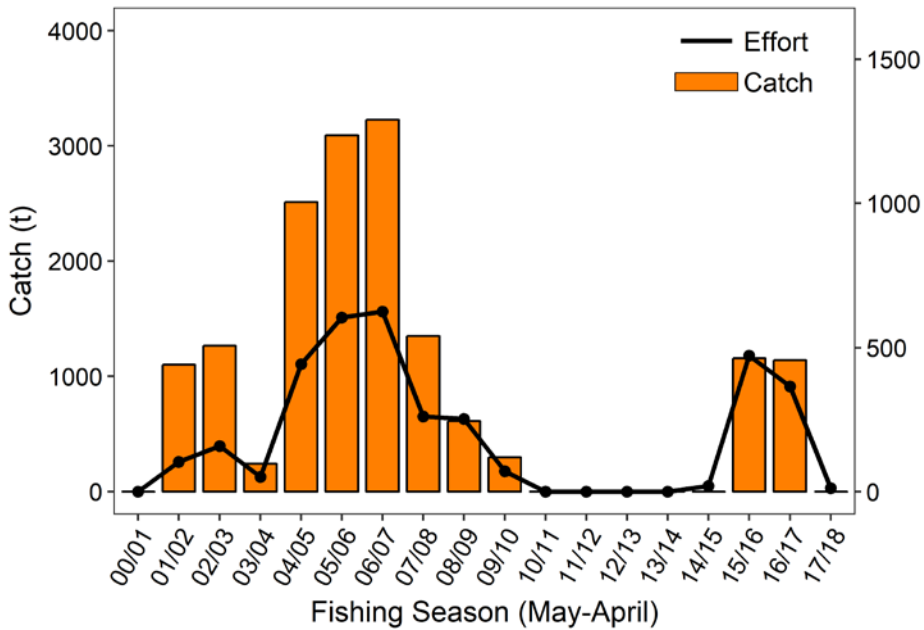


- Total Catch: peaked at 3,228 t in 2006/07
- Fishery: Commonwealth JMK/SPF
- ↑ 2001/02: mid-water trawl trial off TAS
- Targeted catches 2001/02 to 2006/07
- Catches ↓ to <1 t in 2010/11 & no further catches until 2015/16
- ↑ in 2015/16: 1,157 t
- Total catch 2017/18: 0 t

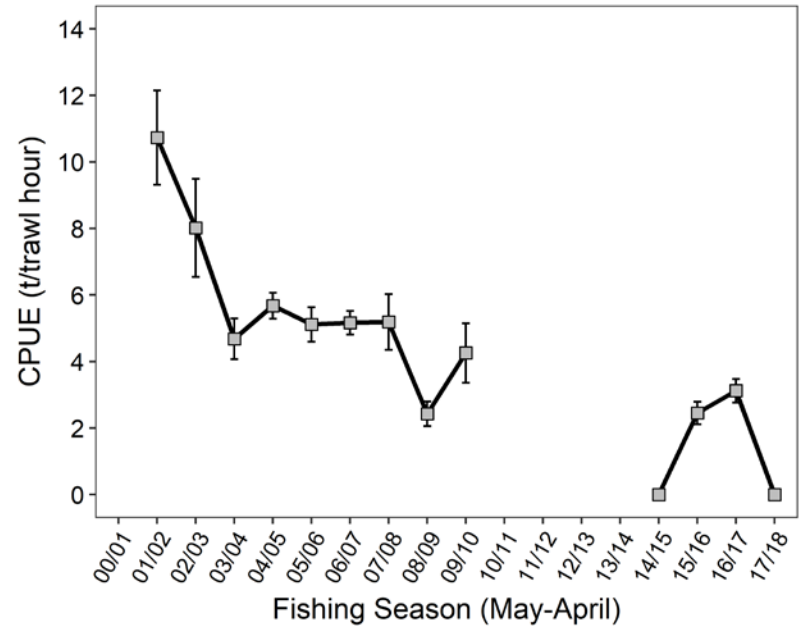


Redbait (West)

Commonwealth Catch/Effort: Trawl



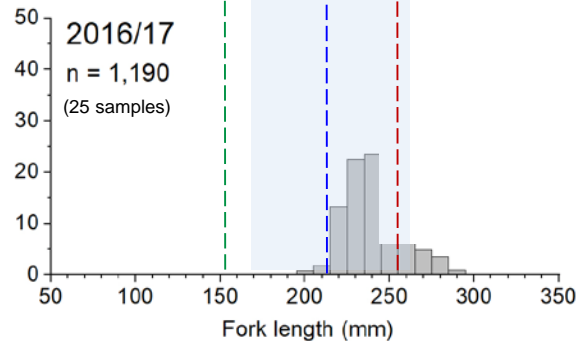
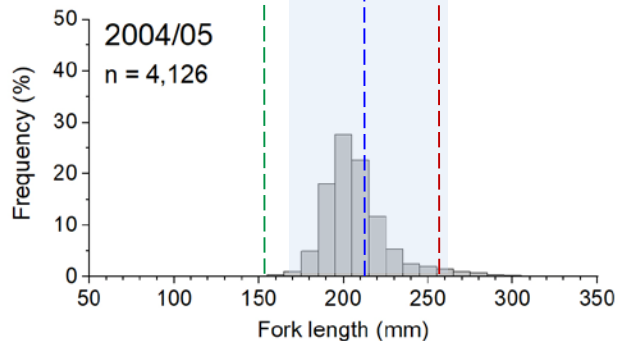
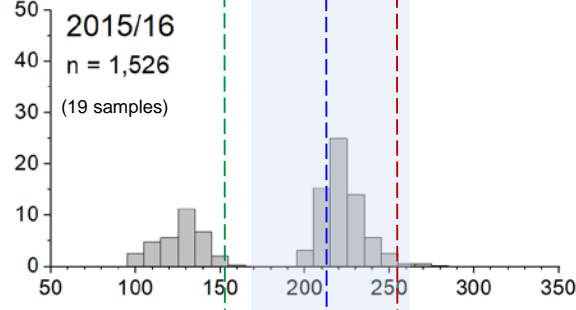
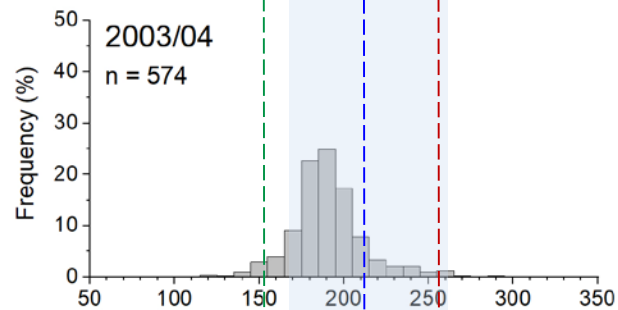
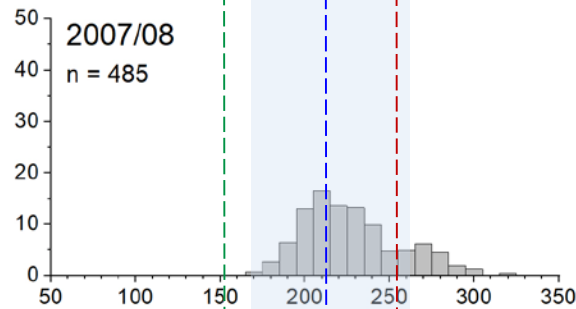
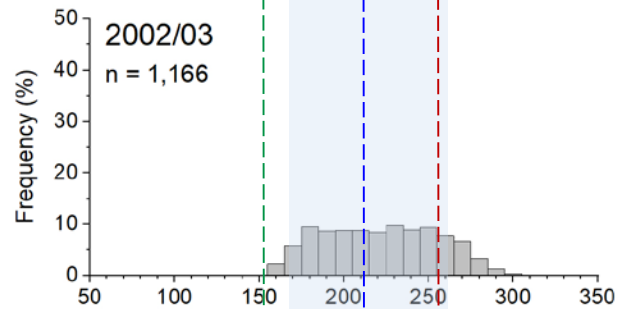
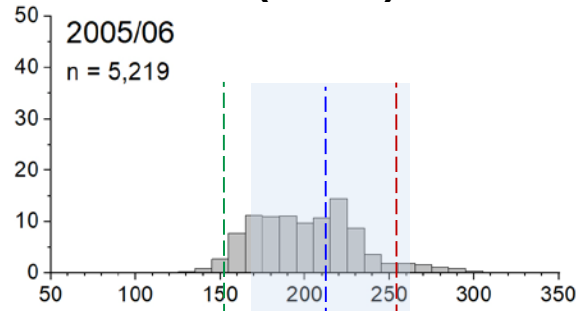
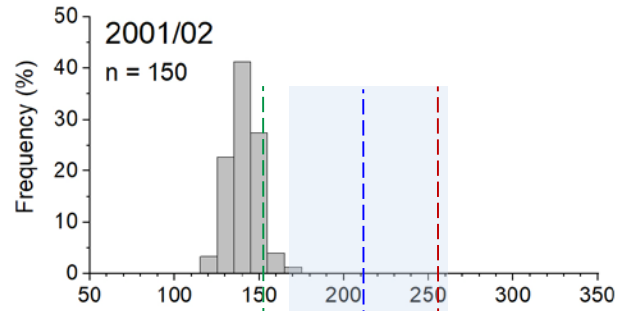
Commonwealth CPUE: Trawl





