

The social-ecological dimensions of a small-scale crab fishery in Western Australia

Very much a collaborative effort

★ Supervisory team



2018



2019



2020



Clara Obregón, Dr James Tweedley, Prof. Neil Loneragan, Dr Michael Hughes, Dr Ingrid van Putten, Dr Ryan Admiraal, Dr Joe Christensen

Fisheries as social-ecological systems (SES)

- Globally → **EBFM** for sustainable fisheries management as SES
- Framework on **social-ecological systems** management
- SES dimensions: biological, economic, human
- Recognition of **human dimensions** but... no data!

Fishery Status Reports
Healthcheck for Australian Fisheries

Australian Fisheries Healthcheck

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MISSION
ENT

AND DEVELOPMENT

Hobday et al. 2016

energy to achieve sustainability. A general framework is used to identify 10 subsystem variables that affect the likelihood of self-organization in efforts to achieve a sustainable SES.

Ostrom 2009



FAO 2003

Brundtland 1987

WA blue swimmer crab fishery

Commercial sector:

- ~32 people
- Target fisheries:
 - 10 m vessel & family businesses
- 2018/19: **94.7 t**

Recreational sector:

- ~100,000 people
- 2018/19: ~ **61.1 t** (boat-based)

- **Peel-Harvey: MSC cert.**



©MSC 2016



©DPIRD 2018

Research overall aims

Understanding human dimensions

- 1) Beliefs and attitudes of recreational fishers towards **management**
- 2) Concerns and solutions supported by **both** fishing sectors
- 3) **Social network** structure of the fishery
- 4) **Shifting baselines** and local fisher knowledge

Research focus:

- **South-western Australia**
 - Swan-Canning Estuary
 - Peel-Harvey Estuary
 - Leschenault Estuary

Paper 1. Beliefs & attitudes of stock enhancement



**Aim: Beliefs and attitudes of recreational
fishers
towards management**

Study area and sector:

- Recreational sector
- Stock enhancement
- Three estuaries

Paper 1. Beliefs & attitudes of stock enhancement

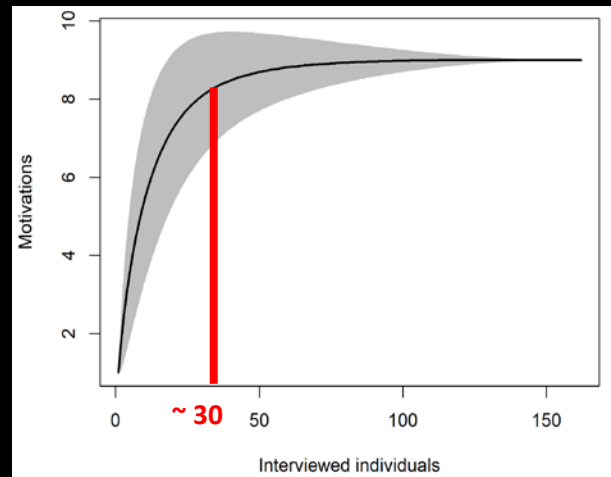
Phase 1

Open-ended face-to-face interviews



Identify fishers beliefs & attitudes

Data saturation



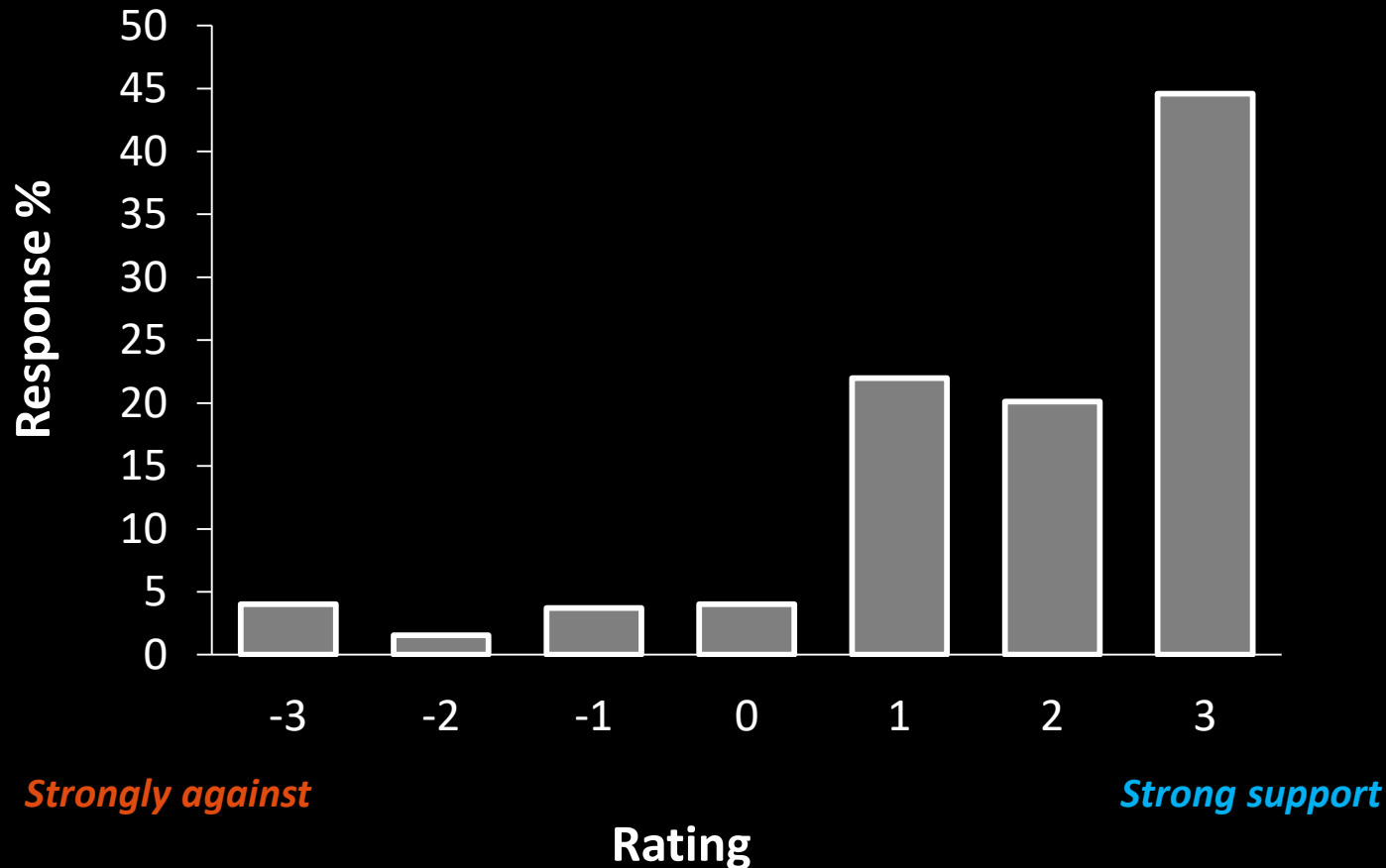
Phase 2

Closed-question online survey



Quantify strength of beliefs & attitudes

Paper 1. Beliefs & attitudes of stock enhancement

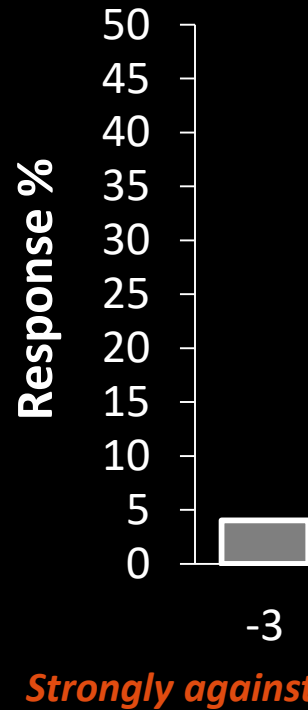


“Increase the population and (..) better for rec. fishers”

“Mess up with the natural balance”
“Cost of it”

- 1) **Support** for stock enhancement
- 2) Aware of the **positive** and **negative** outcomes

Paper 1. Beliefs & attitudes of stock enhancement



Ambio
<https://doi.org/10.1007/s13280-019-01212-y>

KUNGL. VETENSKAPS-
 AKADEMIEN
 THE ROYAL SWEDISH ACADEMY OF SCIENCES

Check for updates

RESEARCH ARTICLE

A two-phase approach to elicit and measure beliefs on management strategies: Fishers supportive and aware of trade-offs associated with stock enhancement

