South Australian Sardine Fishery: an example of the benefits of Individual Transferable Quotas

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Leader, Pelagic Fishes Research Group
SARDI Aquatic Sciences

Flinders University of SA, University of Adelaide

SA Population 1.7 M; Gross State Product ~$60 B; Ex $9.0 B, In $6.0 B

Primary industries ~$10 B

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South Australian Research and Development Institute – SARDI

SA Government's primary industries research provider

Four research divisions:

- Aquatic Sciences
- Innovative Food and Plants
- Livestock and Farming Systems
- Sustainable Systems

Annual Budget ~ $60M, Staff ~350

Funding through government allocation, competitive grants, cost recovery

Vision: Science excellence and innovation to enhance sustainable and profitable primary industries

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Aquatic Sciences

Aquaculture

- Aquatic Animal Health & Welfare
- Nutrition & Feed Technology
- Genetics, Reproduction & Biotechnology
- Propagation & Systems
- Algal Production Group

Wild Fisheries

- Offshore Crustacean Fisheries
- Inshore Crustacean Fisheries
- Molluscan Fisheries
- Finfish Fisheries
- Fisheries Modelling

Marine Environment & Ecology

- Environmental Assessment, Mitigation & Rehabilitation
- Marine Pests
- Aquaculture Environment
- Threatened, Endangered & Protected Species
- Benthic Ecology

Inland Waters & Catchment Ecology

- Fish Ecology
- Invasive Species
- Plant Ecology
- Climate & Catchment

Oceanography

- Physical Oceanography
- Biological Oceanography

Staff ~125
Annual Budget ~ $18 M
Wild Fisheries ~ $ 5 M

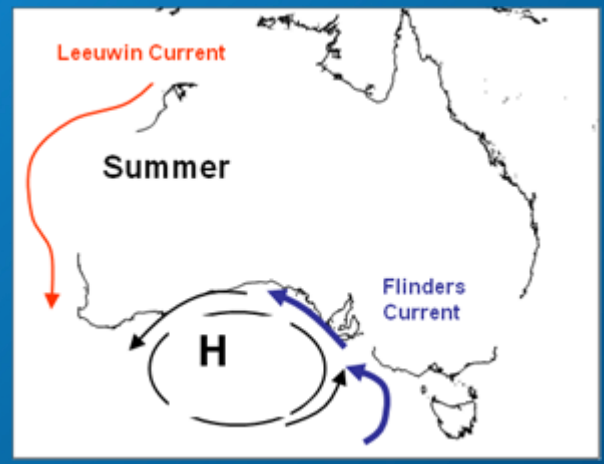
SA Fisheries ~ $200+ M
Aquaculture ~ $200+ M
Seafood exports ~$800 M