Redbait (West)

Length Frequency Mid-water Trawl



2001-2008

- southwestern TAS
- Commercial sampling (FY)
- Data: TAFI/AFMA

2015-2017

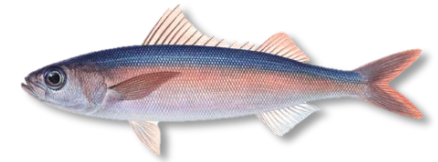
- Commonwealth (Fishing season)
- Off SA & southwestern TAS (Sub-zones 3 & 4)
- Catch weighted
- Data: SARDI

Female size at maturity (261 mm FL) – incorporates sampling bias (Neira et al. 2008)

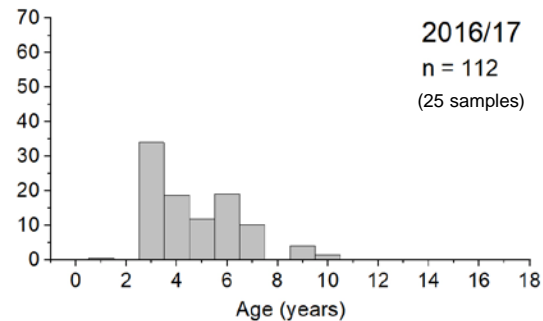
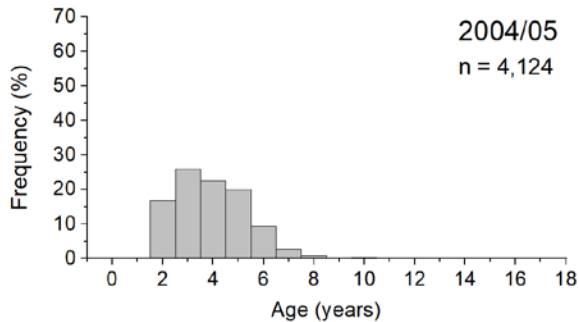
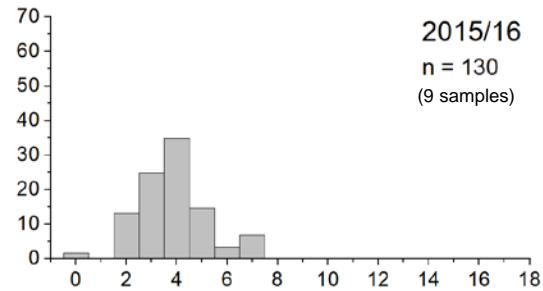
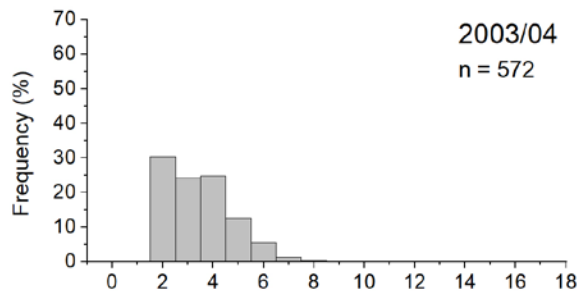
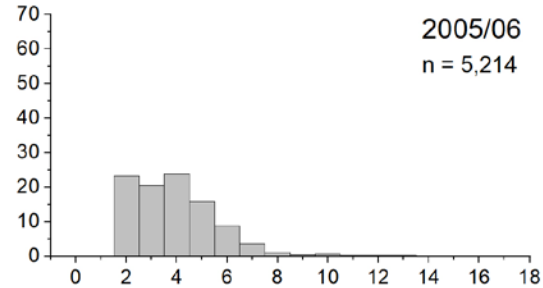
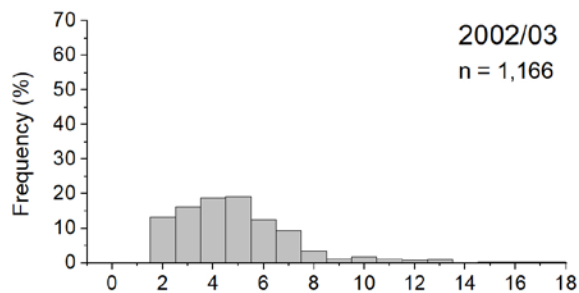
RB East size at mat.: 157 mm FL (Neira et al. 2008)

2017 RB West DEPM mean size of spawning females: 215 mm FL (173-269 mm FL); n fish=826, n samples=9

Redbait (West)



Age Frequency: Mid-water Trawl



2002/03-2005/06

- southwestern TAS
- Commercial sampling (FY)
- Data: TAFI/AFMA

2015/16-2016/17

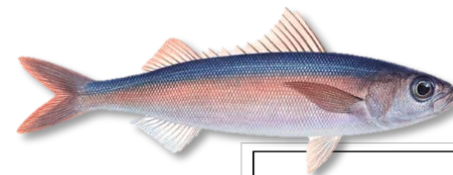
- Commonwealth (Fishing season)
- Catch weighted
- Off SA & southwestern TAS (Sub-zones 3 & 4)
- Data: SARDI

- ✦ Age at maturity:
~4 yrs (use with caution – sampling bias)
~2 yrs (RB East estimate)

Redbait (West)

DEPM Survey

Spring 2017: Oct/Nov



Eggs:

- Oct/Nov 2017
- 3,280 live redbait eggs from 113 of 308 total sites
- Spawning area: 28,365 km²

Adults:

- Collected off TAS (Oct 2017)
- Demersal trawl
- Female n = 826 (9 samples)

Redbait (West)

DEPM Survey (2017)