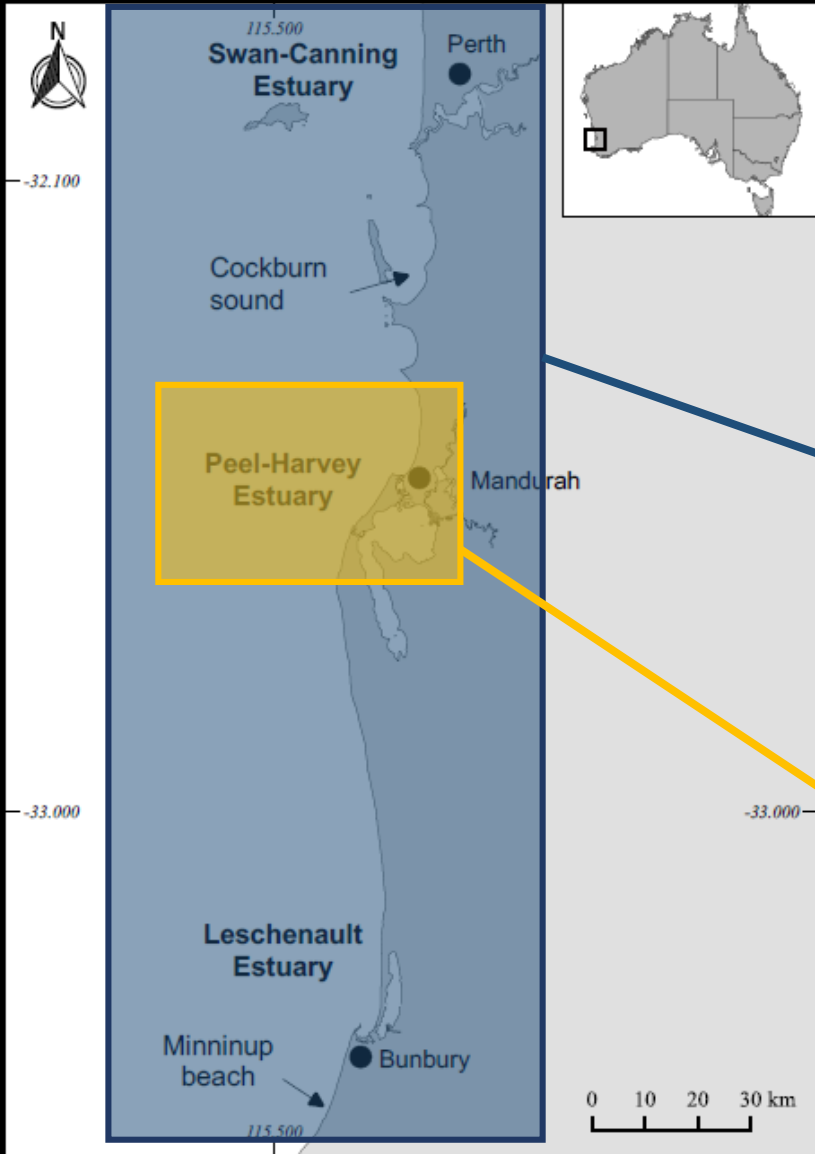
Clara Obregón , Michael Hughes , Neil R. Loneragan , Sarah J. Poulton, James R. Tweedley

osers?
 outcomes
 nsequences

Management of fisher expectations requires communication of outcomes & likelihood of outcomes

Paper 2. Human dimensions of both sectors

Aim: Concerns and solutions supported by both fishing sectors

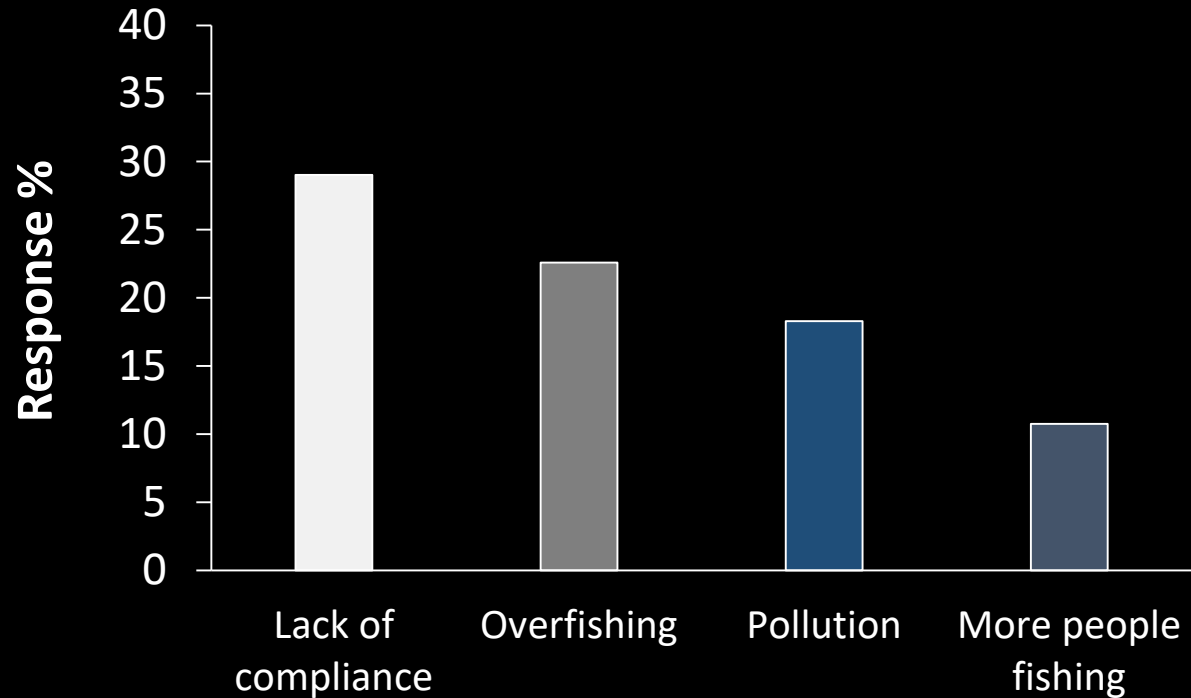


- RECREATIONAL SECTOR ONLY**
- Peel-Harvey : 41 rec. fishers
 - Swan-Canning: 24 rec. fishers
 - Leschenault: 28 rec. fishers

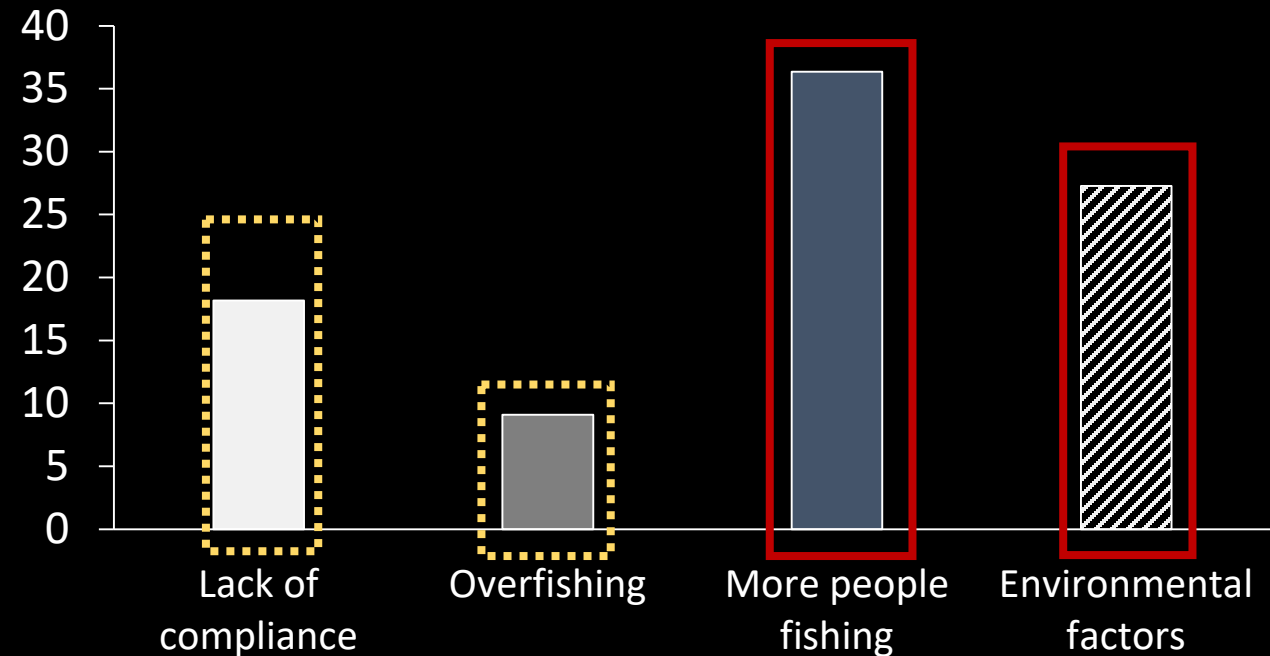
- BOTH SECTORS**
- Swan-Canning: 2 comm. Fishers
 - Peel-Harvey: 7 comm. fishers
- * This is now 6 in the PH*

