Impact and mitigation of Australian sea lion bycatch in the Commonwealth managed shark gillnet fishery off South Australia

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Impact and mitigation of Australian sea lion bycatch in the Commonwealth managed shark gillnet fishery off South Australia

1. Background to Australian sea lion (ASL) and demersal shark gillnet fishery
2. Estimate ASL bycatch number and impacts on populations
2. Develop spatial management scenarios to mitigate bycatch and inform management response
3. Update on management response (time-area closures, take limits, gear-switching)

Fishery bycatch of threatened, endangered and protected species (TEPS) is a critical conservation and fishery management issue

Assessing the impact of bycatch requires:

- estimates of number of caught
- population/demographic implications

Bycatch numbers usually estimated based on rates of bycatch per unit of fishing effort, then extrapolated across the fishery
e.g. individuals per km net-set/trawl hrs/1000 hooks

Bycatch rates can be very imprecise means to estimate bycatch number/impact:

- fraction of total fishing effort is monitored
- bycatch typically rare/chance events
- fishing effort & encounter probabilities (which drive bycatch rates) can be highly spatially/temporally heterogeneous across distribution of fishery

Knowledge of distribution and density of bycatch species is critical to:

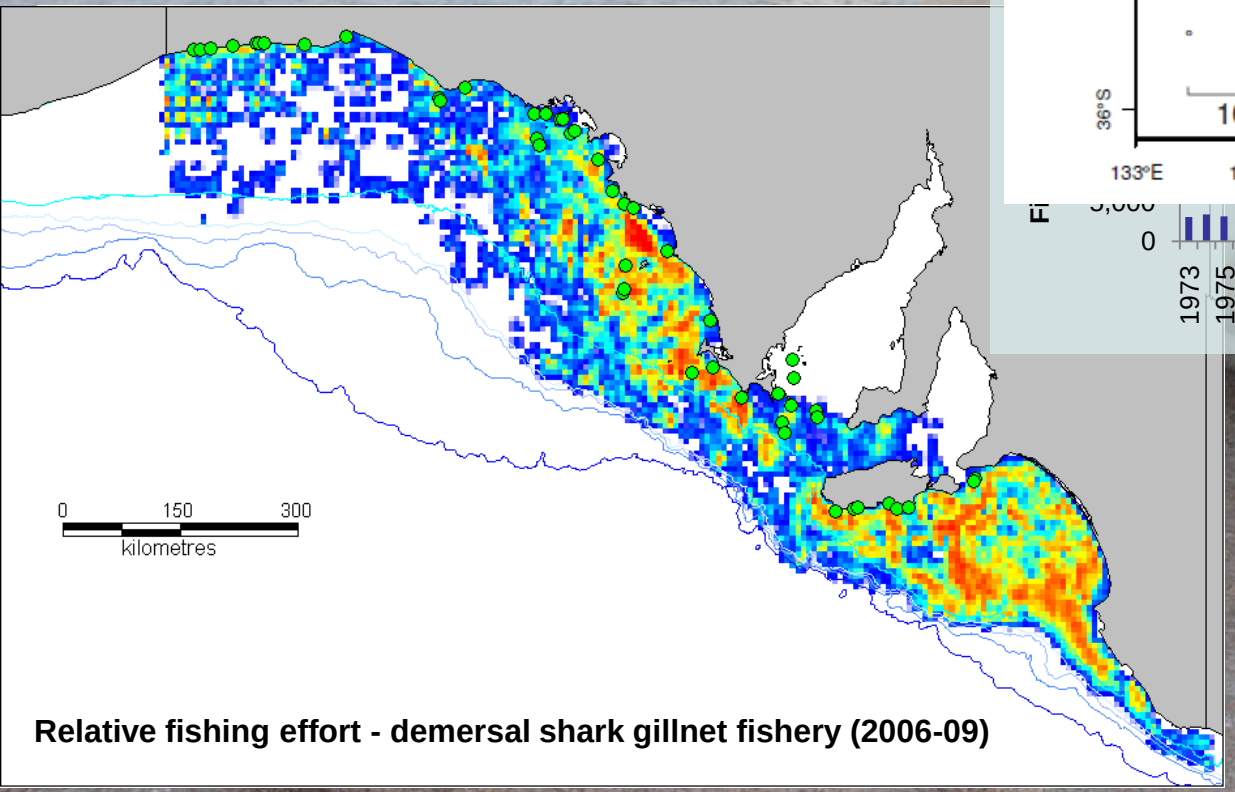
- assessing how encounter probability affects bycatch rate, and

- improving estimates of bycatch impacts, developing mitigation methods, achieving management targets/performance indictors

Bycatch of Australian sea lions in the demersal gillnet shark fishery

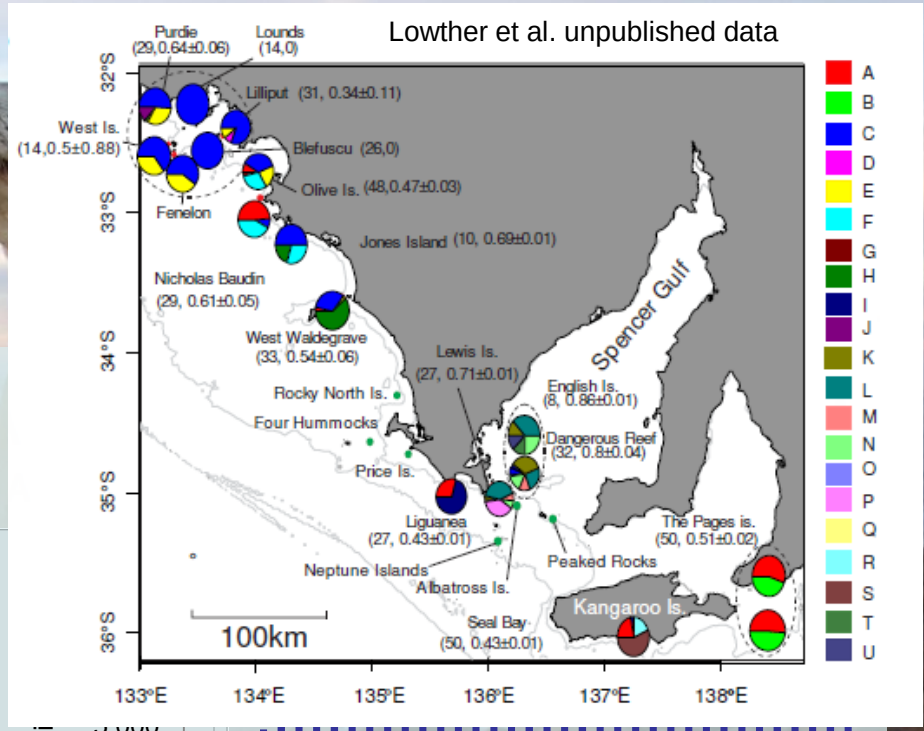
Australian sea lion (ASL)