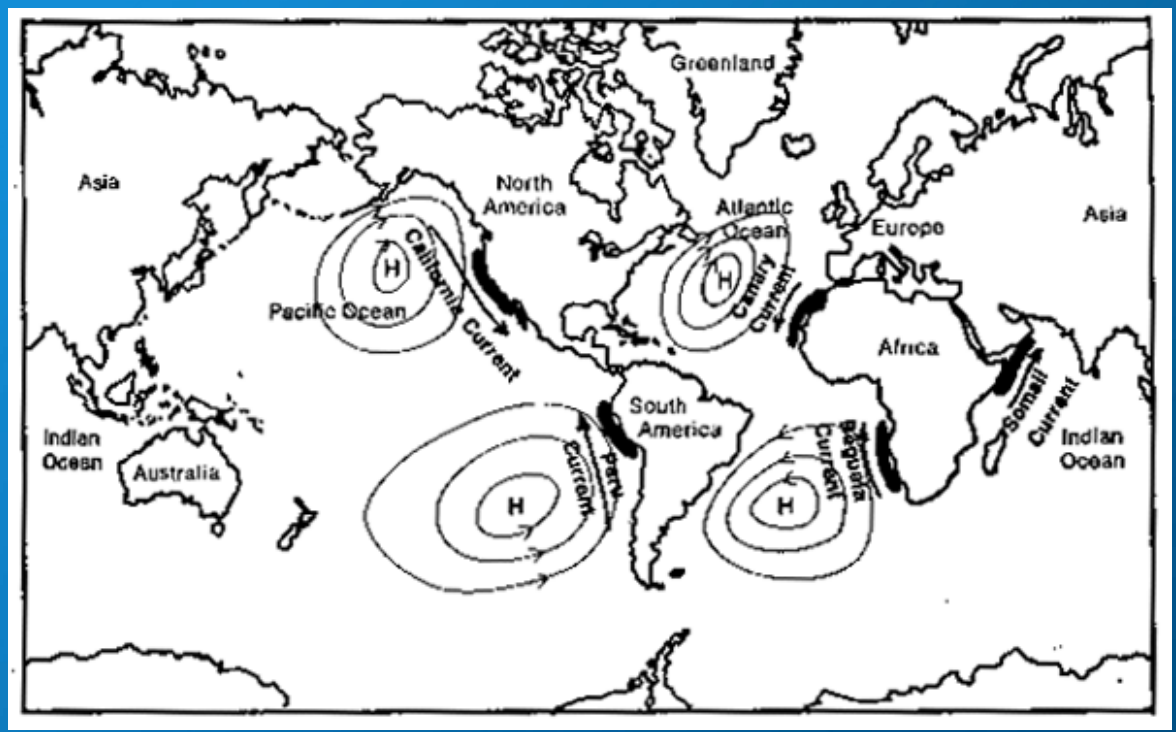
Flinders Current System

World's only **northern boundary current ecosystem**

- oceanographic, biological and ecological **similarities** to eastern boundary current systems

- "**little sister**" to Californian, Humbolt, Benguela, and Canary Currents – similar processes, **lower wind shear**