Paper 2. Main concerns (both sectors)

REC. SECTOR (n = 41)

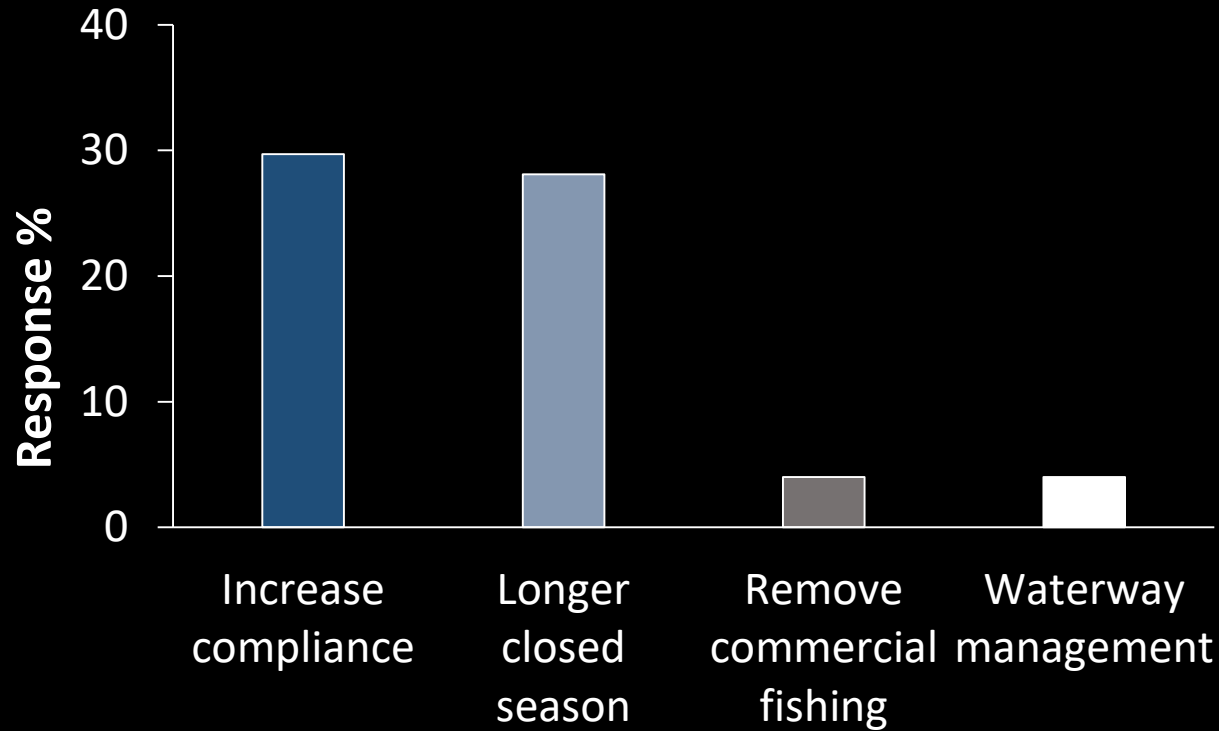


COMM. SECTOR (n = 7)

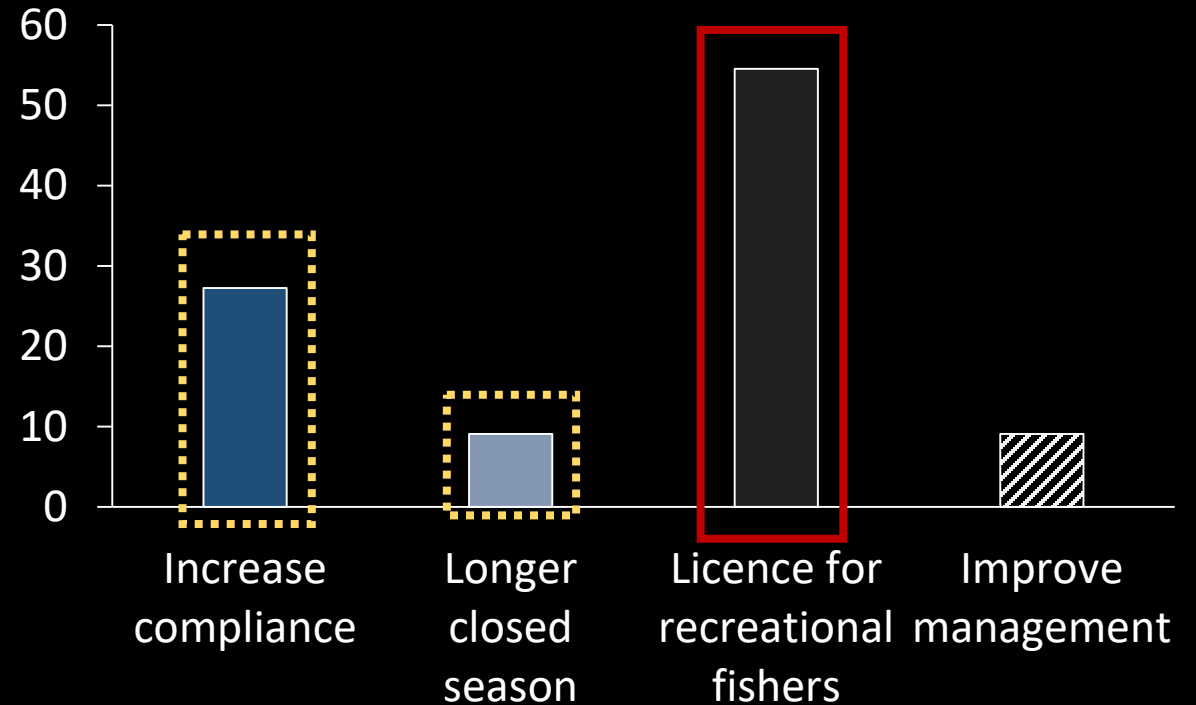


Paper 2. Main solutions (both sectors)

REC. SECTOR (n = 41)



COMM. SECTOR (n = 7)



Fishing sectors:

Differences but also common perceptions on management approaches and stocks



Paper 2. Main concerns & solutions (recs. only)

Response %

50
40
30
20
10
0

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ICES CIEM International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Different but not opposed: perceptions between fishing sectors on the status and management of a crab fishery

Clara Obregon ✉, James R Tweedley, Neil R Loneragan, Michael Hughes

ICES Journal of Marine Science, Volume 77, Issue 6, November-December 2020, Pages 2354–2368, <https://doi.org/10.1093/icesjms/fsz225>

Published: 05 December 2019 **Article history** ▾

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Estuarine systems:

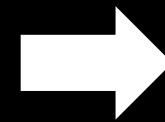
Different **systems** subjected to **different pressures** → different concerns and solutions supported