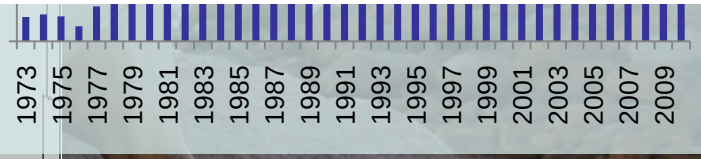
- Australia's only endemic seal
- Range limited to SA and WA
- unusual breeding biology incl. non-annual (17.5 m) temporally asynchronous breeding cycle
- extreme philopatry/population structure
- limited evidence for recovery of ASL populations since colonial sealing (60% of colonies <30 pups)
- Listed as *threatened* under Australian EPBC Act, *endangered* under IUCN Redlist



Relative fishing effort - demersal shark gillnet fishery (2006-09)

Lowther et al. unpublished data

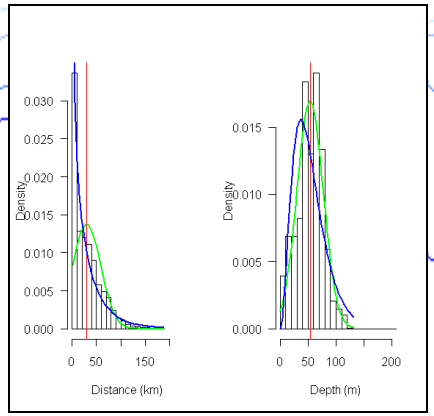




Modelling ASL distribution of foraging effort

ASL foraging models

Overall model of distribution of foraging effort of ASL population in South Australia (all males and females >1.5 yrs)

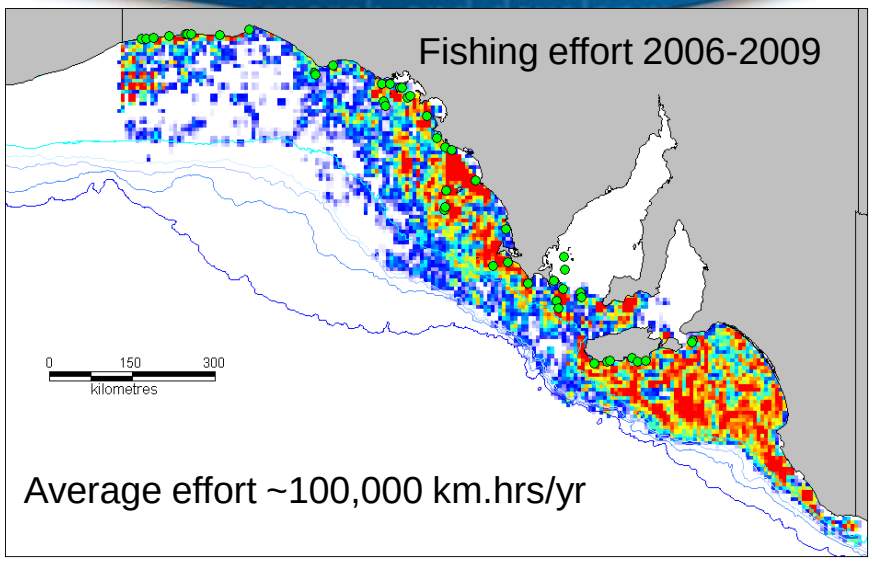


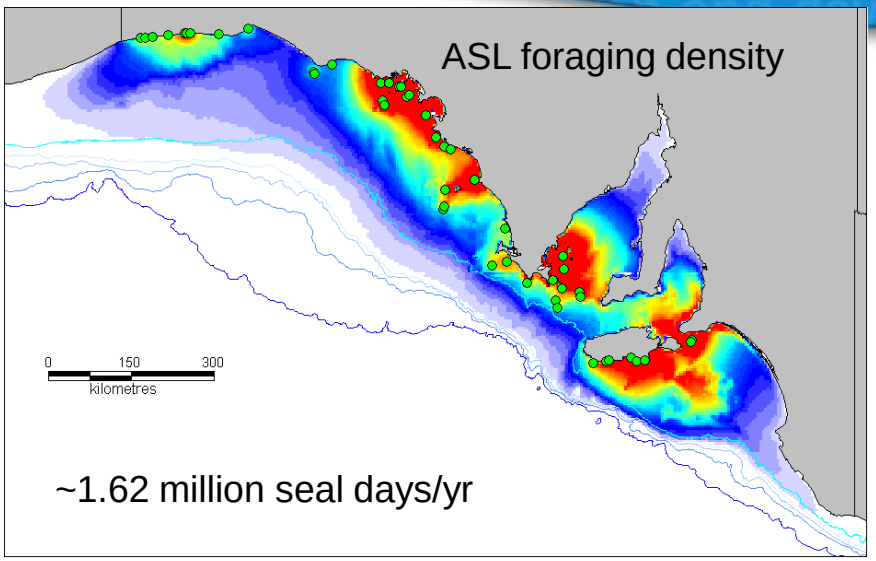
Foraging models

- time spent at distance & depth
- Fit to gamma or normal prob. density functions
- joint probabilities (product of depth & distance)
- applied to 1 x1 km node array ~350,000 nodes
- subpopulation (sex/age-class) models developed where tracking data available
- pooled models used for non-tracked sites

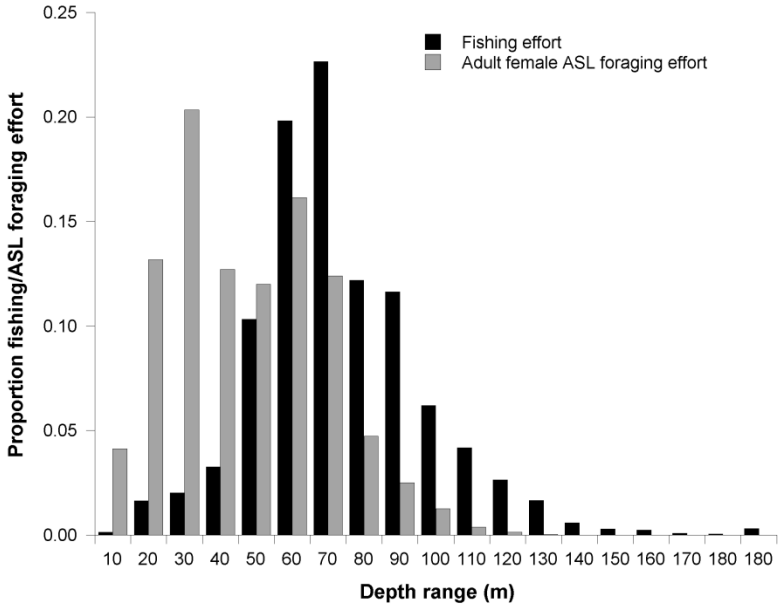
Overlap in fishing effort and ASL foraging effort