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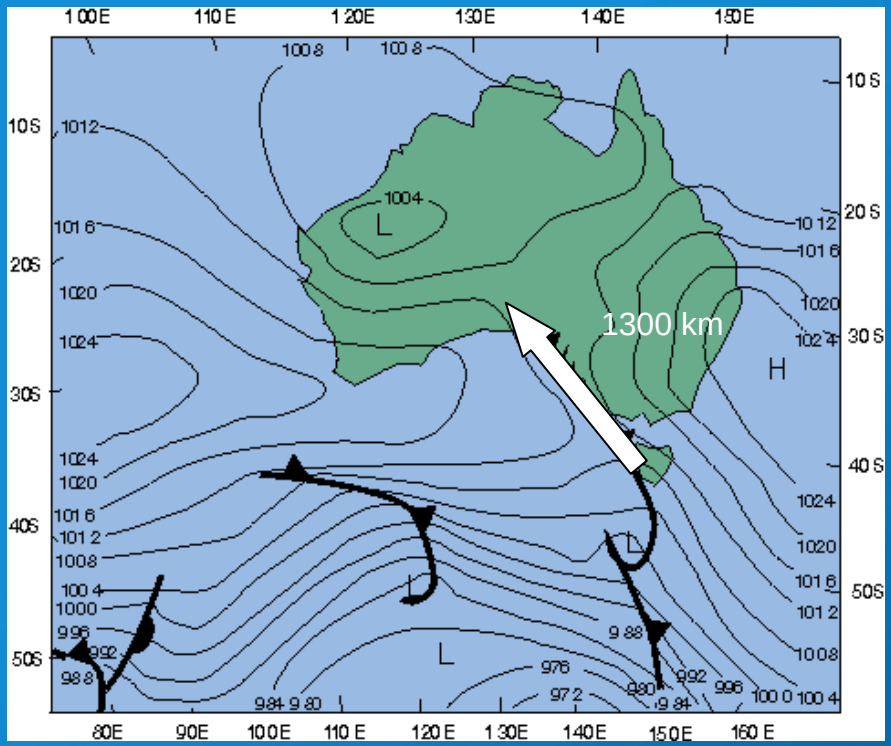
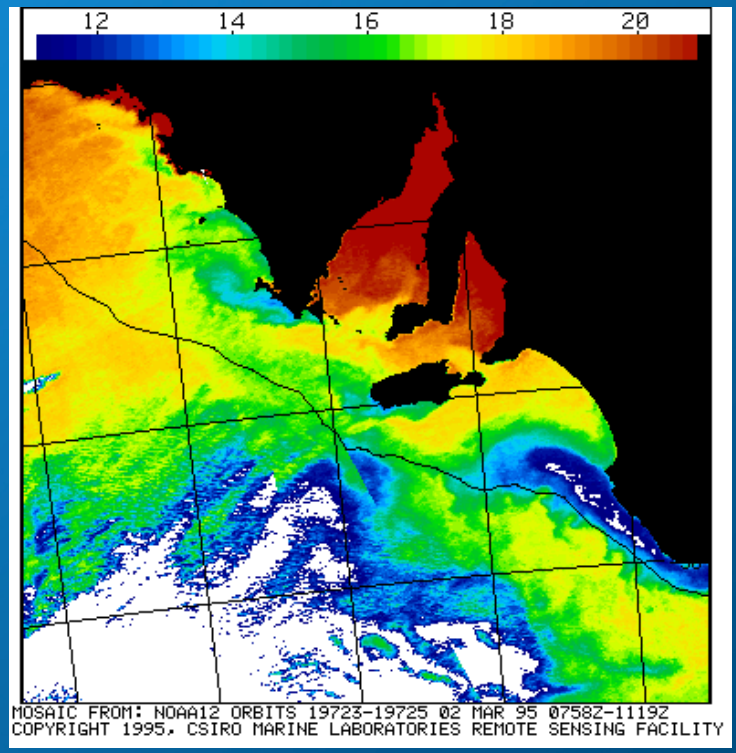
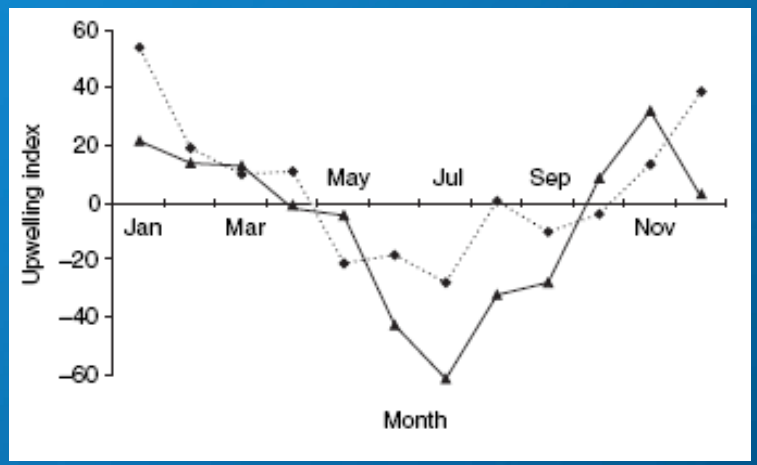
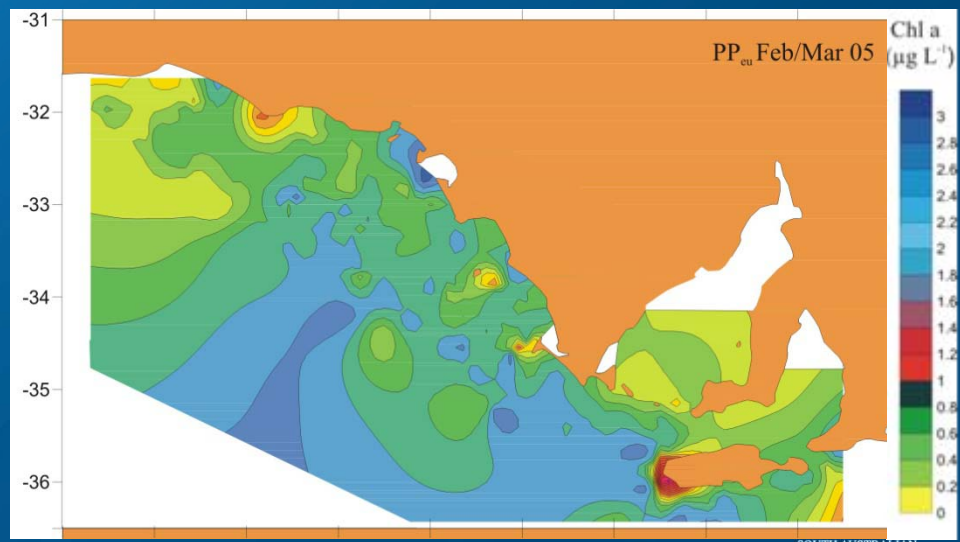
Upwelling during summer-autumn