Paper 3. Network analysis - Peel-Harvey fishery

2018 survey **concerns** on sustainability

Overfishing

- 9% of commercial fishers
- >30% of recreational fishers



Social network analysis
(SNA) to understand
information flow



Paper 3. Network analysis - Peel-Harvey fishery

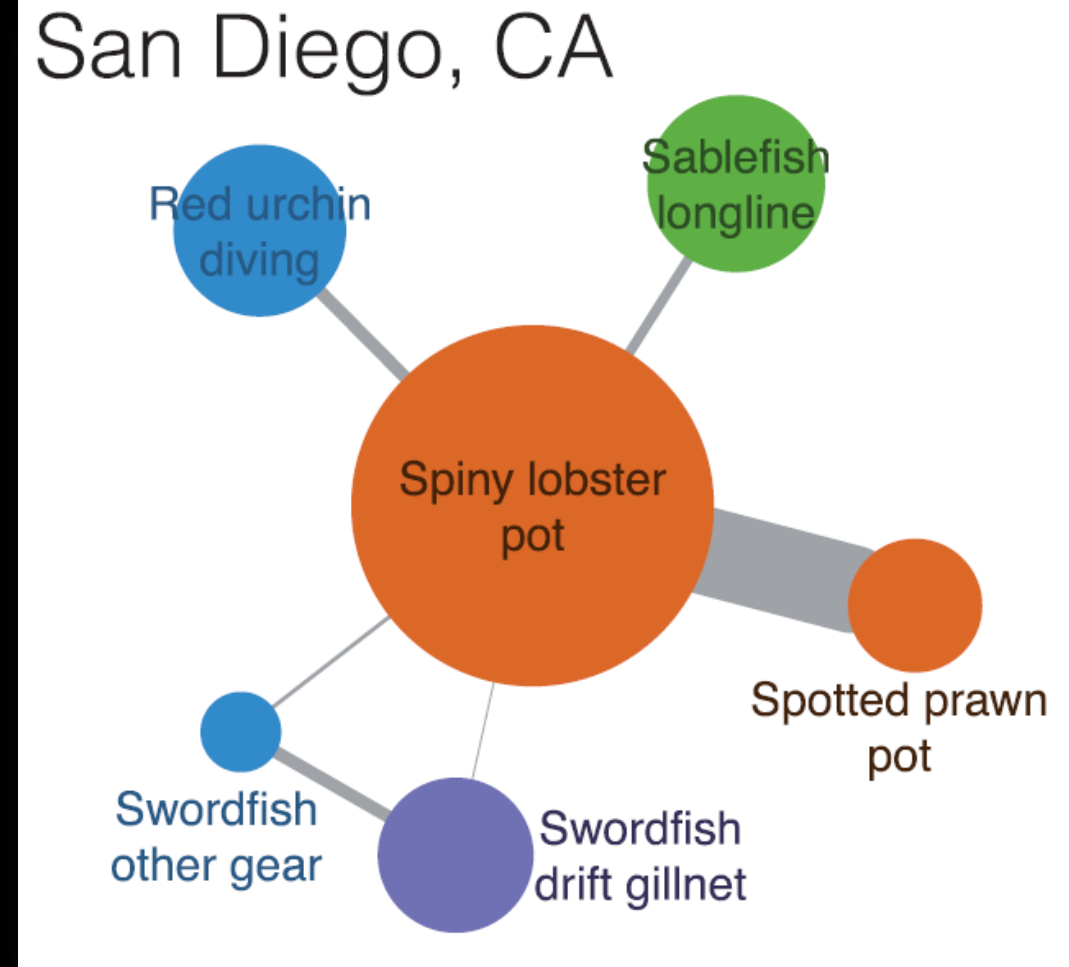
Interdisciplinary tool

Represent & analyze relationships

- Behavioral patterns
- Disease spread
- **Information & communication** channels

Fisheries research

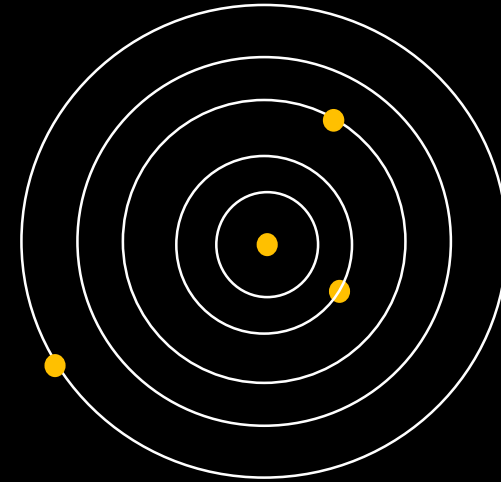
- Relationships catches / gear types
- ... between fishers
- ... between **stakeholder** groups



Paper 3. Network analysis - Peel-Harvey fishery

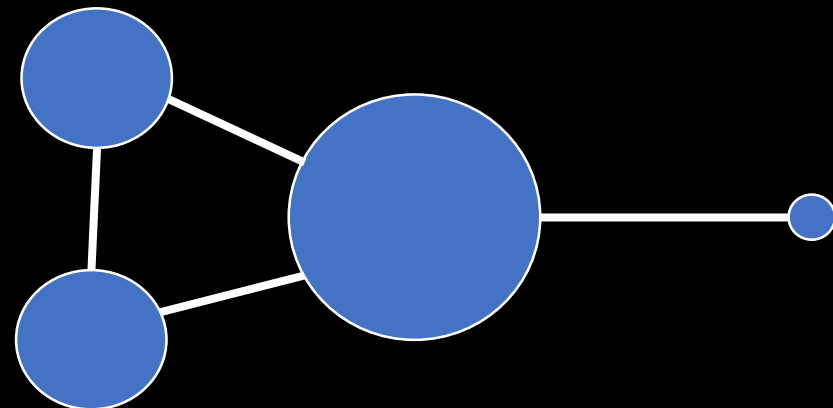
Connectivity

No. of incoming & outgoing interactions



Bridging capacity

No. of actors connected that would be disconnected otherwise



Paper 3. Network analysis - Peel-Harvey fishery

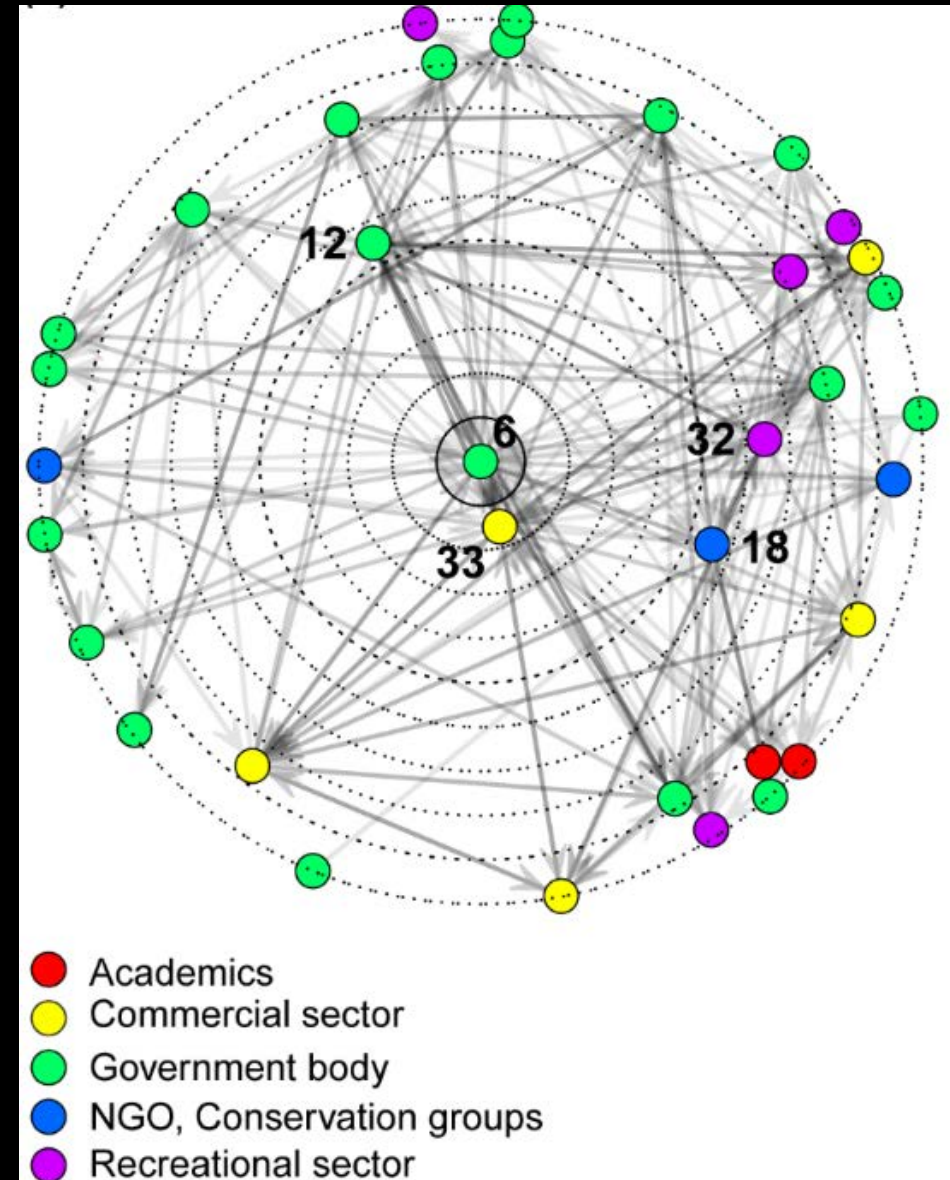
Network of **individuals**

- Mentioned: 194 individuals
- Included: 85 individuals
 - 50 recreational fishers
 - 35 other individuals (incl. 2 commercial fishers)