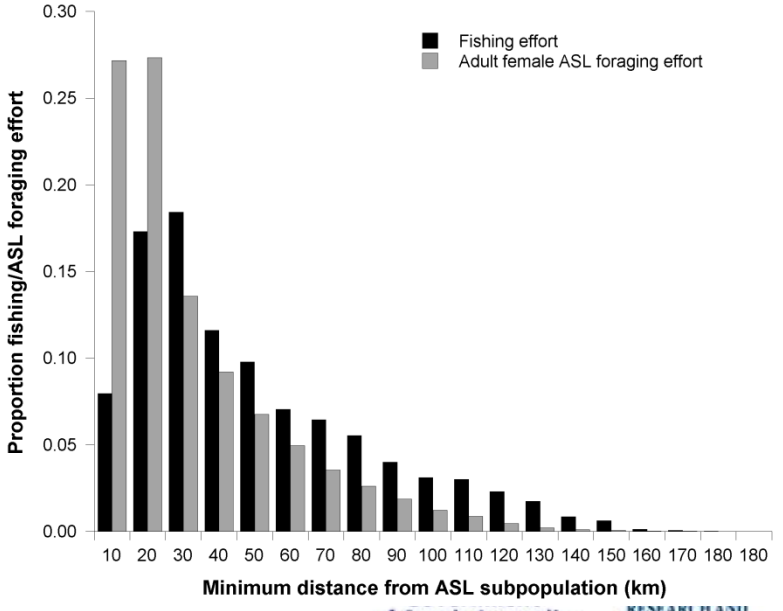
Sea lion & fishing distribution





Overlap in proportion fishing effort /adult female sea lion foraging density





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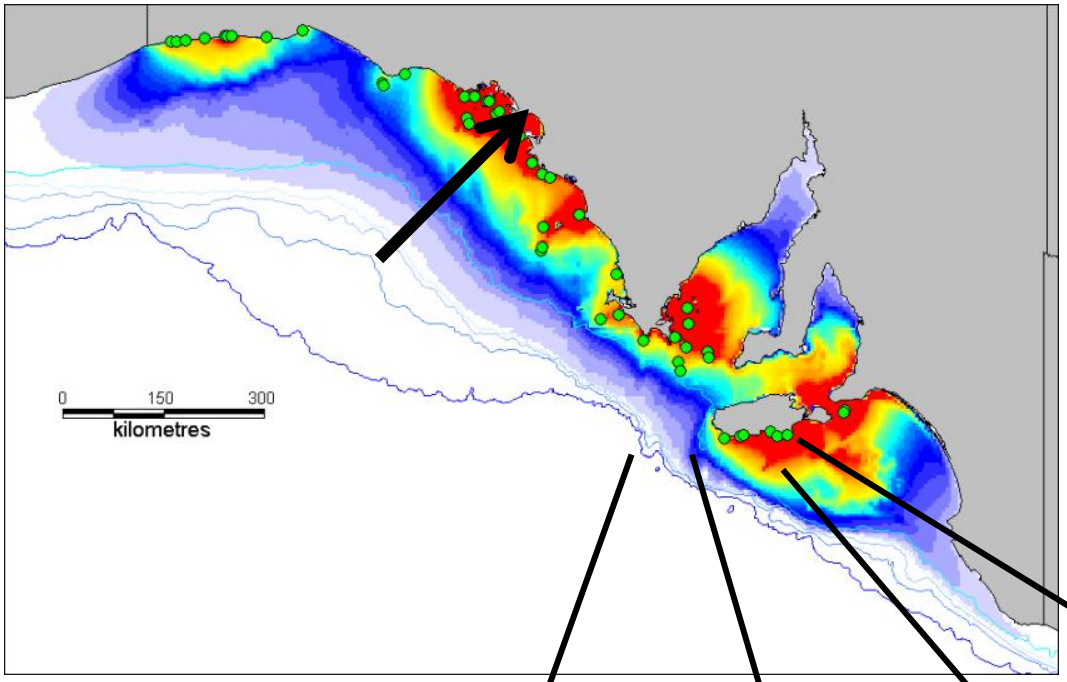
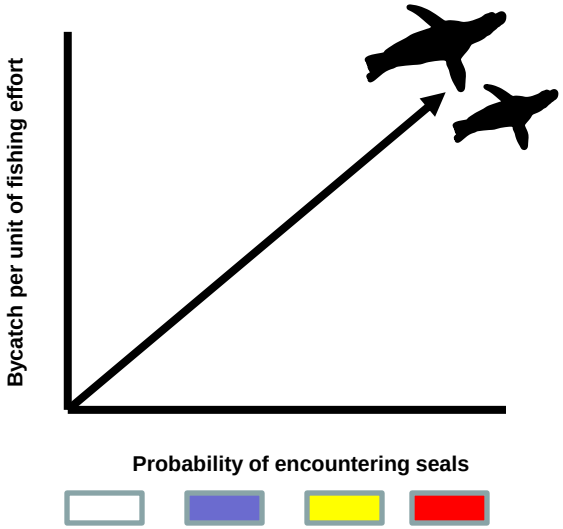
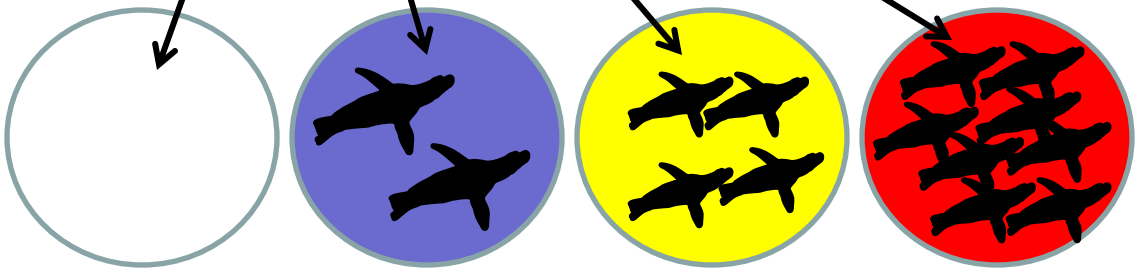
Modelling ASL bycatch rates: bycatch estimator