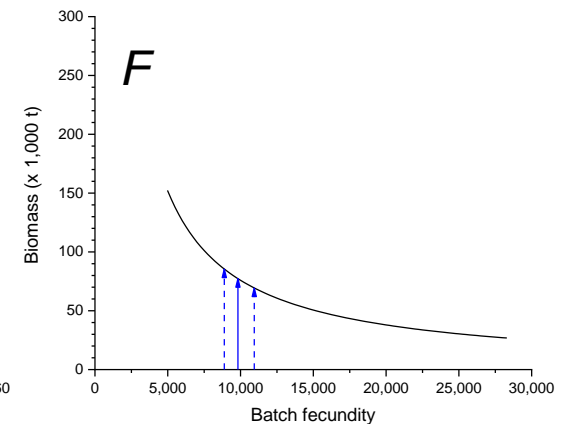
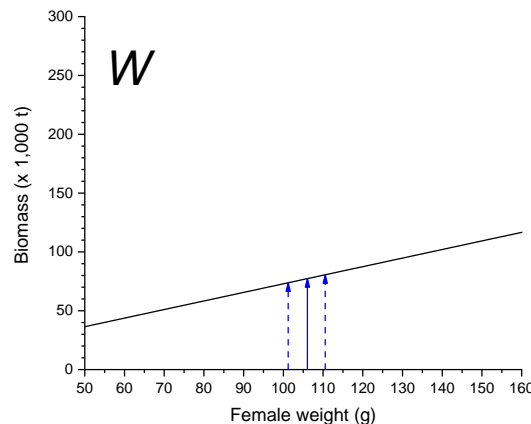
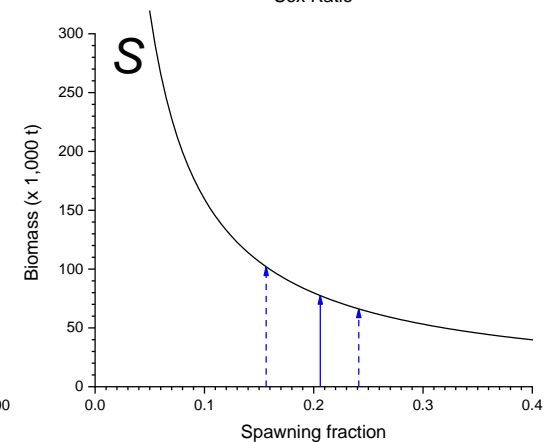
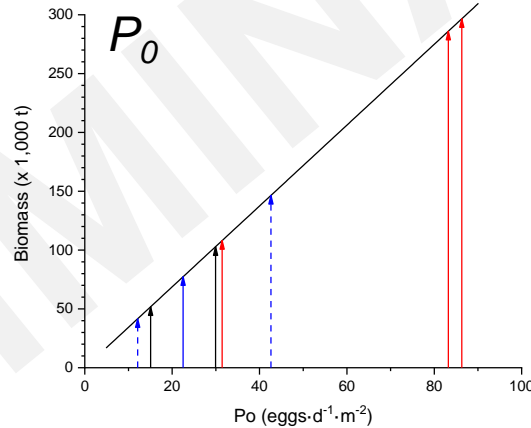
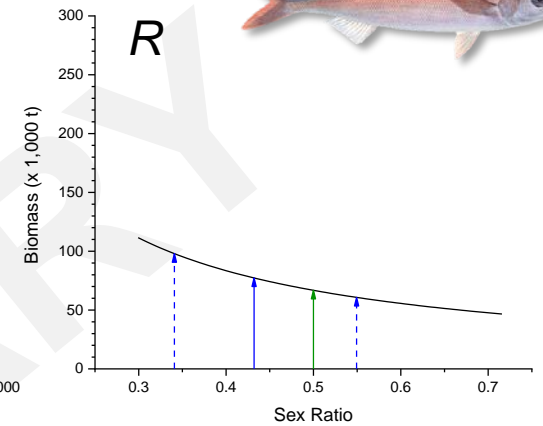
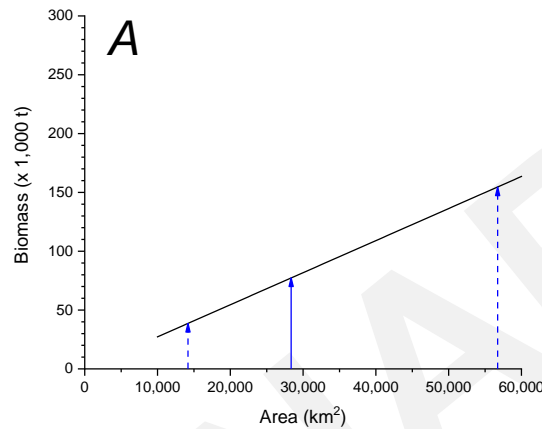
Sensitivity analysis

2017 SB estimate: **77,292 t**

Sex Ratio 50:50 = **66,787 t**

Parameters in sensitivity analysis:

- Blue:** values used in DEPM calculations to estimate SB (solid) and their 95% CIs (dashed)
- Black:** P_0 of log-linear & Quasi-Poisson GLM models: mean P_0 of these models used in SB estimate (51,765 and 102,867)
- Red:** P_0 estimated from alternative egg production models.
- Green:** R estimate forced to 50:50 (66,787 t)



Redbait (West)



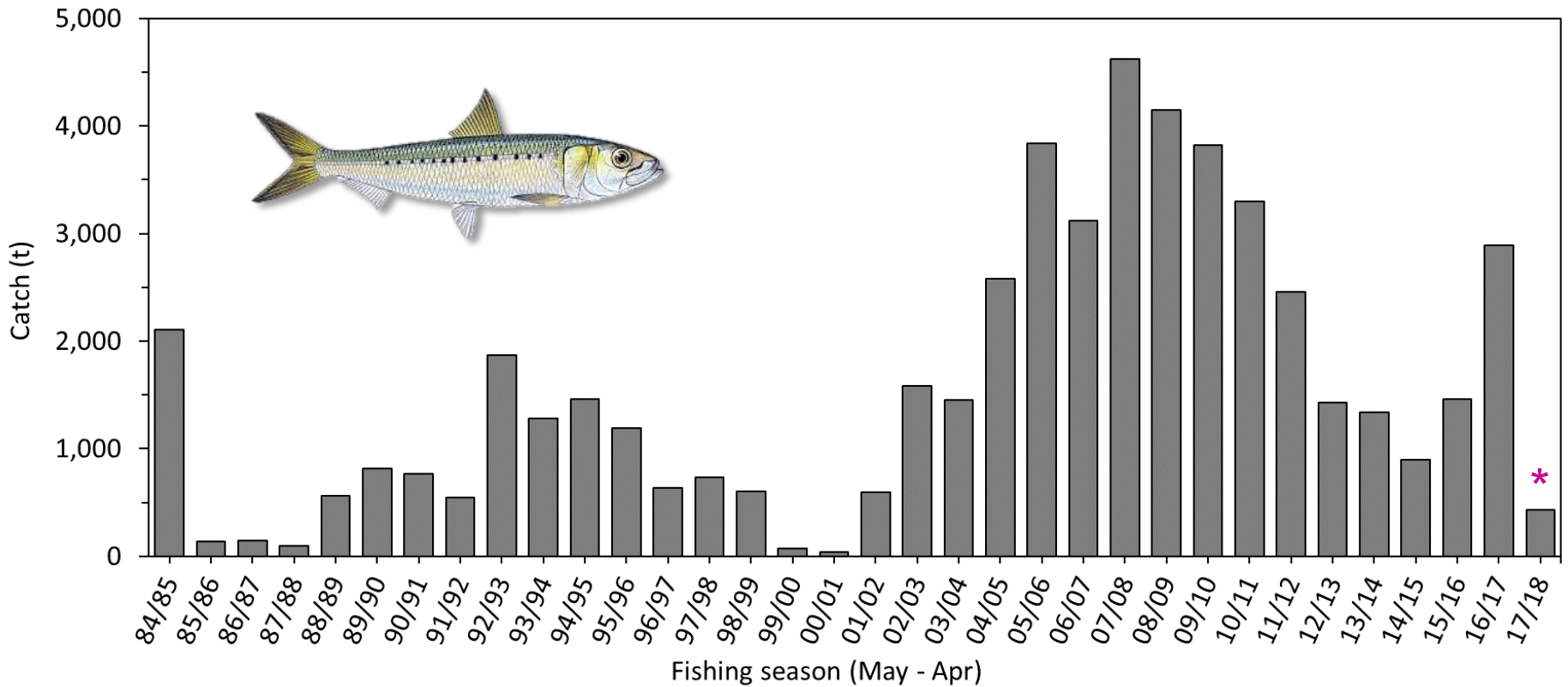
% DEPM & TAC

Zone	DEPM Date	DEPM Biomass Estimate (t)	2017/18 RBC (t)	2017/18 TAC (t)	2017/18 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
West	2017	77,292	825	820	Total: 0 SPF: 0	0	0	0
		SR 50:50 66,787 (mean of estimates below)						
		51,765 (log-linear)						
		102,867 (quasi-Poisson GLM)						

→ SB Estimate (Redbait - West): Preliminary

Australian Sardine (East)

Total Catch



- Total Catch: 429 t in 2017/18 (VIC not included)

- Historical peak: 4,619 t in 2007/08

- Principal Fisheries: Commonwealth JMK/SPF; NSW Ocean Hauling; Victorian Ocean Purse Seine