Connectivity

Top 5 individuals → 4 major groups:

- Government body
- Commercial sector
- Recreational sector
- NGOs/Conservation groups



Paper 3. Network analysis - Peel-Harvey fishery



Network

- Ment
- Inclu

Bridging

- DPIRD
- PHCC
- transfe
- groups
- Poor co
- year of

ORIGINAL RESEARCH ARTICLE
Front. Mar. Sci., 27 October 2020 | <https://doi.org/10.3389/fmars.2020.578014>

Who You Speak to Matters: Information Sharing and the Management of a Small-Scale Fishery

Clara Obregón^{1,2*}, Ryan Admiraal³, Ingrid van Putten^{4,5}, Michael Hughes^{1,2}, James R. Tweedley^{1,2} and Neil R. Loneragan^{1,2}

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- Importance of **communication means** to reach stakeholders
- **bridging organizations** might have a bigger role
- the need for **academics** to actively create connections

Paper 4. Fisher perceptions and shifting baselines



*“We transform the world, but we don't remember it. We **adjust our baseline** to the new level, and **we don't recall what was there**”*

Pauly, 1995

Perceptions of change through **shifting baseline syndrome**

Recreational fishers' perceptions of change (size, abundance) through time

Paper 4. Fisher perceptions and shifting baselines

Data sources

Face-to-face
survey

Trove
(newspapers)



1948

Where To Fish

Fisheries Department Inspectors report.

Bottnest: Skipjack plentiful with a few garfish and herring. Spanish mackerel and bonito from boats

Rockingham: Skipjack and herring plentiful. Fishing good generally

River: Prawns in the lower reaches near Preston Point, plentiful on banks. **Good-size crabs** (up to 24lb.) taken by drop net in deep water.

1939

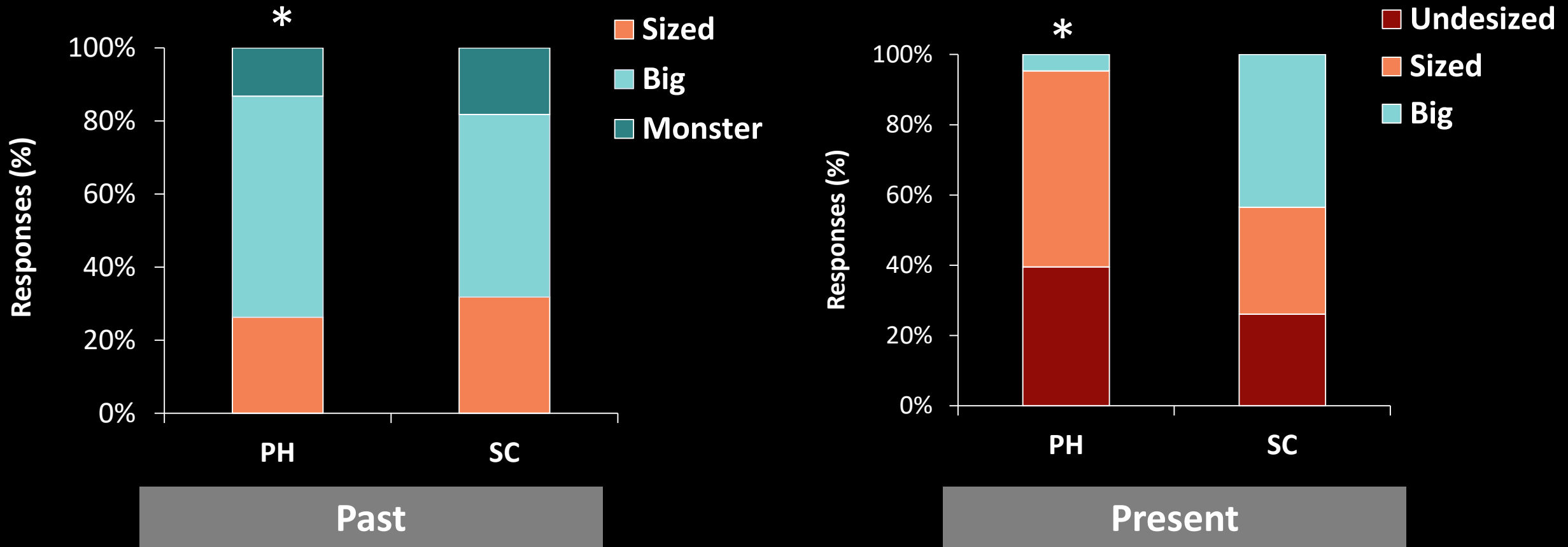


THIS OUTSIZE IN CRABS measuring 29in from the claw-tips and representing one of the largest catches of this species caught at Lucky Bay, Applecross, by Mr. L. Smith, telephone mechanic, of Perth