Bycatch rate estimation models

Bycatch rate estimation method







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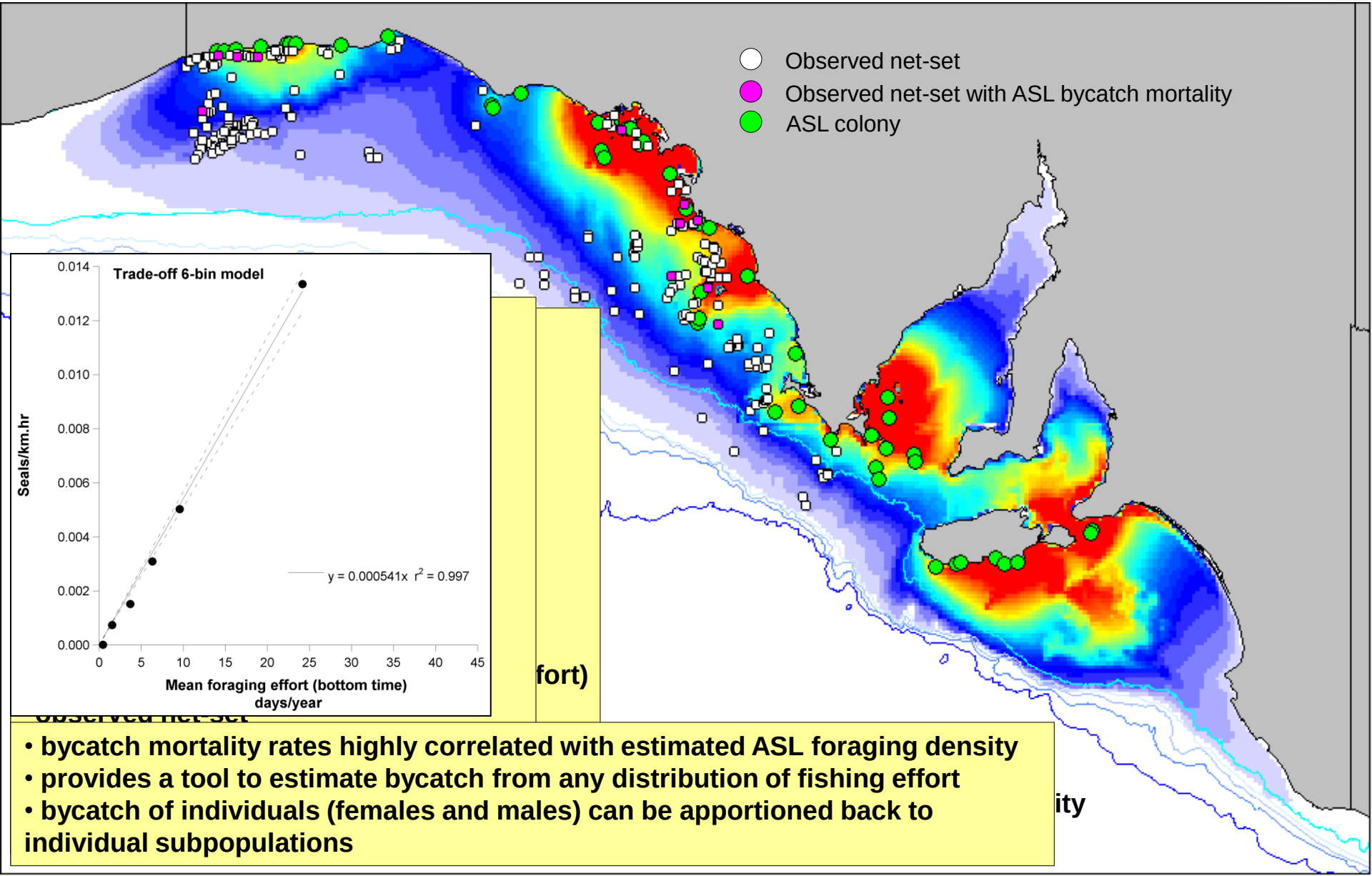
SARDI South Australian Research and Development Institute

Modelling ASL bycatch rates: bycatch estimator

Bycatch estimation models



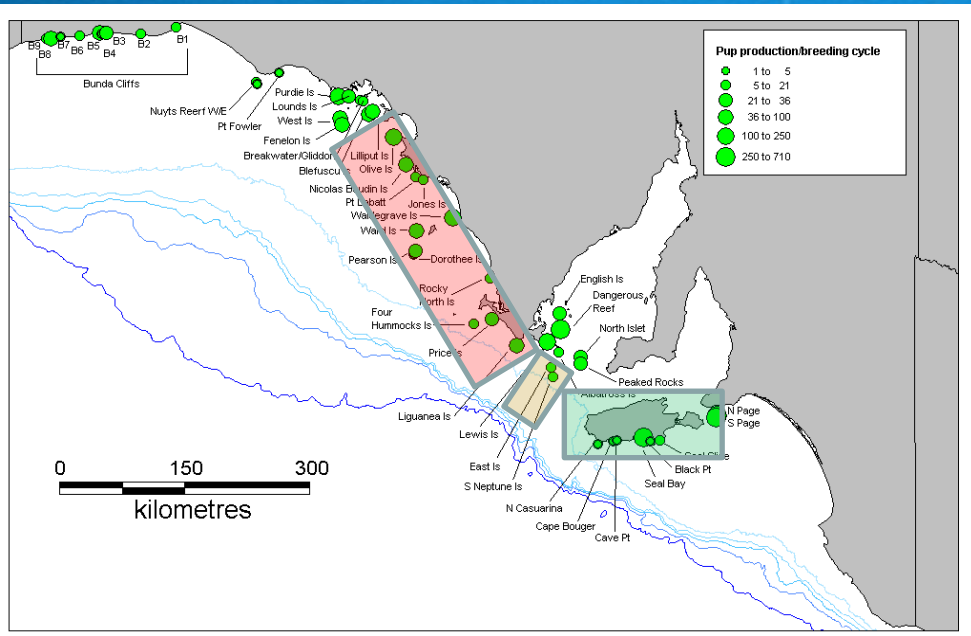
- bycatch mortality rates highly correlated with estimated ASL foraging density
- provides a tool to estimate bycatch from any distribution of fishing effort
- bycatch of individuals (females and males) can be apportioned back to individual subpopulations

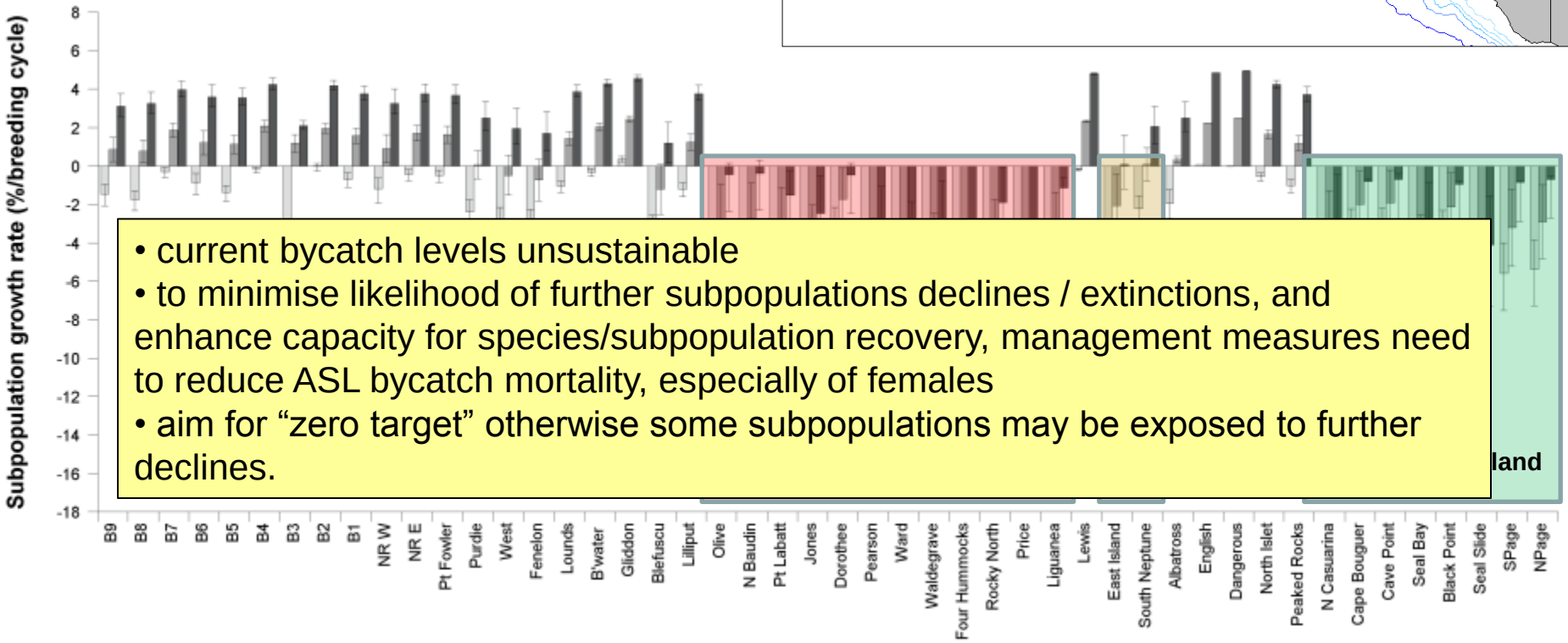
Impact of bycatch on ASL

- 374 (272-506) sea lion bycatch mortalities were estimated to occur off South Australia each breeding cycle (17.5 months) (based on fishing effort 2006-09)