- VIC total catch 2016/17: 2,253 t in 2016/17 (8 boats— all gear types, 90 boat days)

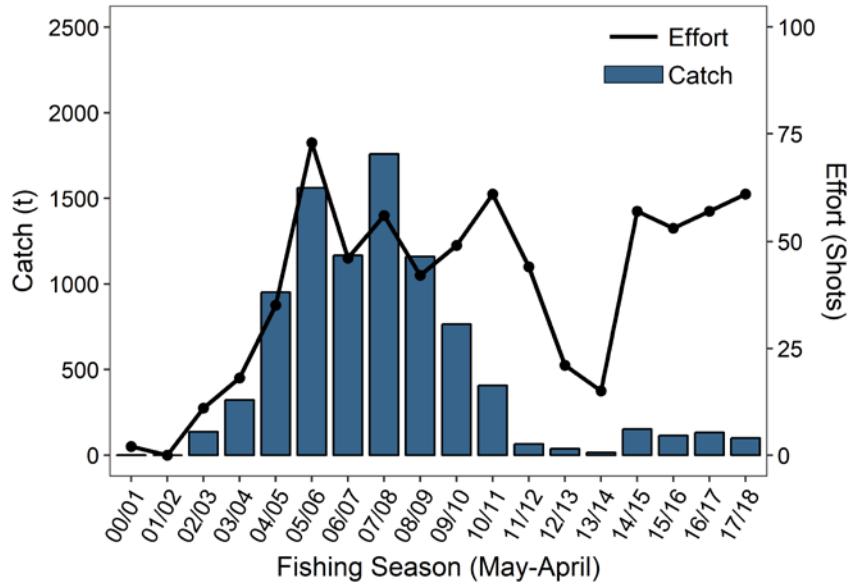
- ↓ during 1999/00 - 2000/01: herpes virus in both 1995 & 1998 wiped out sardine (targeted fishing resumed in 2002 when stocks recovered)

- * VIC catch not included: confidential

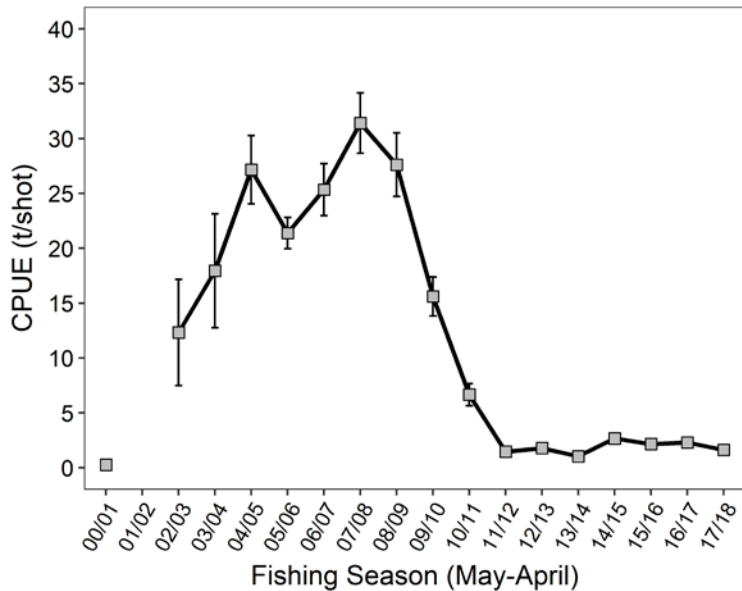
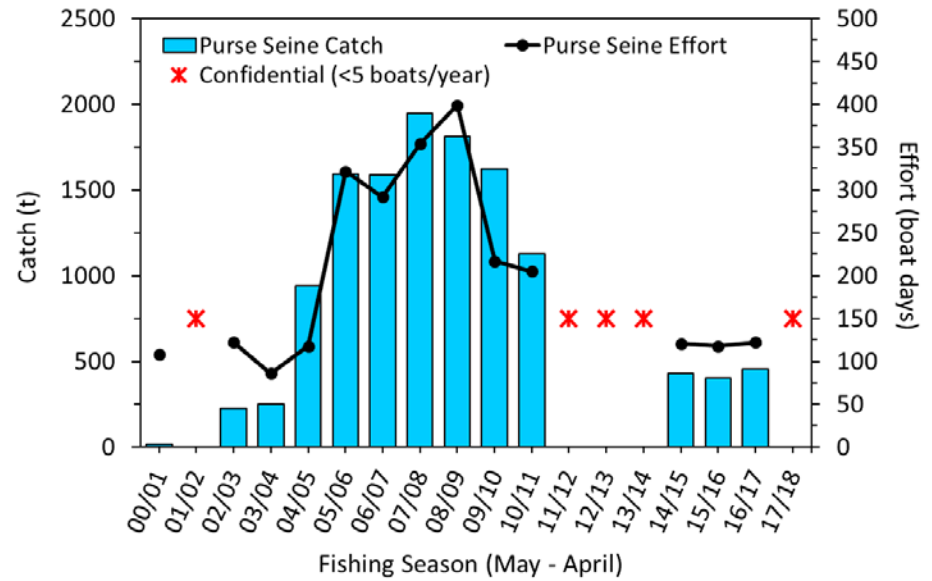
Australian Sardine (East)



Commonwealth: Purse Seine



NSW: Purse Seine



Australian Sardine (East)