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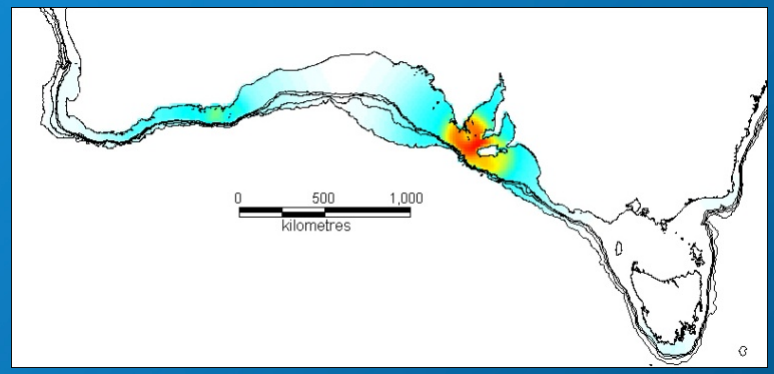
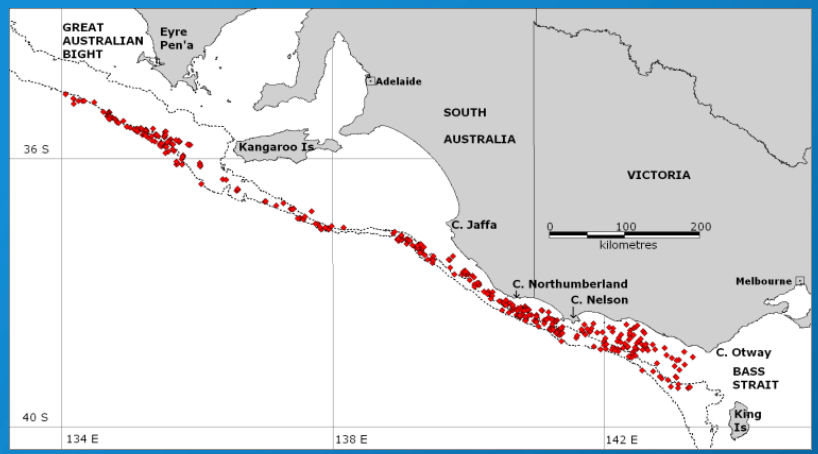
Regional hot-spot for pelagic species





>80% of Australian population of NZ fur seals & Australian sea lions

Australia's most significant feeding ground for pygmy blue whales – movements linked to upwelling and krill swarms

Australia's largest population of short-tailed shearwaters 1,000,000 pairs

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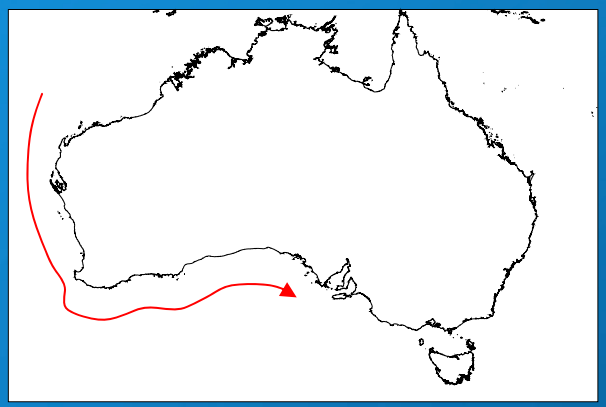
Southern Bluefin Tuna



Globally - most significant feeding ground for juvenile SBT
Aggregate in GAB during upwelling
Feed mainly on sardines

SBT mariculture industry began in early 1990s due to major cut in tuna quota.

Low value fishery evolved into high value wild capture aquaculture industry

Recent 30% cut in SBT quota

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South Australian Sardine Fishery (SASF)

- Target species is *Sardinops sagax*
- Began in1991 to provide fodder for SBT
- Based in Port Lincoln in southern Spencer Gulf
- 14 licence holders
- TAC and ITQs since outset
- Cautious development based on science
- Mass mortality events in 1995 and 1998 each killed

~70% of adult population (Ward et al. 2001, ICES)

- catch of 10 t in 1991 up to 30K t in 2009
- Increasing proportion of catch is value added

(3 processing factories in Port Lincoln)