- bycatch mortality represents ~3.9% of females (>1.5 yrs) each breeding cycle (~35% increase from natural mortality levels)

- PVA of bycatch indicates that the majority (42-96%) of ASL colonies were exposed to unsustainable levels of bycatch mortality

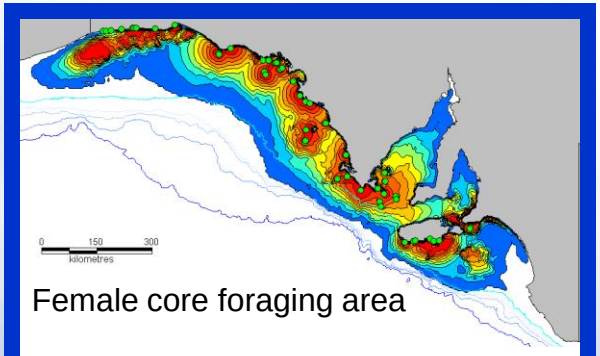




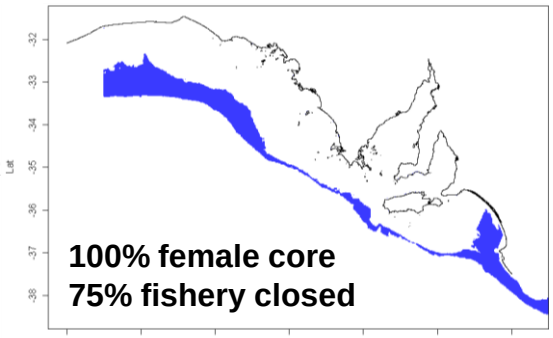
- current bycatch levels unsustainable
- to minimise likelihood of further subpopulations declines / extinctions, and enhance capacity for species/subpopulation recovery, management measures need to reduce ASL bycatch mortality, especially of females
- aim for “zero target” otherwise some subpopulations may be exposed to further declines.

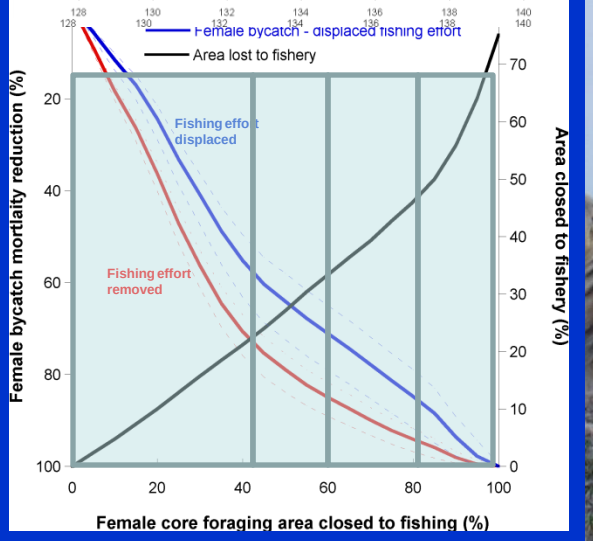
Spatial closure scenarios

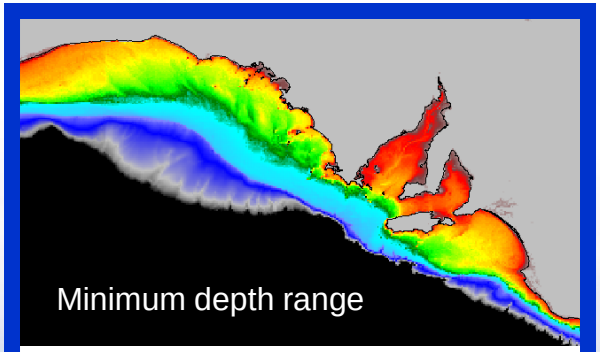
Examined expected bycatch mortality reduction from different **spatial closures** in fishery
Scenarios examined both **removal** and **displacement** of fishing effort (100,000 km.hrs/yr)