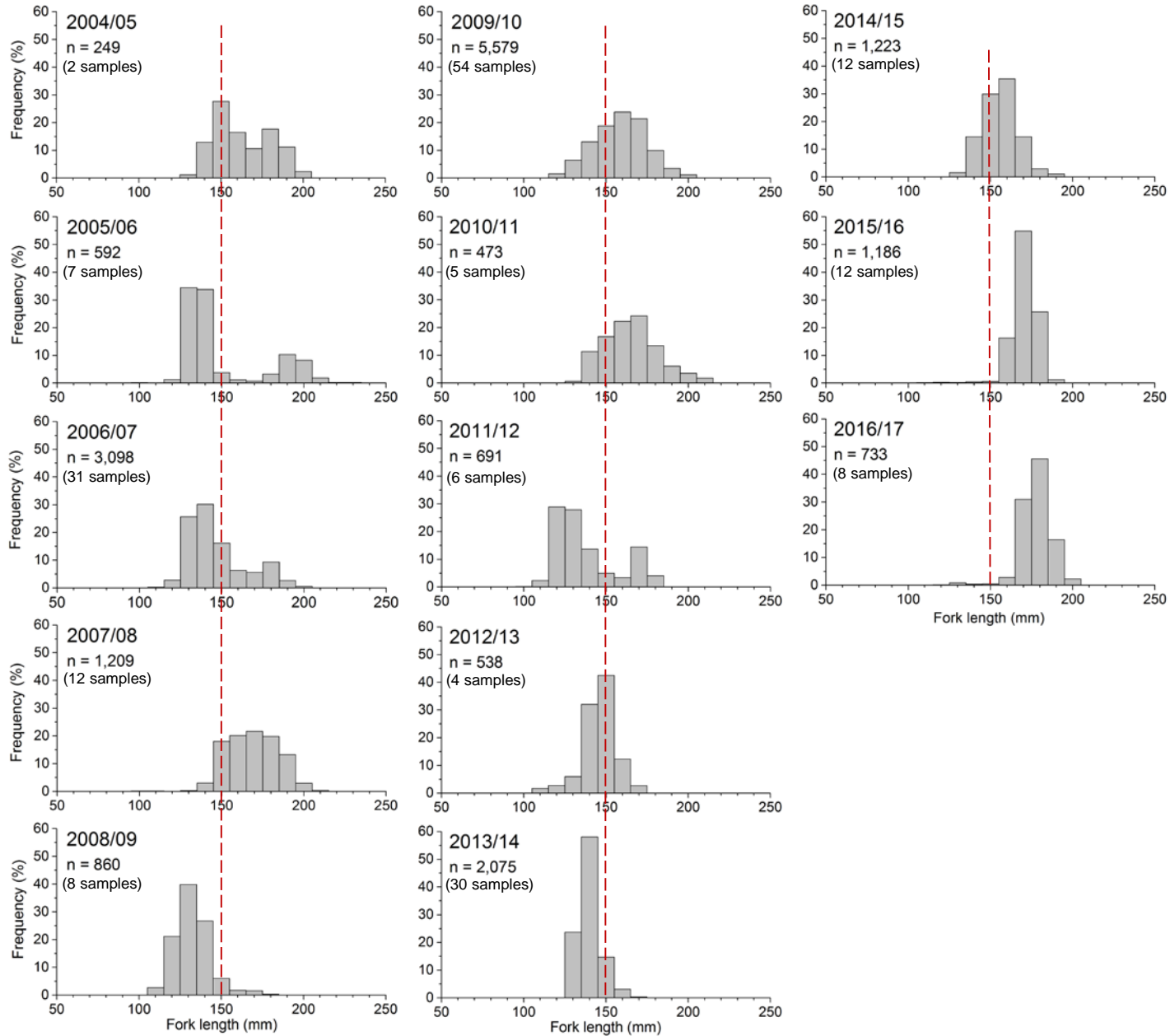
Length Frequency

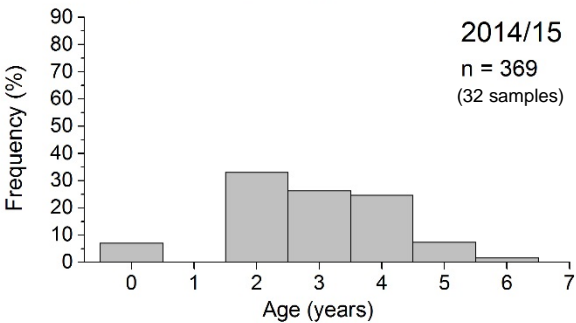
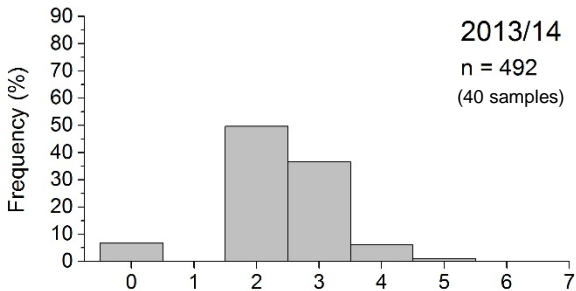
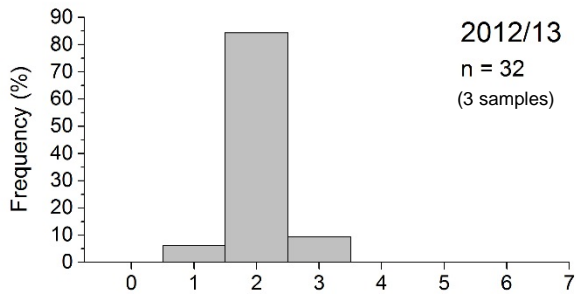
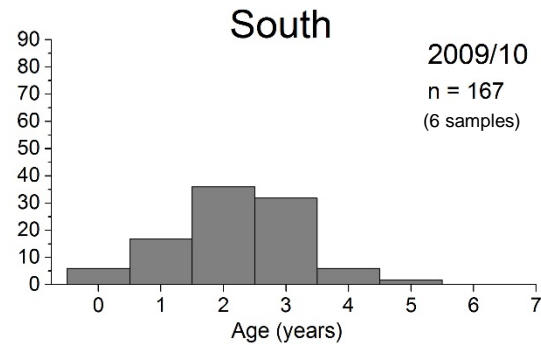
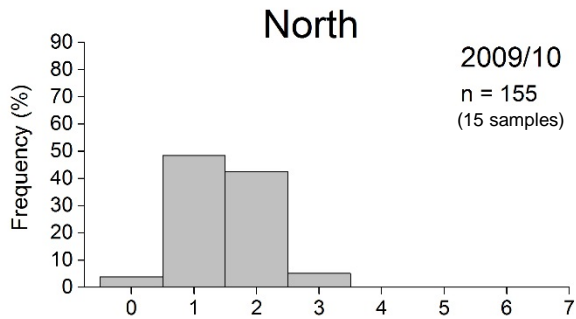


Purse Seine Catches

- NSW Commercial catches
- represent entire NSW fishery
- 2004/05 to 2016/17 (FY)
- Data: NSW DPI

Female size at maturity
(150 mm FL)





Australian Sardine (East) Age Frequency

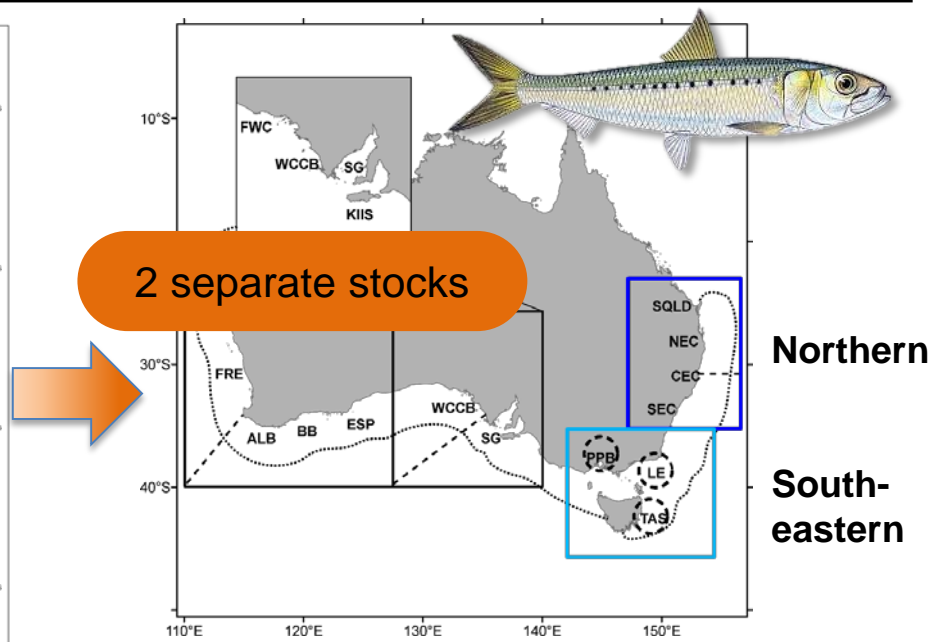
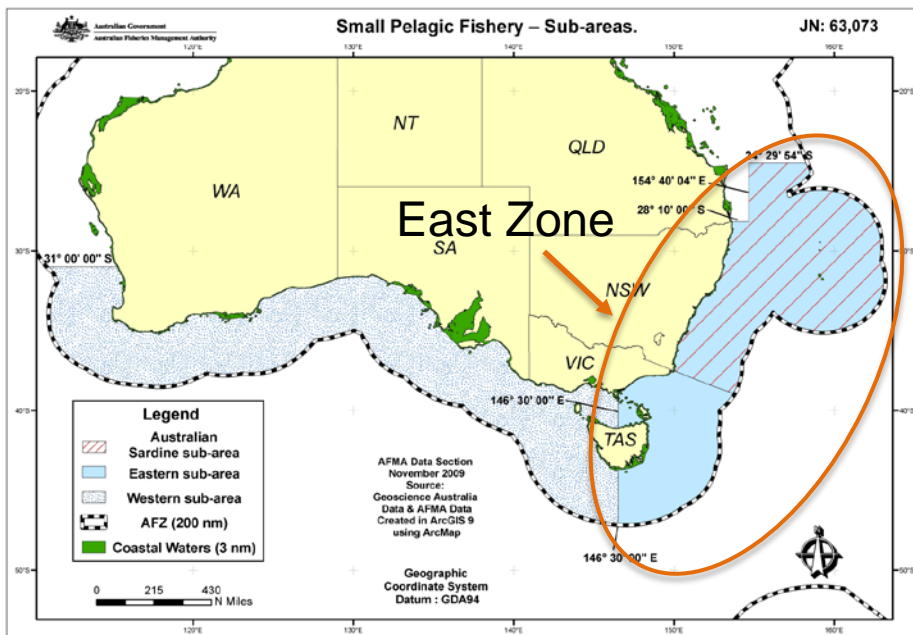
- Commercial Purse Seine catches
- North & South NSW coast
- Data: SARDI
- 2009/10-2012/13 (FY)
- 2013/14-2014/15 (Fishing season)