Paper 4. Fisher perceptions and shifting baselines

Size through time

a) Face-to-face survey



Paper 4. Fisher perceptions and shifting baselines

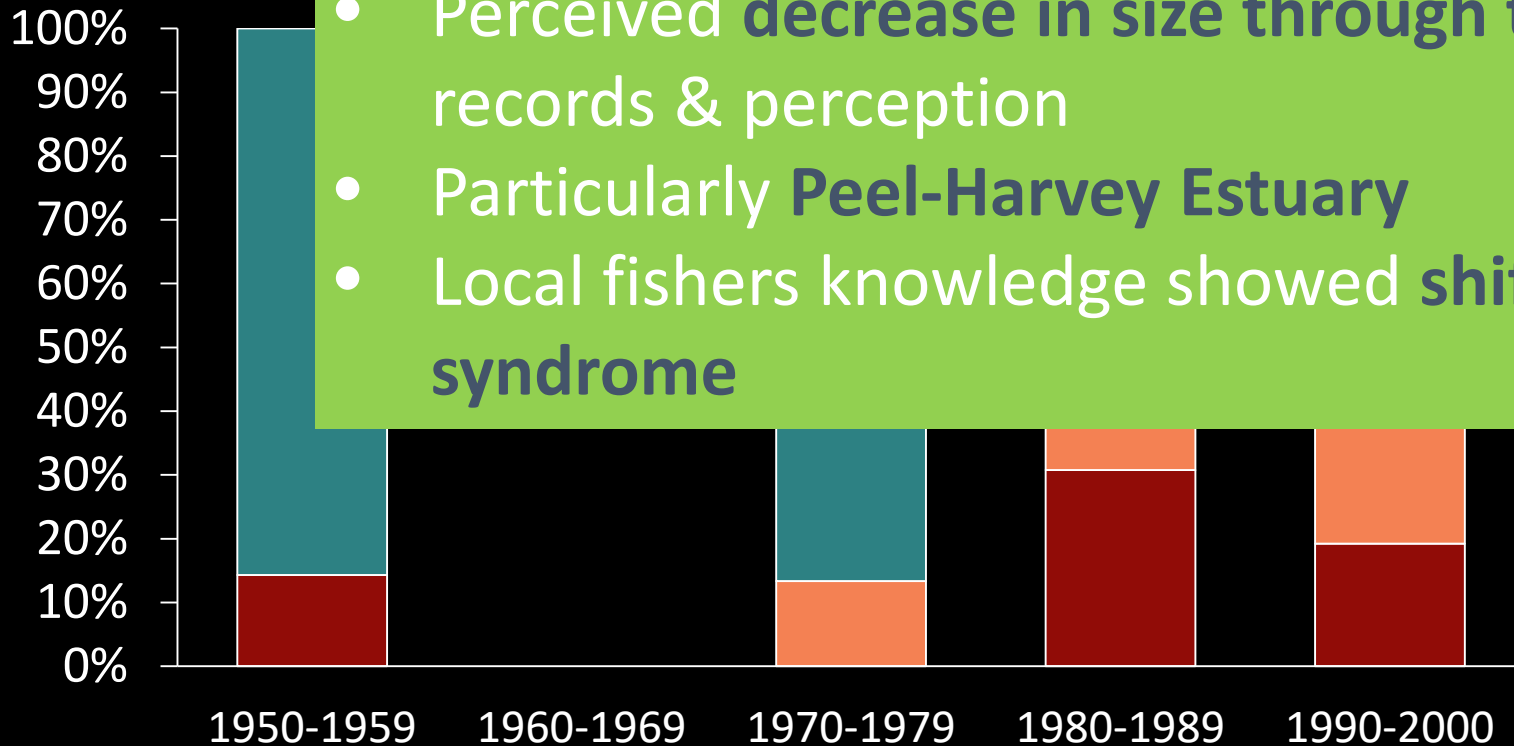


1931

Size through time

b) Trove

Undersized Sized
Big Monster



- Perceived **decrease in size through time** supported by Trove records & perception
- Particularly **Peel-Harvey Estuary**
- Local fishers knowledge showed **shifting baselines syndrome**

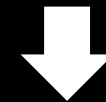
Take-home message...



**Ecosystem Based Fisheries
Management**



**Commitment to including
human dimensions of fisheries**



**Inclusion of human dimensions in
fisheries research & management
requires interdisciplinary approach**

Thank you!

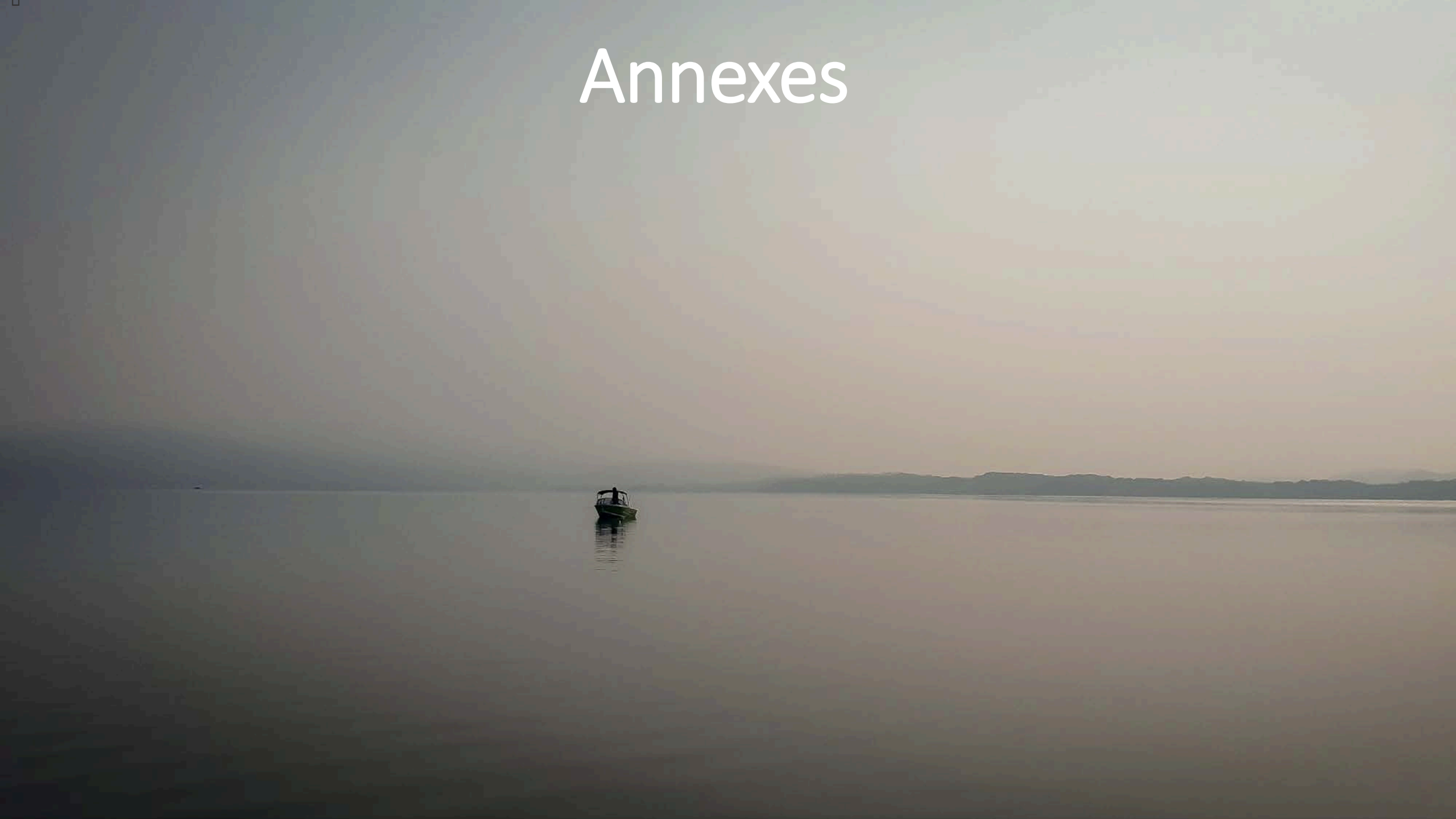


WAFIC



**Mandurah Licensed
Fishermen's Association**

Annexes



Thesis appendices: Social justice & MSC

Appendix 1: Marine Stewardship Council (MSC) certification

What are the impacts, benefits & costs of certification?




Appendix 2: Social justice in small-scale fisheries

TBTI Book Chapter

PLOS ONE advanced search

OPEN ACCESS PEER-REVIEWED
RESEARCH ARTICLE

Shifting focus: The impacts of sustainable seafood certification

Ingrid van Putten , Catherine Longo , Ashleigh Arton , Matt Watson , Christopher M. Anderson , Amber Himes-Cornell , Clara Obregón , Lucy Robinson , Tatiana van Steveninck

Published: May 20, 2020 • <https://doi.org/10.1371/journal.pone.0233237>

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Correction



Chapter 5. Fisher perceptions and shifting baselines



Data sources

Online
survey

Fishing exp.: ~1960-2018
Sample size: ~300-500

Face to
face

Fishing exp.: ~1960-2019
Sample size: 90

TROVE

Years: 1908-2000
Sample size: 405

Perceptions of change (size, abundance) **since you started fishing** to now?

- Age
- Fishing experience
- Education
- System

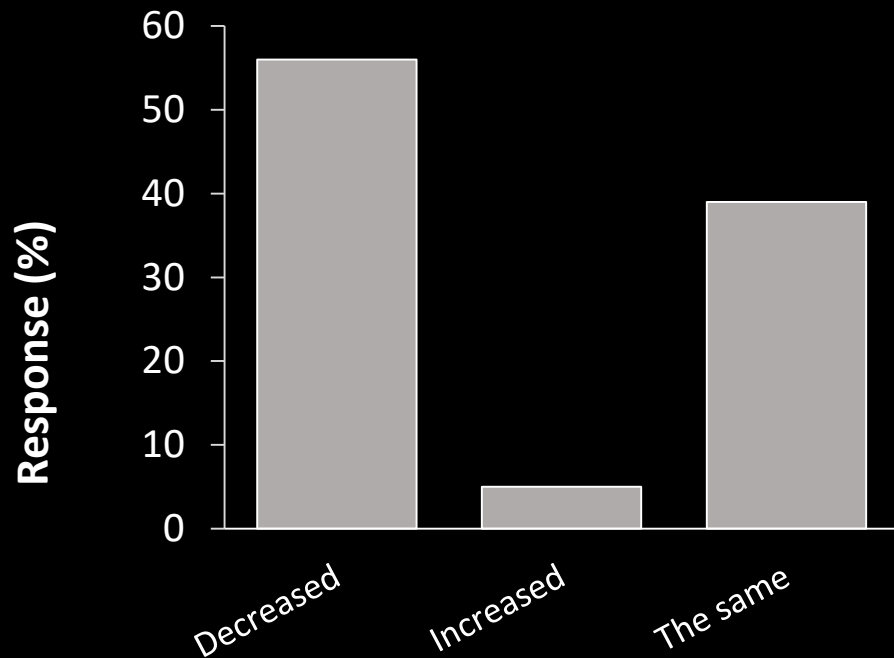
Newspaper records describing **abundance & size** of crabs **through time**