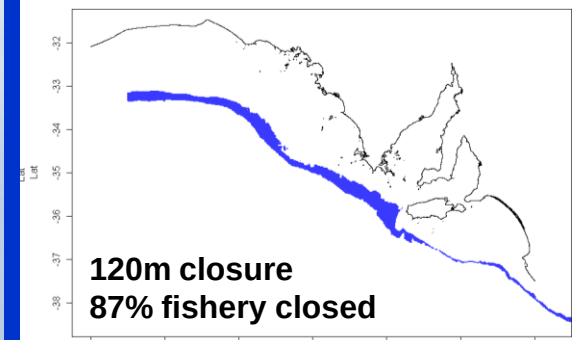
Female core foraging area

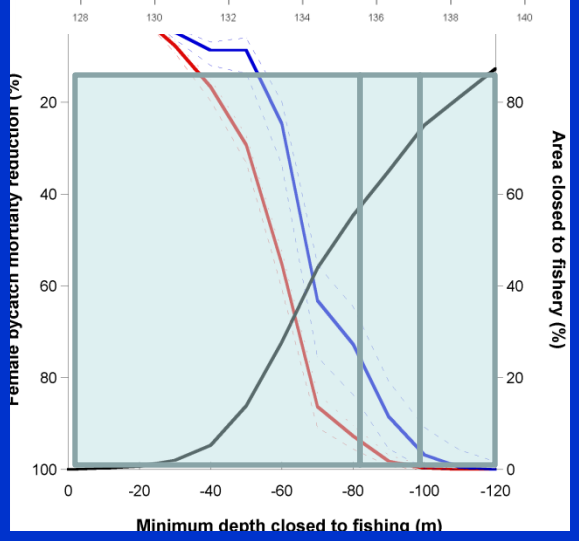


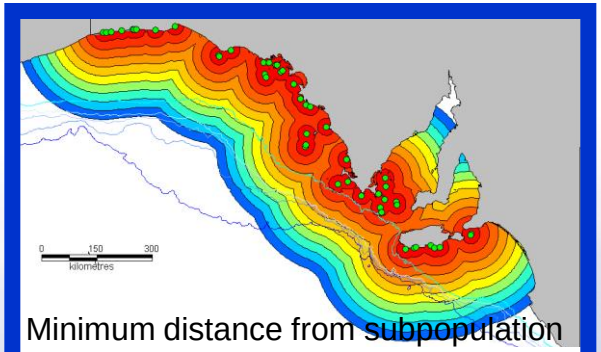




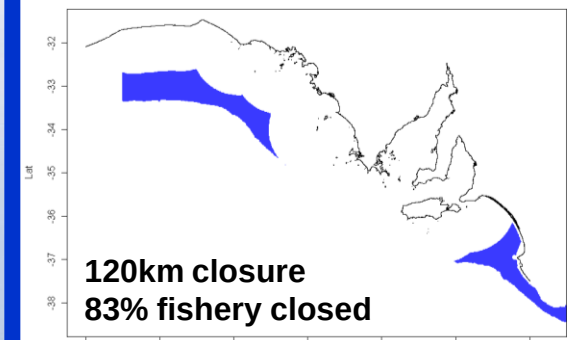
Minimum depth range

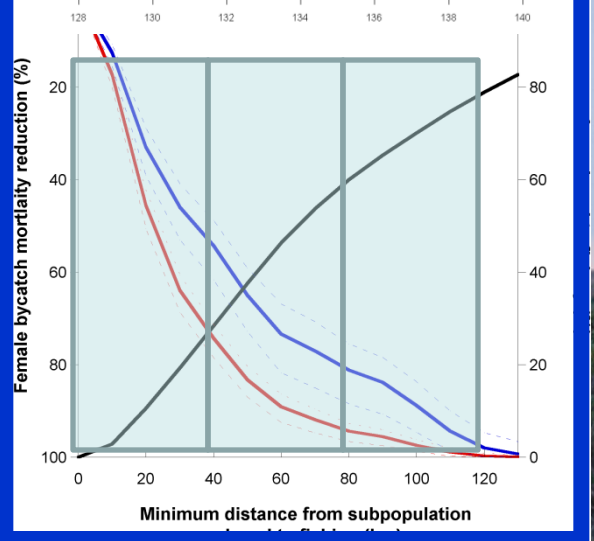






Minimum distance from subpopulation



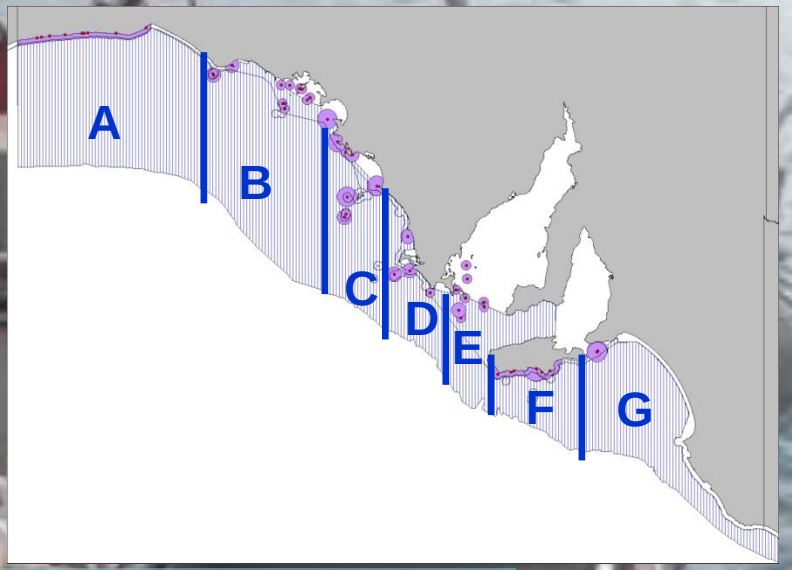


Australian Fisheries Management Authority (AFMA) – Management Response

AFMA's management measures are required to significantly reduce ASL bycatch and enable the recovery of the species and all subpopulations (WTO Conditions)

ASL Management Strategy July 2010

1. **Fishery closures (4-10nm) around all ASL colonies**
   - 3.9% reduction in area open to fishery



2. Observer coverage (11%) within 7 zones – ASL trigger limits (limit allowable bycatch)

- per zone observed trigger limit (3-6 ASL per season)
- overall trigger limit of 15 ASL

Issues with Management Response

- est. ASL bycatch reduction 19%
- limited reduction in percentage colonies with decreasing growth rates
- problems with trigger limits (set too high);
- **Observer effect** - change in fishing behaviour when observer aboard (reduced net length/soak time) decreased prob of detecting bycatch;
- **Observer quality** - uncertainty re. observer quality (missing drop-outs)

Observer data	Bycatch Expected	Bycatch Observed	Landed	Drop-out	n
SARDI	12.4	12	2	10	234
AFMA	10.2	2	2	0	208

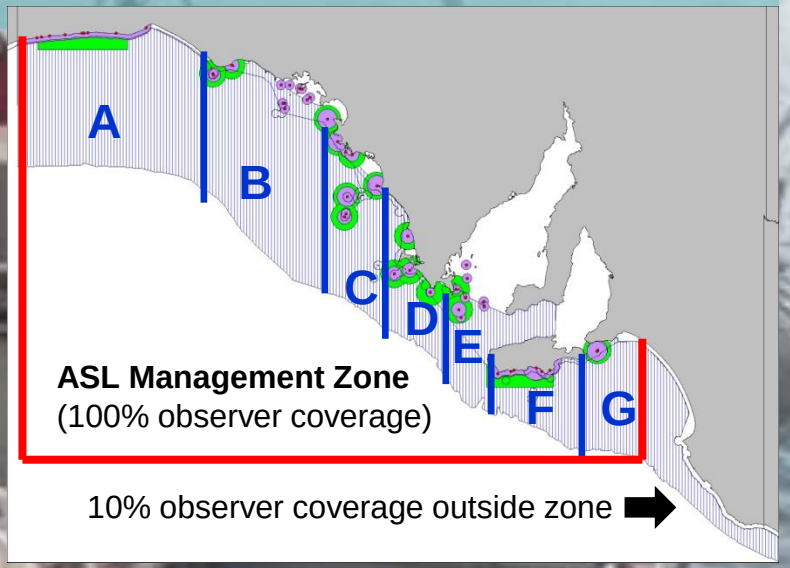
Photo D Hamer

Australian Fisheries Management Authority (AFMA) – Management Response

AFMA Temporary Order May 2011

• assessment of observer/logbook data identified significant under-reporting of TEPS interactions by fishers

• concerns about level of dolphin interactions in fishery



1. Increased fishery closures around some ASL colonies

- Area closures GAB, KI
- Some colony closures increased to 11nm
- 9.7% reduction in fished area, pre-July 2010

2. Increased observer coverage

• 100% observer effort when gillnetting (ind. observer or electronic monitoring) west of 139° long. (**ASL Management Zone**),

•10% observer coverage east 139°

3. Trigger limits with 100% observer coverage within 7 zones

• per zone observed trigger limit (3-16 ASL per season)

• overall trigger limit of 52 females, 104 in total ASL

• assumes 1.5% bycatch is sustainable an enables all populations to recover

4. Gear-switching (hooks)

• option to switch to demersal long-line hooks (400 max) with 10% observer coverage (can fish within ASL closures)