✦ Age at maturity: ~2 to 3 yrs (varies by location)

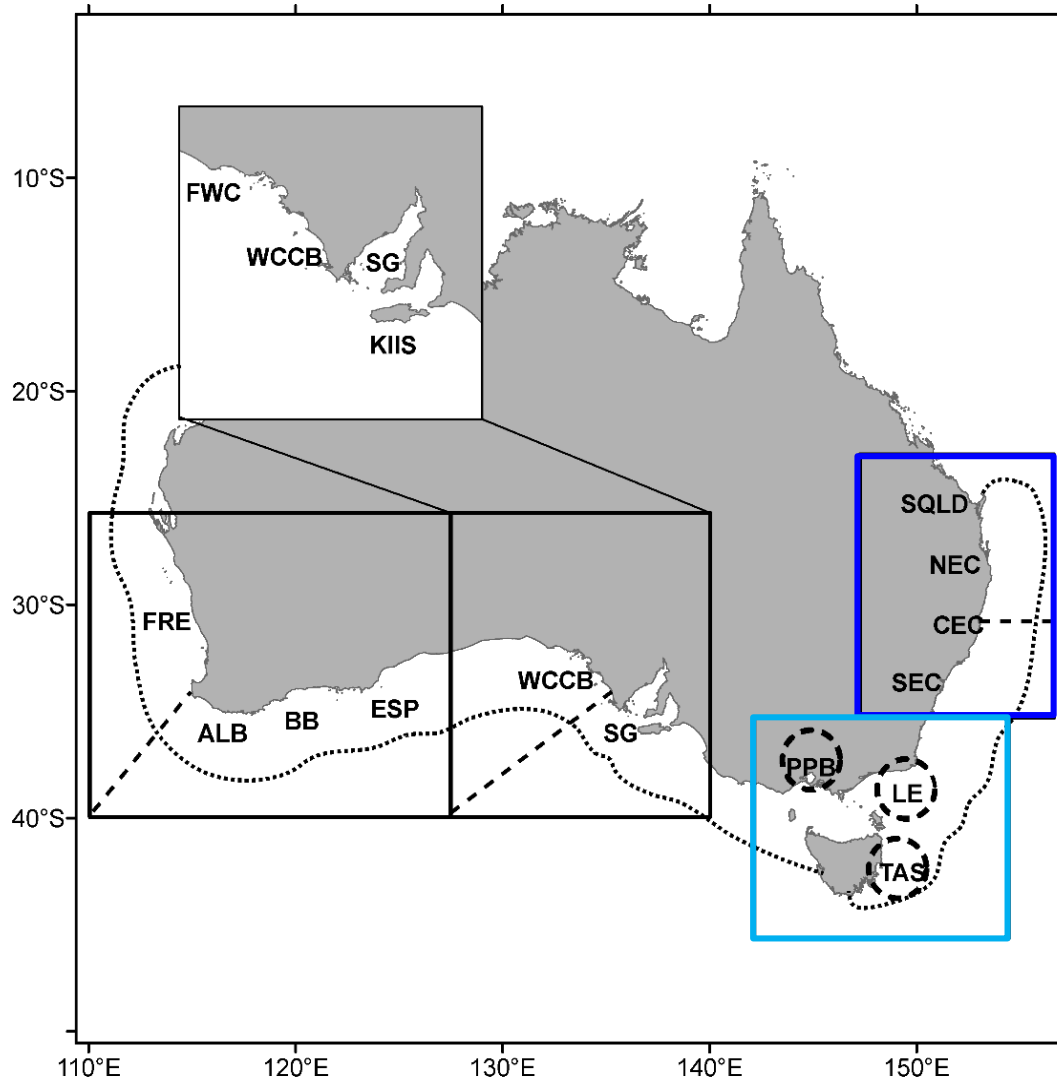
Australian Sardine

DEPM – Overall East Zone

Zone	DEPM Date	DEPM Biomass Estimate (t) (95% CI)	2016/17 RBC (t)	2016/17 TAC (t)	2016/17 Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East	1997 (winter/ spring)	27,553 (10,406 - 59,625)				1.6		
	1998 (winter/ spring)	25,747 (5,240 - 102,528)				1.7		
	2004 (winter)	28,809	9,915	9,550	Total: 429 (VIC unknown)	1.5	4.3	1.0
	2014 (winter/ spring) Ward et al. 2015a	49,575 (24,179 - 213,323)			SPF: 99	0.9		
South-eastern	2014 (summer) (Ward et al. 2015b)	10,962						



Australian Sardine (East)



Stock Structure

Integrated evidence from Izzo et al. (2017)

Northern Stock

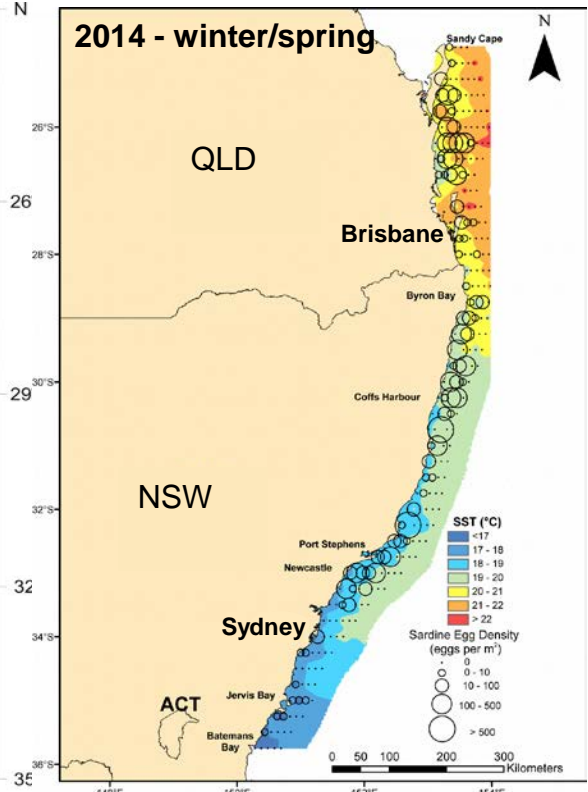
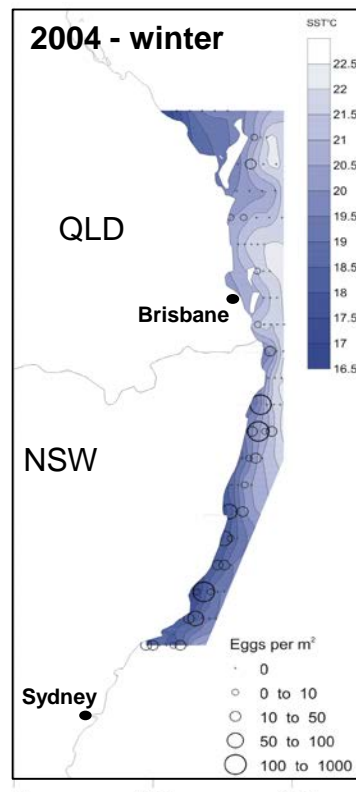
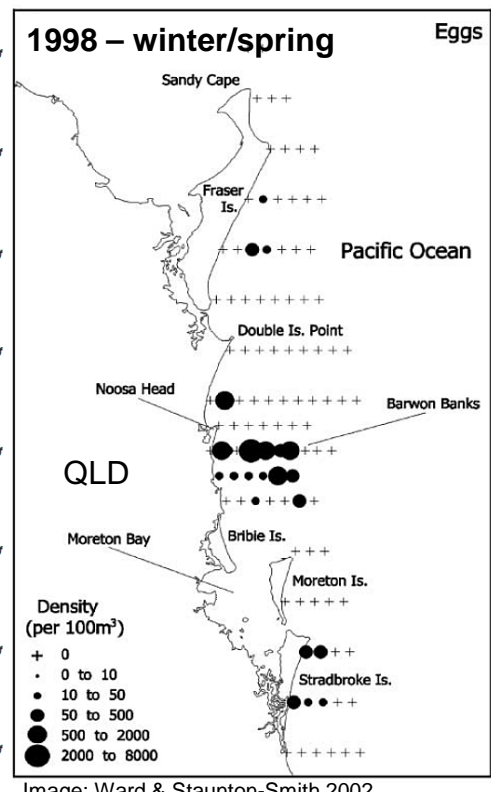
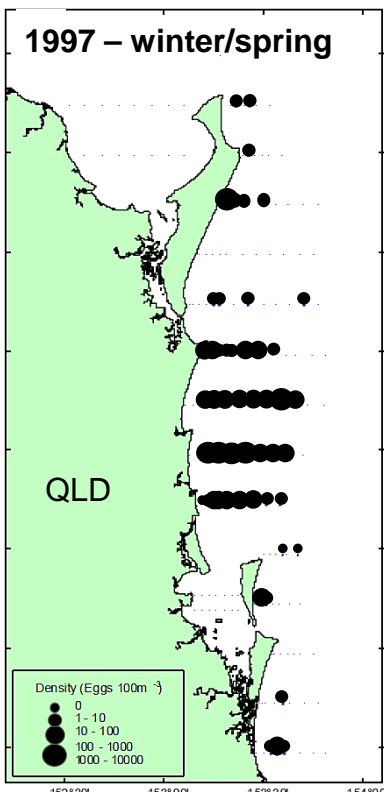
Southeastern Stock