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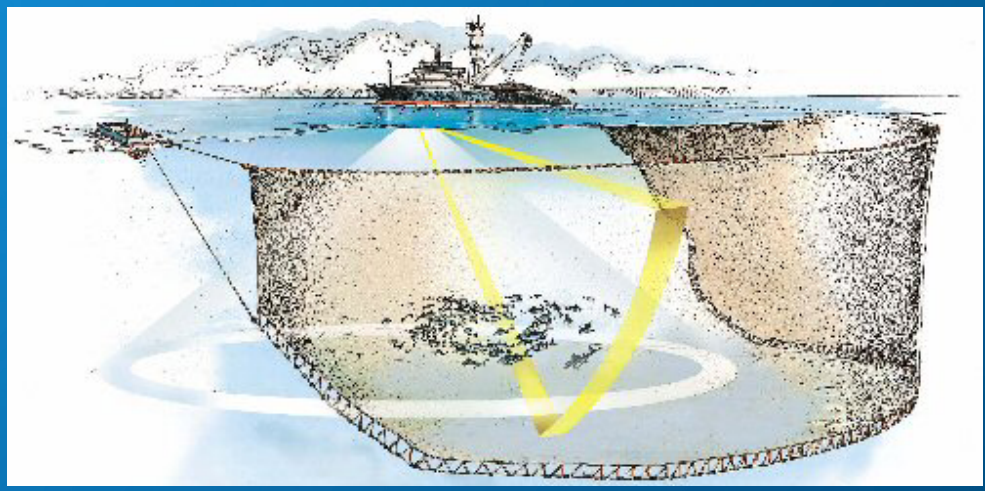
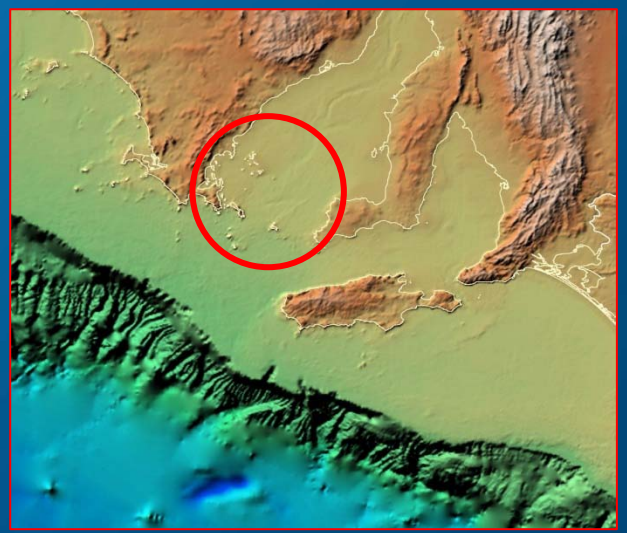
Modern Purse Seine Fishery





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Assessment and Management Framework

Managed by Primary Industries and Resources SA (PIRSA) under SA *Fisheries Management Act 2007*

Objective to manage fisheries according to ESD principles – sustainability and maximise economic and social benefits to community

PIRSA Fisheries funds research and management through annual licence fess (cost recovery, user pays)

SARDI Aquatic Sciences provides core research – stock assessment and other research to underpin fisheries ESD

Funding for research, monitoring and assessment of SA Sardine Fishery: ~$A500 K

Science conducted under Service Level Agreement with PIRSA fisheries with clear milestones and deliverables

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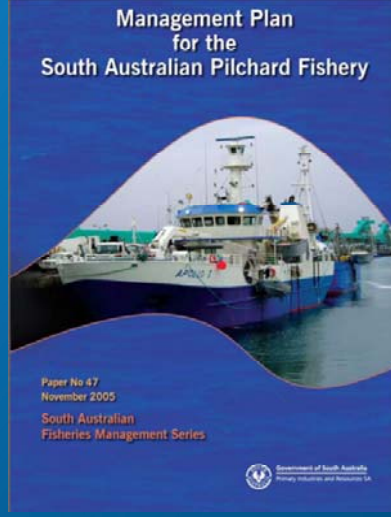
Management Goals



Pilchard Fishery Working Group established in 1995.

Management Plan established in 2005 - Goals:

1. Sustainable harvest of resources
a. Manage catch to ensure fishery remains **stable** in long-term
b. Develop **performance indicators** to ensure harvest is sustainable

2. Minimise adverse impacts on **ecosystem**
a. Minimise impacts on **structure** of the ecosystem
b. Minimise **operational effects** on endangered and protected species

3. Optimal utilisation of resource within sustainability constraints
a. Improve **economic efficiencies**
b. Maximise social and economic **benefit to community**

4. Good **governance**
a. Promote **cost-effective** management
b. Promote **co-management**
c. Ensure **compliance** with management measures