Paper 4. Fisher perceptions and shifting baselines

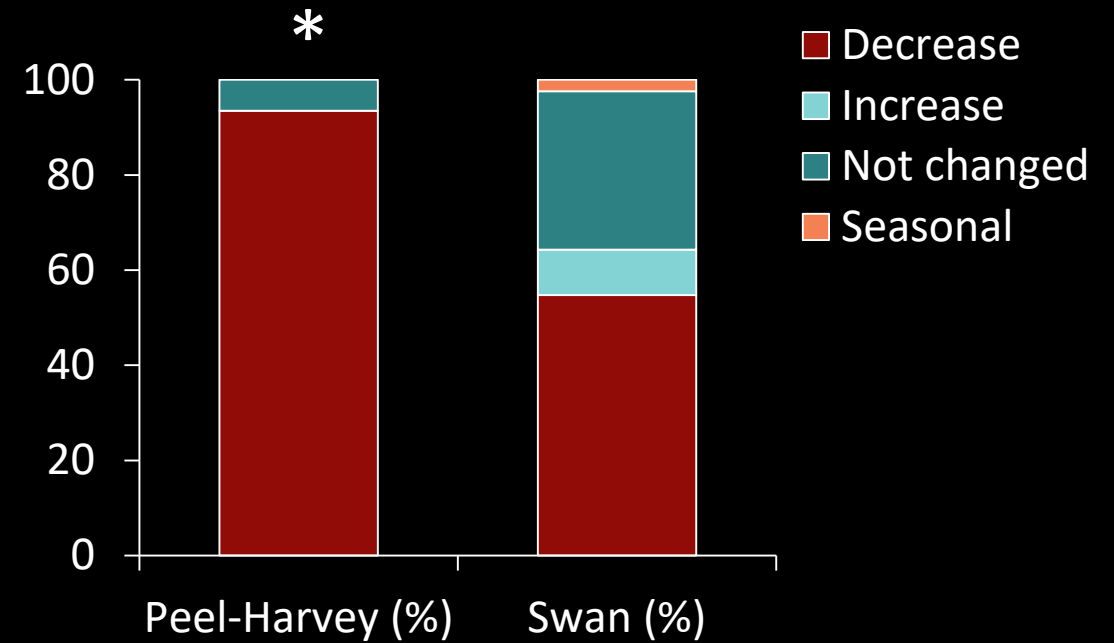


Size per estuary

a) Online survey



b) Face-to-face



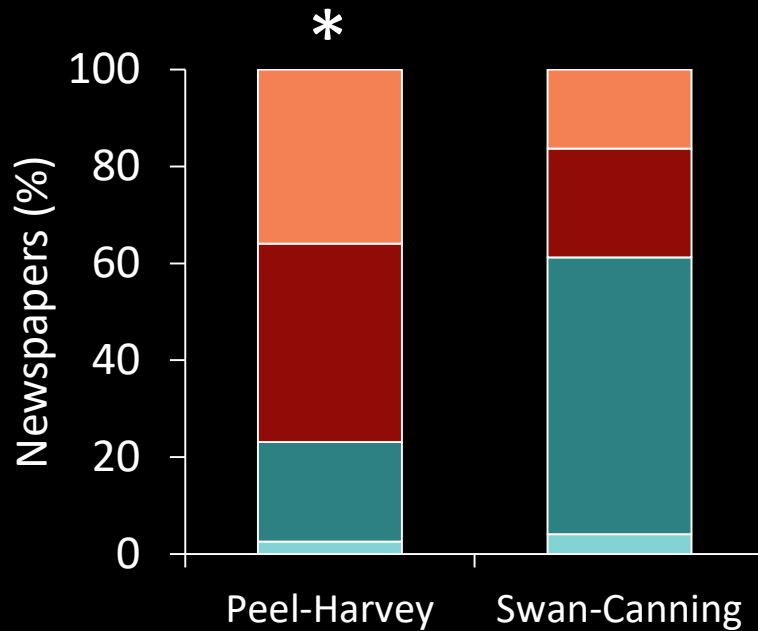
Note: * Indicates sign. diff.