Photo D Hamer

Australian Fisheries Management Authority (AFMA) – Management Response

AFMA Temporary Order Sept 2011

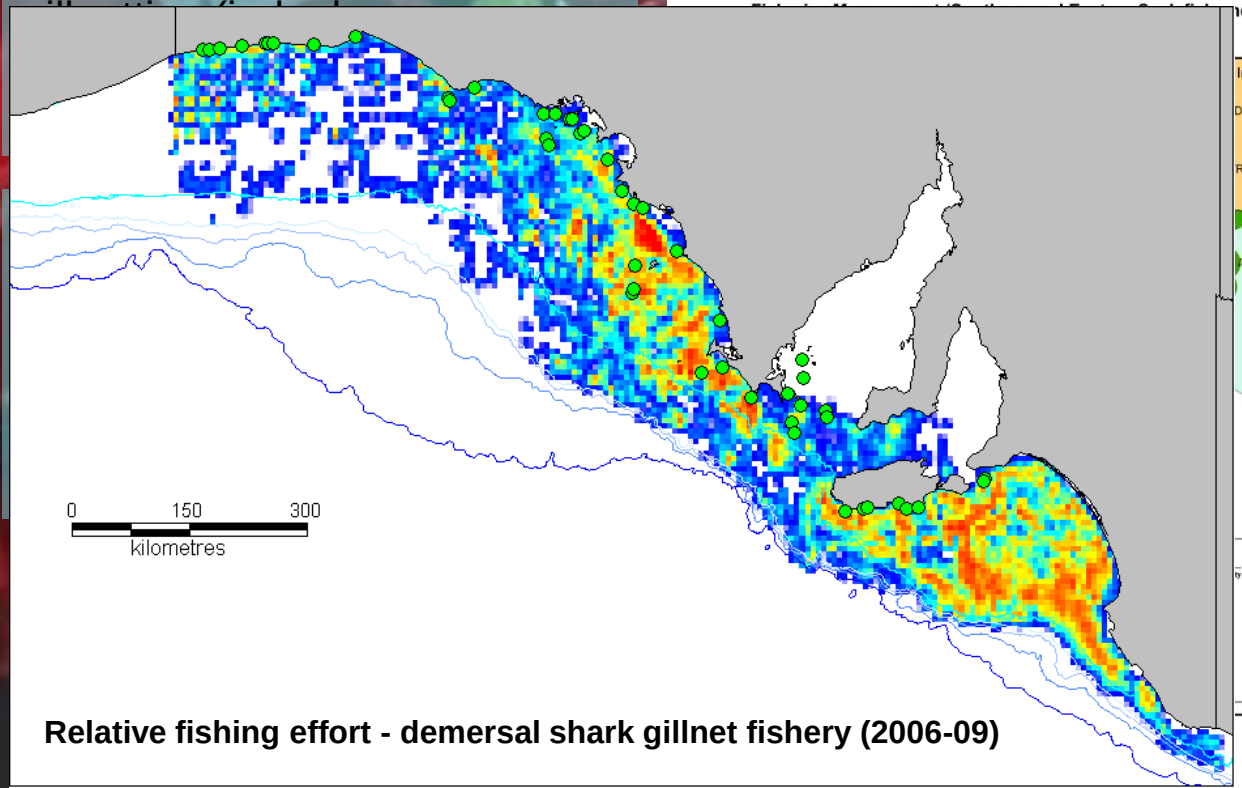
• 49 dolphin interactions (Sept 10 – Sept 11) promoted new TO

1. Additional Dolphin Gillnet Closure

• 27,239 km^2 closure (KI to Cape Jaffa)

2. Additional Dolphin Observer Zone

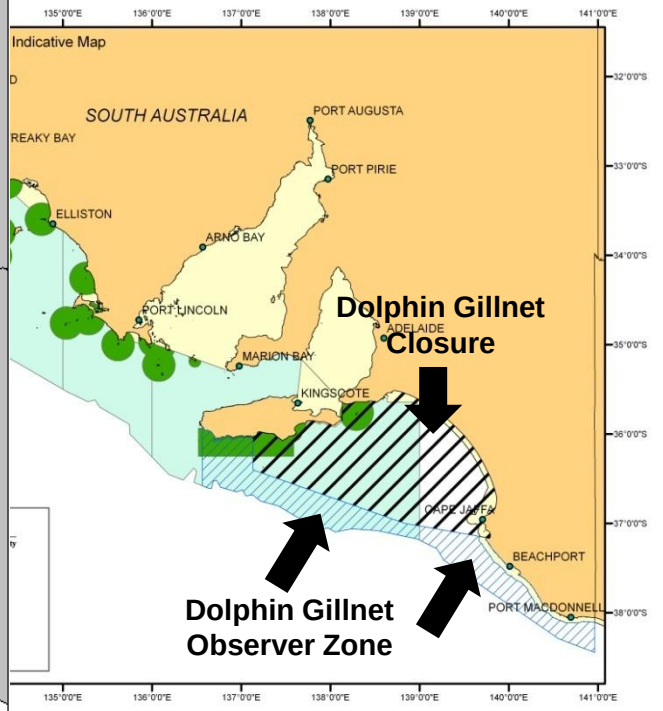
• 100% observer effort when



Relative fishing effort - demersal shark gillnet fishery (2006-09)

Annexure

d Shark Fishery Management Plan 2003) Temporary Order 2011 No. 2



Summary

We believe this study represents the first where estimates of at-sea densities have been used to correct for encounter probability to estimate bycatch number and impact on populations

This approach can greatly increase the precision of bycatch estimates, impacts on populations and appropriateness of management response (scenario testing)

Analyses suggest the majority of ASL subpopulations in SA have been exposed to unsustainable levels of bycatch mortality over at least a 40 year period, and without appropriate management response, further population declines, subpopulation extinctions and reductions in range are likely

Results have been used by the Australian Fisheries Management Authority and Environment Departments to shape policy and management response: observer program, time-area closures and trigger limits

Introduction of an observer program in the fishery has identified other significant TEPS interactions (dolphins)

AFMA considering further management response in relation to bycatch trigger limits and permanent switching of gear pending demersal long-line trials

Acknowledgments

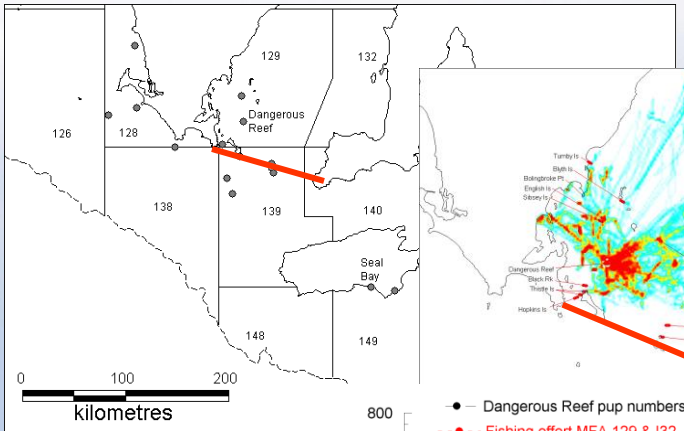
Thanks to the Consortium for Wildlife Bycatch Reduction for invitation to the workshop.