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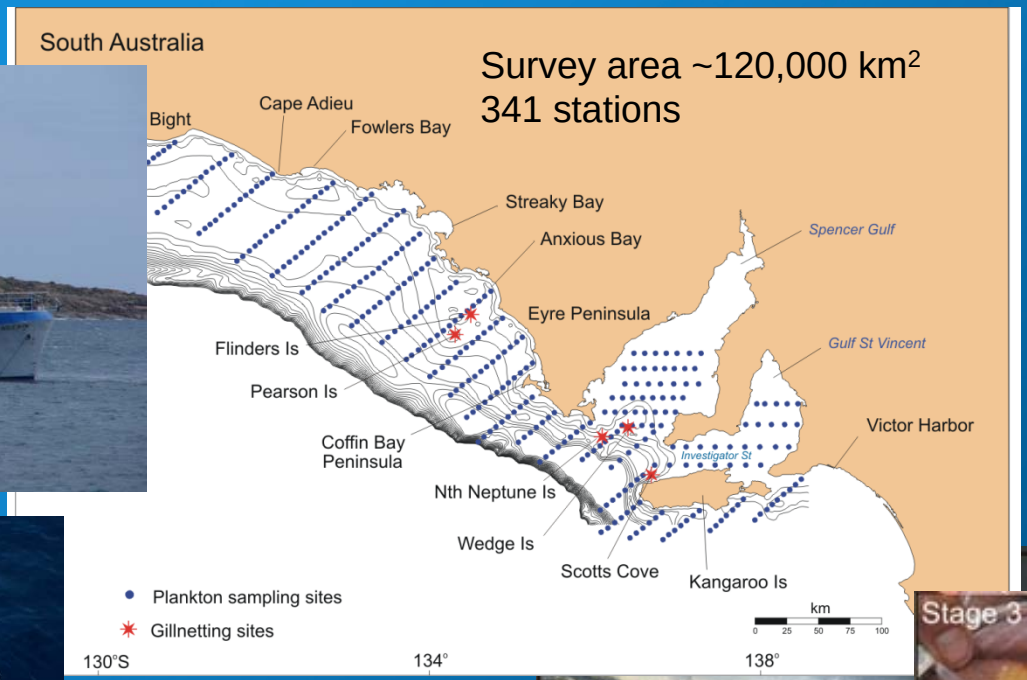
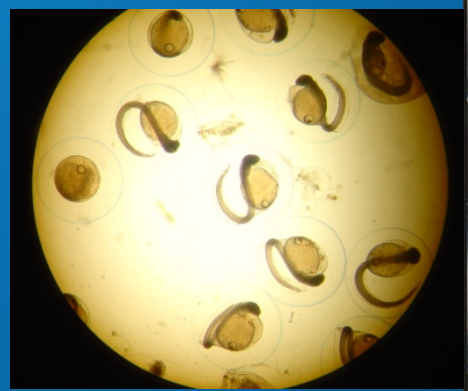
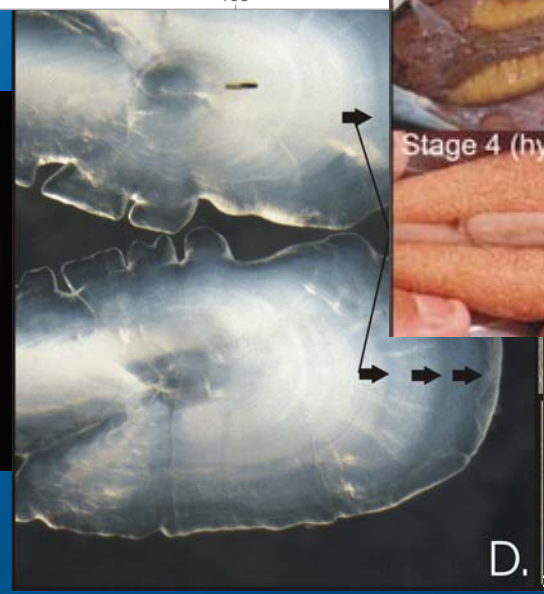
Stock assessment, DEPM etc







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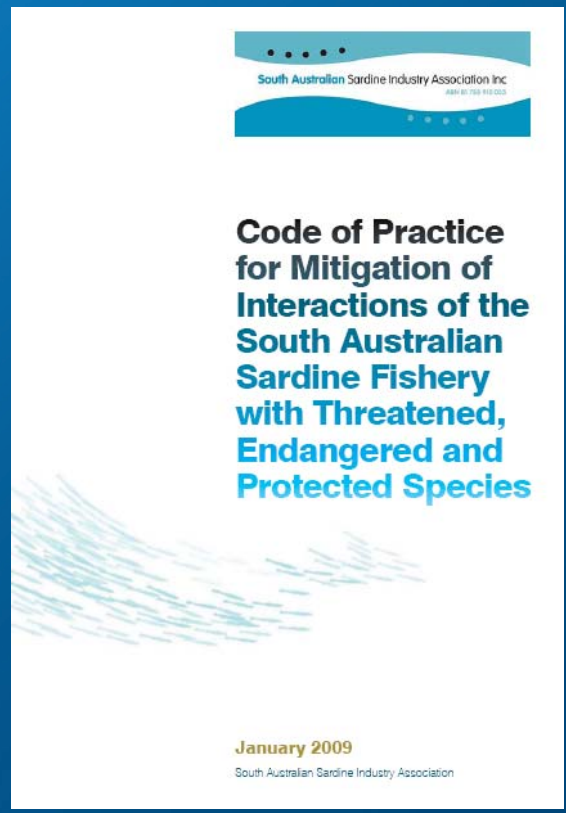
Operational Interactions with Protected Species