Paper 4. Fisher perceptions and shifting baselines

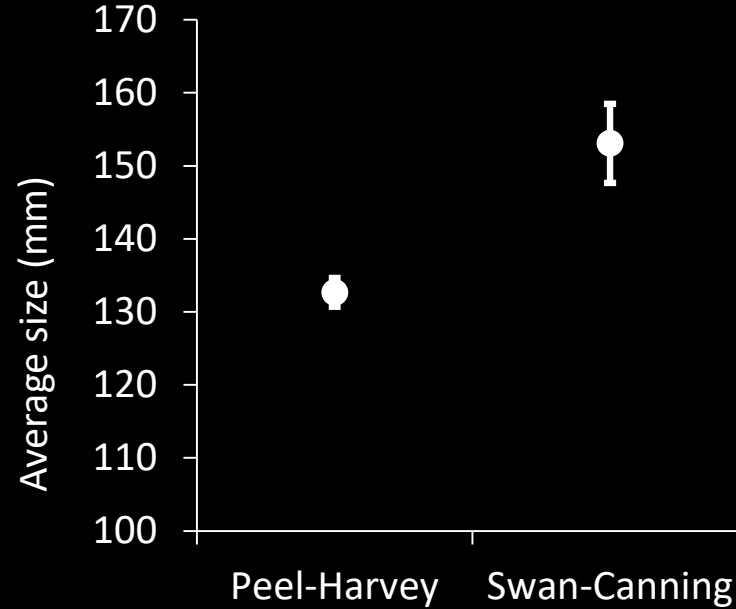
1944

Size per estuary

c) Trove



d) DPIRD

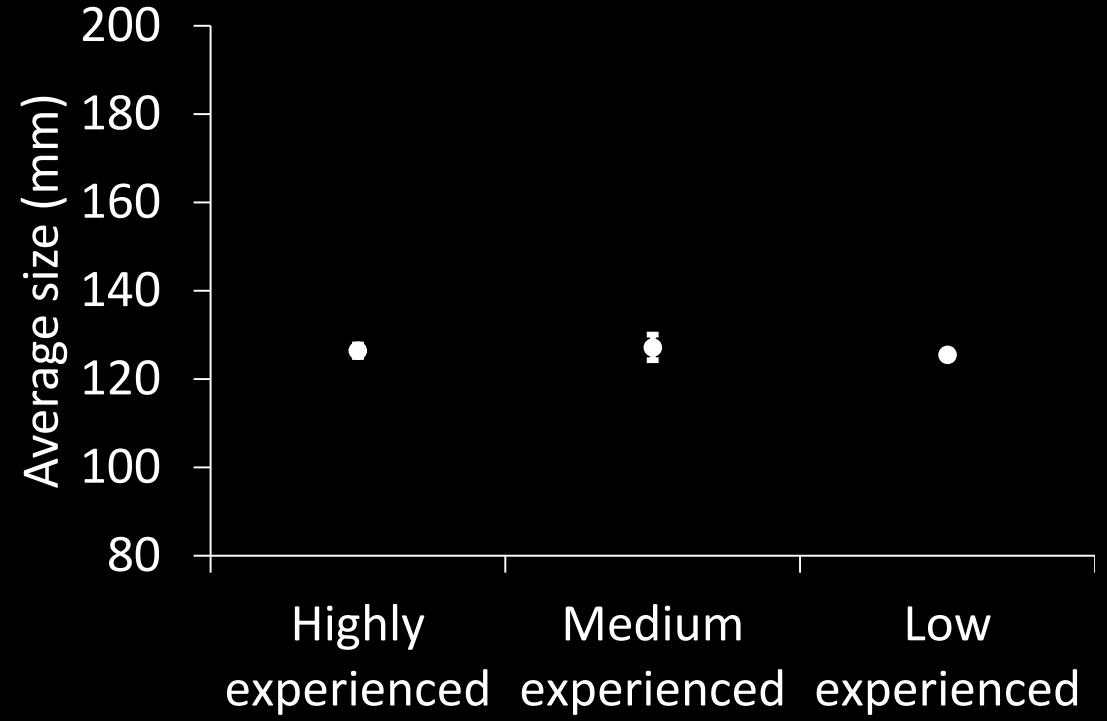
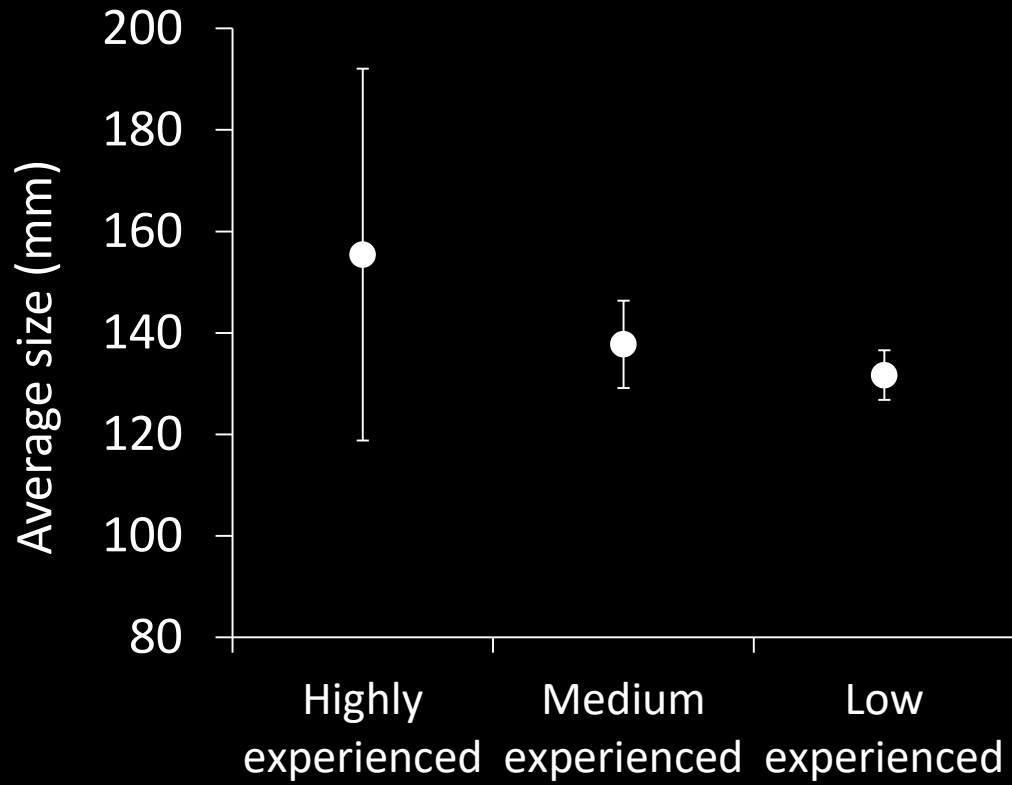


- Monster
- Big
- Sized
- Undersized

Note: * Indicates sign. diff.

Paper 4 Rec. fisher perceptions & historical records

Face to face survey



Paper 4: Rec. fisher perceptions & historical records



CHANGE!

Recreational sector
&
TROVE



DECREASE

Peel-Harvey
Estuary*



TIME

Not linked with
Age/Experience*



PEOPLE...

Perceptions!
But why...?

Stock enhancement perceptions

Summary of mean belief strength; valuation ratings and cross-products associated with stock enhancement of *Portunus armatus* from the online survey (phase 2) of recreational fishers

Beliefs	Strength 0 to 6*		Evaluation – 3 to 3**		Cross-product – 18 to 18***	
	N	Mean	N	Mean	N	Mean
Increase number of crabs	337	4.78	351	2.14	319	11.5
More crabs to catch	331	4.82	352	2.17	317	11.54
Increase the fishing pressure on crabs	283	3.05	318	– 1.5	265	– 4.09
Impact on the environment and other species	284	2.87	278	– 1.3	237	– 2.47

*; ** and *** refer to “unlikely to likely”; “bad to good” and “belief-based attitude” respectively

Fishery recreational network



Social objectives – Most recent info

Healthcheck Assessment			Number of fisheries in each jurisdiction with equivalent performance indicators (fishery-level)								
Category	Sub-category	Indicator	COMM (n=11)	NSW (n=7)	NT (n=7)	PZJA (n=3)	QLD (n=13)	SA (n=12)	TAS (n=5)	VIC (n=3)	WA (n=41)
	Compliance	Compliance regime	11	7	7	4	13	11	5	3	41
		Surveillance	Variable - not a management performance indicator								
Social	Fishers	Fisher satisfaction	0	0	0	0	0	11	0	0	0
		Age structure	0	0	0	0	0	0	0	0	0
	Wider community	Community satisfaction with fishery	0	0	0	0	9	0	0	0	0
		Other human uses	0	0	5	0	0	0	0	0	0

Healthcheck Assessment		Number of fisheries in each jurisdiction with equivalent management objectives (fishery-level)								
Category	Sub-category	COMM (n=11)	NSW (n=7)	NT (n=7)	PZJA (n=3)	QLD (n=13)	SA (n=12)	TAS (n=5)	VIC (n=3)	WA (n=41)
Social	Fishers	0	0	2	2	0	2	0	0	0
	Wider community	0	0	2	2	0	11	4	3	0

Social objectives – Most recent info

Table 2. Percentage number of recreational and commercial fishers who reported various concerns affecting the *P. armatus* fisheries in the Peel-Harvey, Swan-Canning, and Leschenault estuaries in south-western Australian during face-to-face interviews.

Concerns reported (n)	Recreational fishers				Commercial fishers		
	All (93)	Peel (41)	Swan (24)	Lesch. (28)	All (11)	Peel (9)	Swan (2)
Lack of compliance	29.0	46.3	20.8	10.7	18.2	22.2	
Overfishing	22.6	29.3	16.7	17.9	9.1		50.0
Pollution	18.3	12.2	29.2	17.9			
More people fishing	10.8	7.3	12.5	14.3	36.4	22.2	100.0
NA	9.7	9.8	12.5	7.1			
Commercial fishing	6.5	7.3		10.7			
Environmental factors	5.4		8.3	10.7	27.3	22.2	–
None	5.4	2.4	4.2	10.7	–	–	–
Estuary development	4.3	2.4	8.3	3.6	27.3	22.2	50.0
Ineffective management	2.2	2.4		3.6			
Invasive species	1.1		4.2				
Education					9.1	11.1	
Market share					9.1	11.1	
Not enough food for crabs					18.2	22.2	
Pressure to remove commercial fishing					9.1	11.1	

The number of fishers surveyed from each sector in each system is given in parentheses. The total number of respondents per estuary and total percentage of responses for each category appears in bold.

Social objectives – Most recent info

Table 4. Percentage number of recreational and commercial fishers who reported perceived solutions to improve the management of *P. armatus* fisheries in the Peel-Harvey, Swan-Canning, and Leschenault estuaries in south-western Australian provided by recreational and commercial fishers during face-to-face interviews.

Solutions reported (n)	Recreational fishers				Commercial fishers		
	All (93)	Peel (41)	Swan (24)	Lesch. (28)	All (11)	Peel (9)	Swan (2)
None	30.1	14.6	37.5	46.4			
Increase compliance	20.4	36.6	12.5	3.6	27.3	33.3	
Longer closed season	19.4	26.8	4.2	21.4	9.1	11.1	
NA	6.5	2.4	12.5	7.1	9.1	11.1	
Unsure	6.5	2.4	12.5	7.1			
Remove commercial fishing	4.3	7.3	4.2				
Waterway management	3.2	4.9	4.2				
Education	3.2	7.3					
Increase size limits	3.2	2.4		7.1			
Licence for recreational fishers	3.2	2.4		7.1	54.5	55.6	50
Reduce bag limits	3.2		4.2	7.1			
Ban female catches	2.2	2.4	4.2				
Improve management	2.2	2.4	4.2		9.1		50
More research	1.1		4.2				
No fishing zones	1.1	2.4					
Reduce commercial catches	1.1		4.2				
Reduce recreational catches					9.1	11.1	