Australian Sardine

DEPM – Northern Stock



Zone	DEPM Date	DEPM Biomass Estimate (t) (95% CI)	2017/18 East Zone RBC (t)	2017/18 East Zone TAC (t)	2017/18 Subzone 6 Total Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East – North Stock	1997 (winter/ spring)	27,553 (10,406 - 59,625)				2.2		
	1998 (winter/ spring)	25,747 (5,240 - 102,528)				2.3		
	2004 (winter)	28,809	9,915	9,550	Total: 429 SPF: 99	2.1	4.3	1.0
	2014 (winter/ spring) Ward et al. 2015a	49,575 (24,179 - 213,323)				1.2		

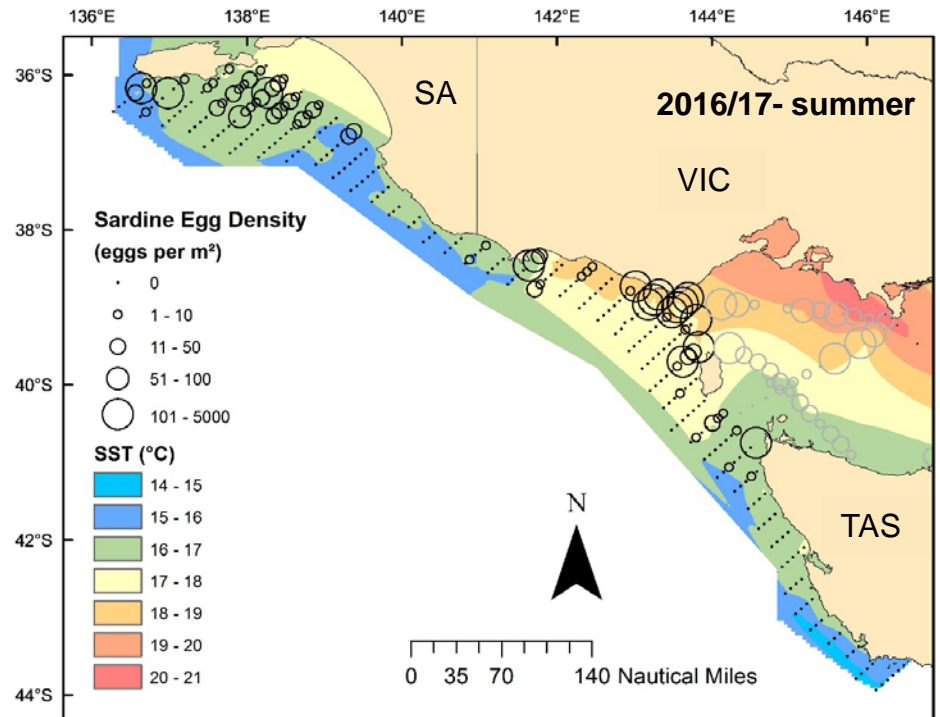
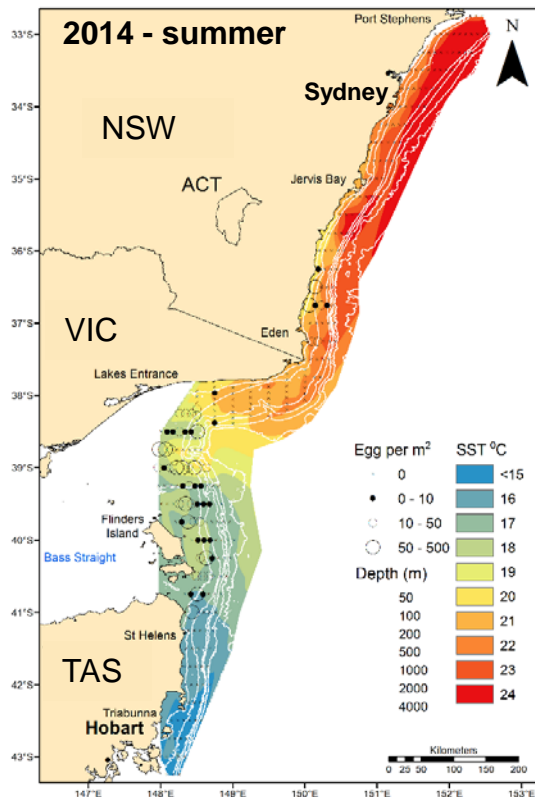


Australian Sardine

DEPM – Southeastern Stock



Zone	Date	DEPM Biomass Estimate (t) (95% CI)	2017/18 East Zone RBC (t)	2017/18 East Zone TAC (t)	2017/18 Subzone 5 Total Catch (t)	Total Catch % DEPM estimate	Total Catch % RBC	SPF Catch % TAC
East	2014 (summer) (Ward et al. 2015b)	10,962	9,915	9,550	Total: ≥ 0.2 (VIC unknown)	? (<0.1)	? (<0.1)	0.0
West	2016/17 (summer) (Ward et al. 2018)	47,283	9,915	9,550	SPF: 0	? (<0.1)	? (<0.1)	0.0
		30,000 (east of Bonney Coast)				? (<0.1)		



Summary and Conclusions

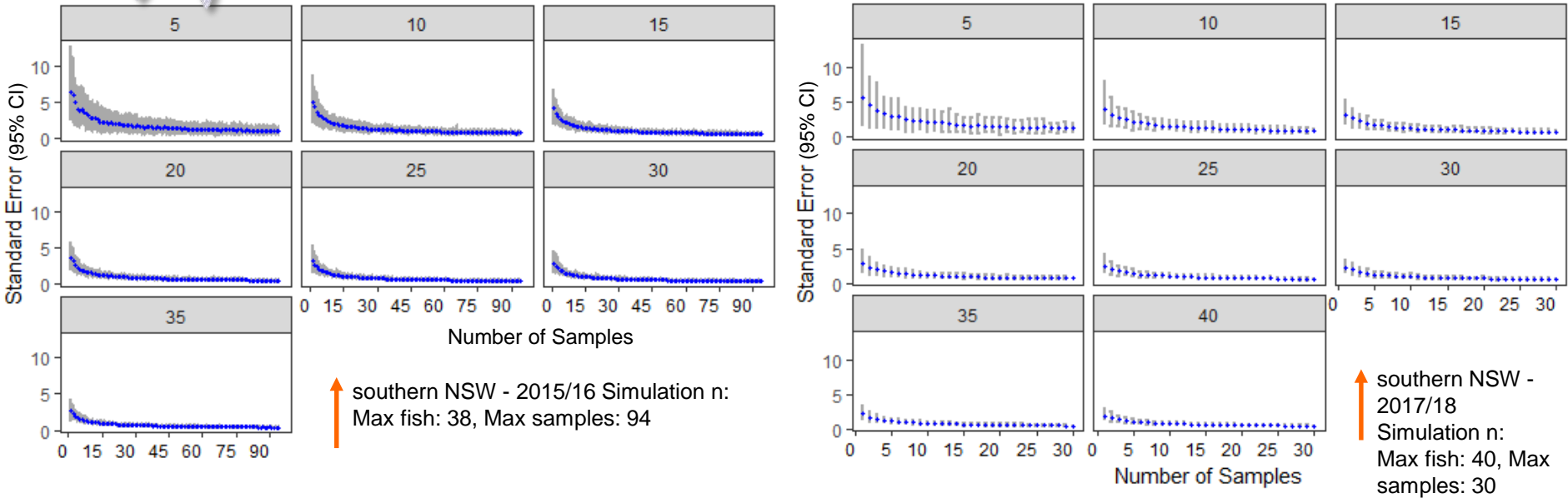


- DEPM spawning biomass estimates for Blue Mackerel (West) and Redbait (East) are more than 5 years old
- DEPM spawning biomass estimates for Blue Mackerel (East) and Jack Mackerel (East) are coming into their 5th season (both DEPM estimates: 2014)
- DEPM spawning biomass estimate finalised for Jack Mackerel (West)
- Preliminary DEPM spawning biomass estimate available for Redbait (West)