- *Environment Protection Biodiversity Conservation Act 1999*
- Ongoing observer and reporting program
- Continuous improvement of CoP

Hamer *et al*., 2008, *Biological Conservation.*
Hamer *et al.* 2009, *Animal Conservation*



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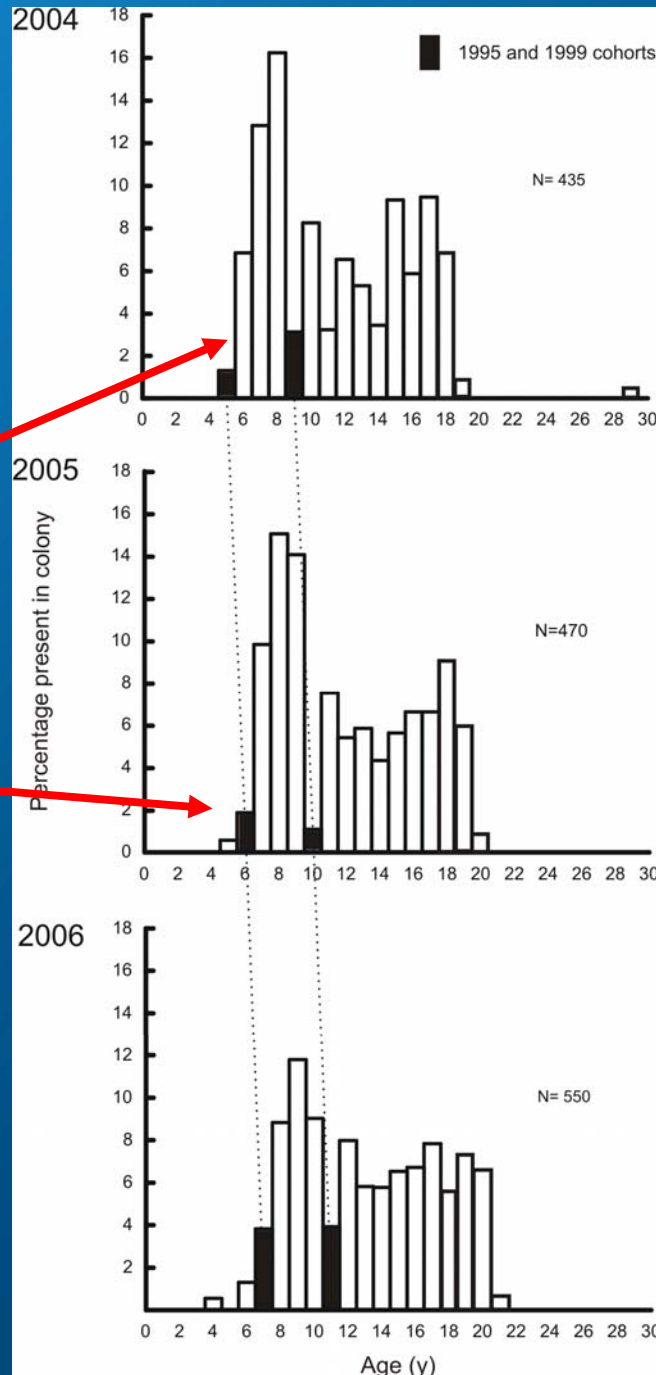
EBFM

Data collection
Ecological Modelling
Potential Ecological PI
Crested terns

Effect of 1995 and 1998 sardine mortality events?