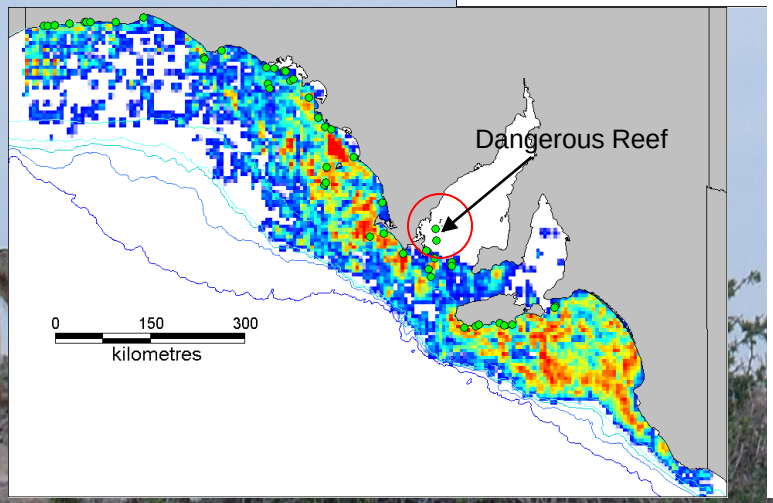
We thank the Fisheries Research and Development Corporation and the Department of the Environment, Water, Heritage and the Arts for financial support for this project. We thank the Fish Factory, and skippers and crew for support of the bycatch observer programs, and Alex Ivy (SARDI) for assistance with observer work. We thank Members of GHATMAC, and Shane Gaddes, Beth Gibson, Trent Timmiss, Matt Daniel (AFMA), and Jeremy Prince (Shark RAG Chair) and Ian Knuckey for their advice and support. We also thank Caroline Stewardson, Crispian Ashby (FRDC), Barbara Muso (DEWHA), and Geert Aarts, Sophie Brasseur (IMARES)

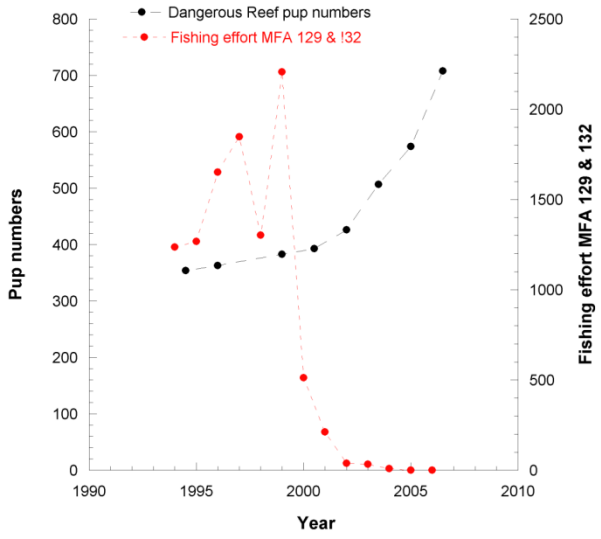
Monofilament gillnet is the most prevalent entanglement material found on Australian sea lions at Kangaroo Island (55% of all entanglements over a 15 year period (Page et al. 2004)

Recovery of population where fishing effort has been significantly reduced

Dangerous Reef population is showing strong recovery ~5-6%/year, coincidental with cessation of demersal gillnetting







Bycatch of Australian sea lions in the demersal gillnet shark fishery

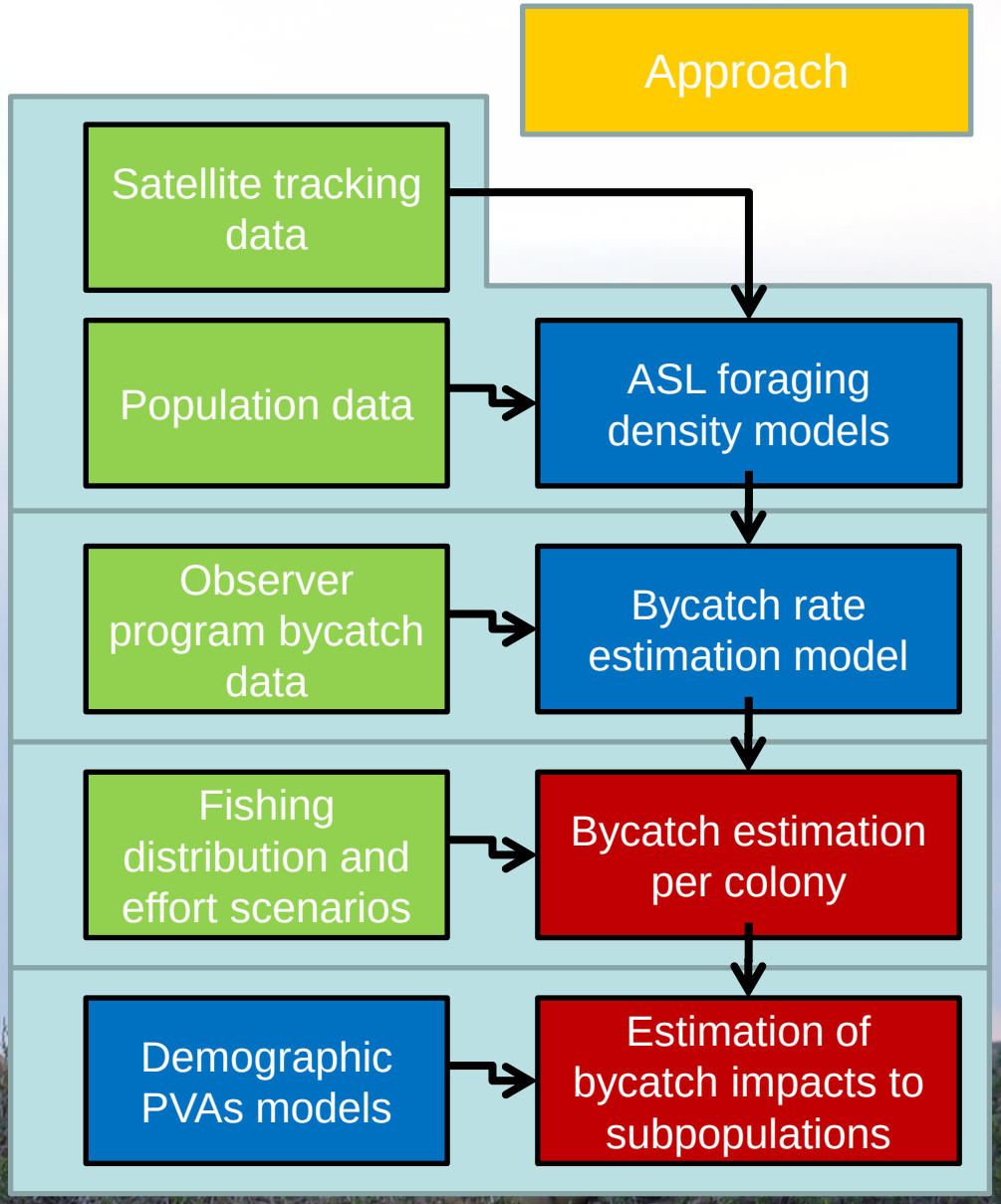
Aims:

1. Estimation of bycatch numbers and impacts

2. Develop spatial management options to mitigate bycatch

The approach used was to:

1. develop model of the ASL foraging density
2. integrate this model with observed bycatch data to develop a bycatch rate estimation model
3. apply bycatch rate estimation model to spatial distribution of fishing effort and estimate ASL bycatch mortality in fishery; and
4. assess the implications of bycatch on ASL subpopulations using demographic & population viability analyses (PVA) models.



Goal to explore a range of fishery closure options to mitigate bycatch impacts