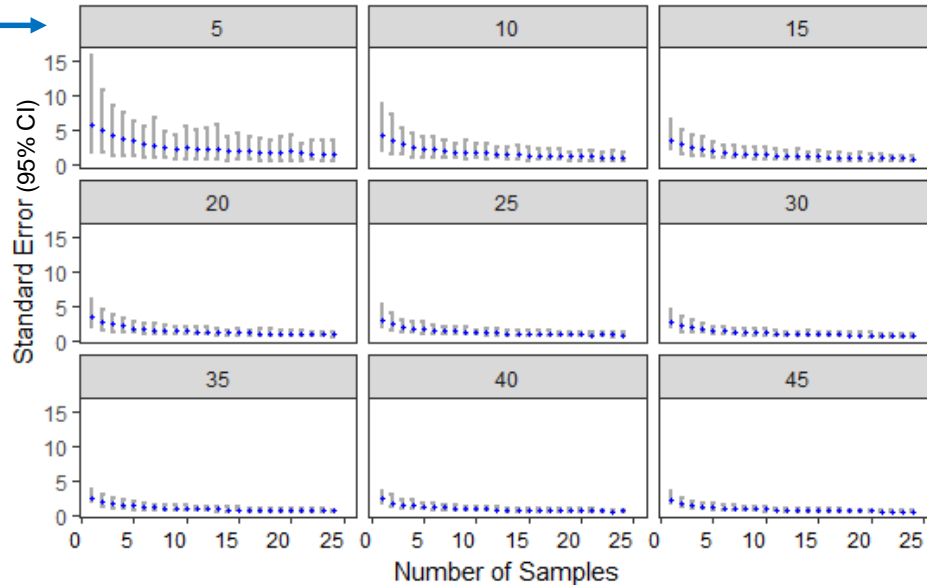
Cost-Benefit Analysis for Catch Sample Processing: Length - Jack Mackerel



Varying number of fish per sample and number of samples collected



fish per sample →



Plots:

- Mean SE (blue) for each n sample × n fish combo
- 95% CI of mean SE

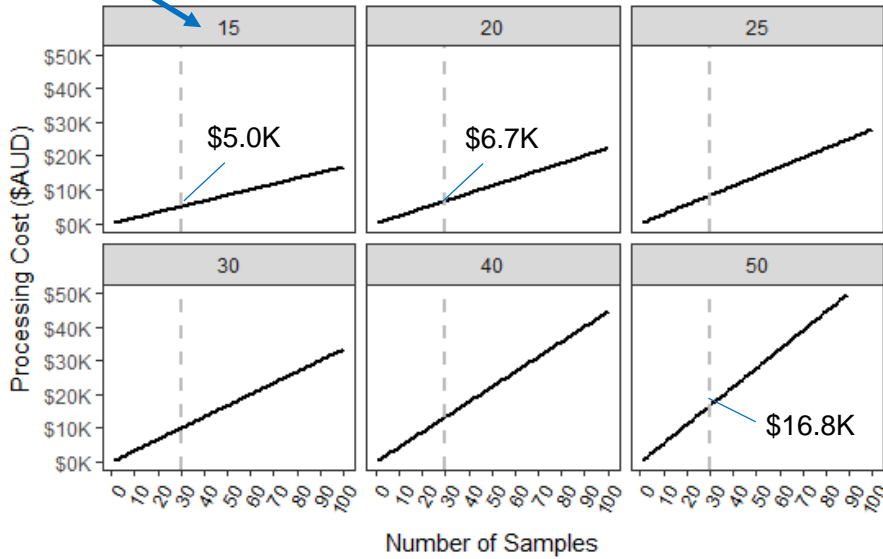
← off Kangaroo Island, SA- 2016/17 Simulation n:
Max fish: 48, Max samples: 24

Cost-Benefit Analysis for Catch Sample Processing

Cost per X samples & X fish

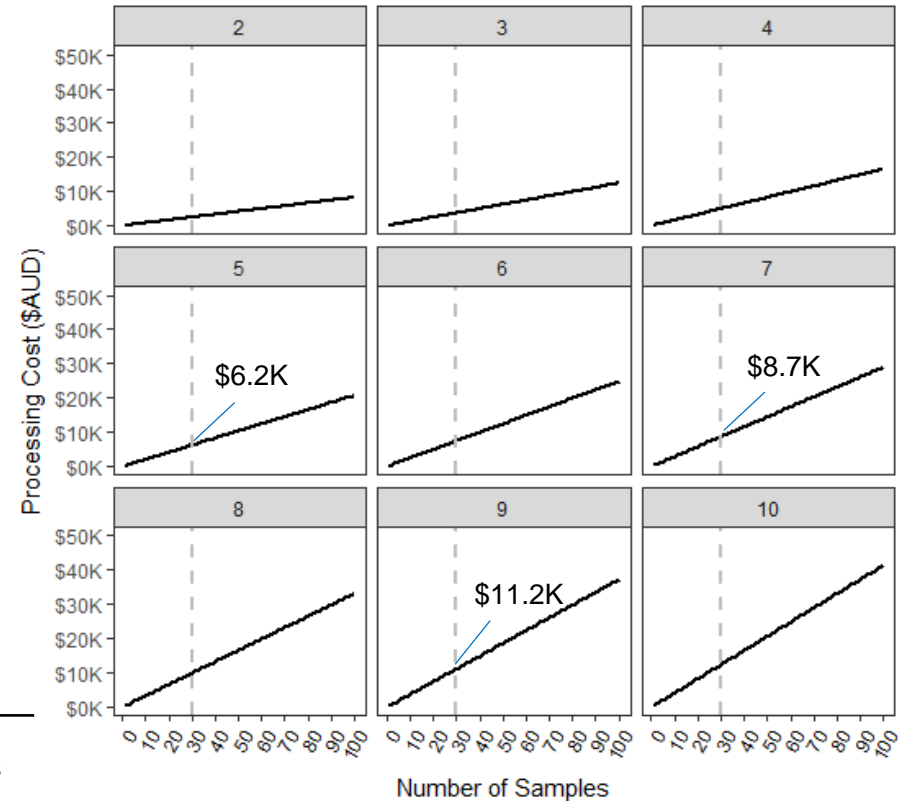
fish per sample

Length-Weight



+

Age



Cost per fish

Services/costs included in per fish \$\$

Length-Weight

\$11.12

- Weight & length
- Reproductive biology: sex, stage gonads, weigh gonads
- Otolith removal
- Data entry
- Freight from Ulladulla to Adelaide
- Laboratory consumables

Ageing

\$41.43

- Weigh otoliths,
- embed in resin & thin section (batch processing)
- cut with low speed saw
- Mount on slide, polish & clean
- Calibrating otolith agers with reference collection
- 2 separate reads of otolith ages & a consensus read
- Otolith processing consumables

Total cost:

30 samples x 20 fish (length) & 5 fish aged

\$6.7K + \$6.2K

\$12.9K per species x 3 species: \$38.7K



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