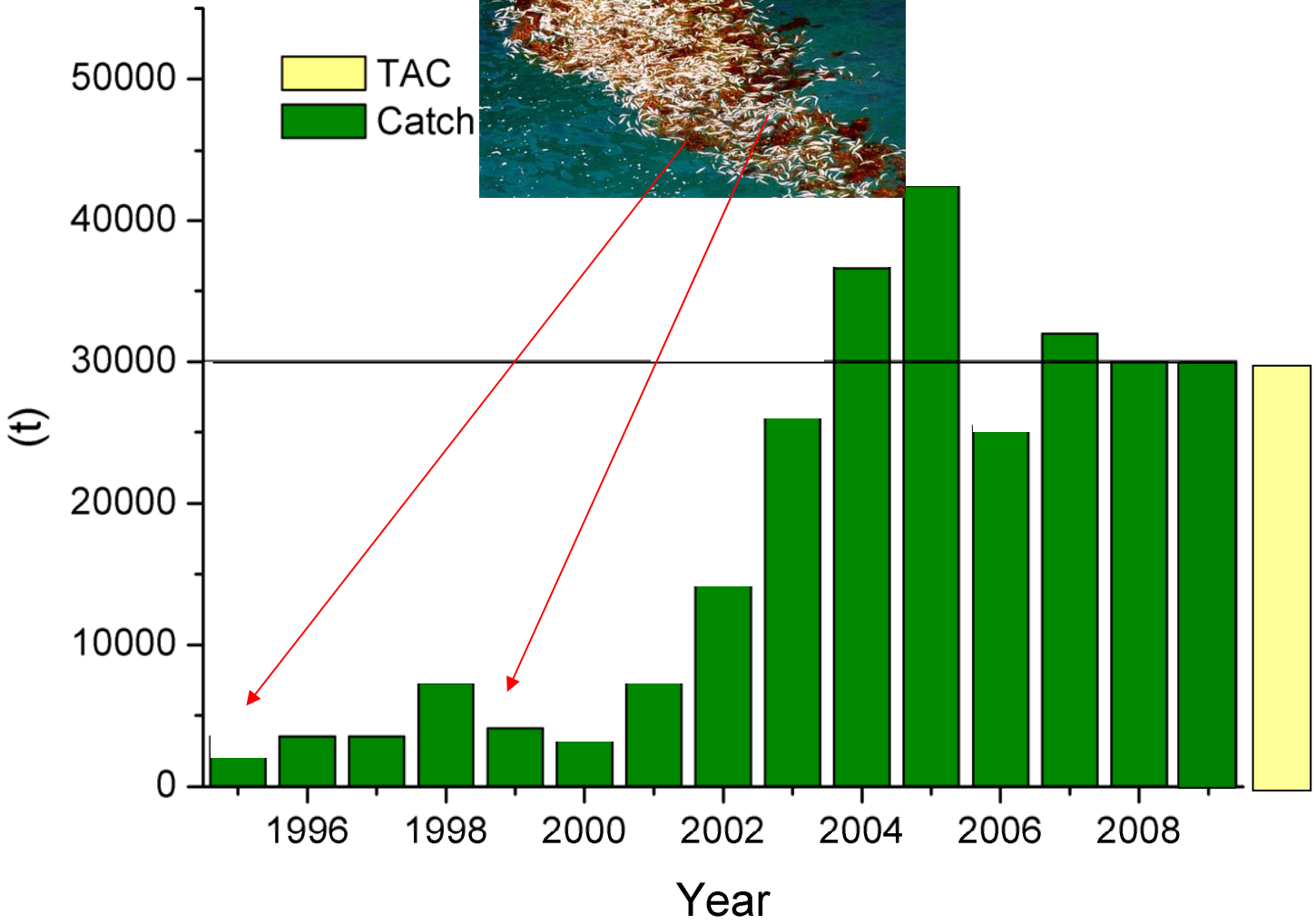
AGE STRUCTURE



Initial TAC decision rules (Harvest Strategy) for SASF

Spawning biomass estimate	Presence of age classes	Management action (as % of spawning biomass).
< 100,000 tonnes		10% or 500 tonnes (which ever is greater).
100,000 – 150,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of catch).	10%
100,000 – 150,000 tonnes	2 and 3 year old age classes strong (>40% of catch).	12.5%
150,000 – 250,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of the catch).	12.5%
150,000 – 250,000 tonnes	2 and 3 year old age classes strong or of average strength (>40% of the catch).	15%
>250,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of the catch).	15%
>250,000 tonnes	2 and 3 year old age classes strong or of average strength (>40% of the catch).	17.5%

Initial HS facilitated growth



2005 – price and profitability fell

2006 – showed that initial HS could lead to instability in catches

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Current TAC decision rules (Harvest Strategy) for SASF

Conservative HS to

achieve stability
reduce catching (fuel) and research costs (biennial application of DEPM)
maintain high price and profitability

Target TAC of 30,000 t

equates to **15%** exploitation rate of **SB of 200,000 t**

Limit reference points for Spawning Biomass of **150,000 t** and **300,000 t**,
equates to limit reference points of **20%** and **10%**, respectively

If SB is between 150,000 and 300,000 t,
TAC remains at 30,000 t

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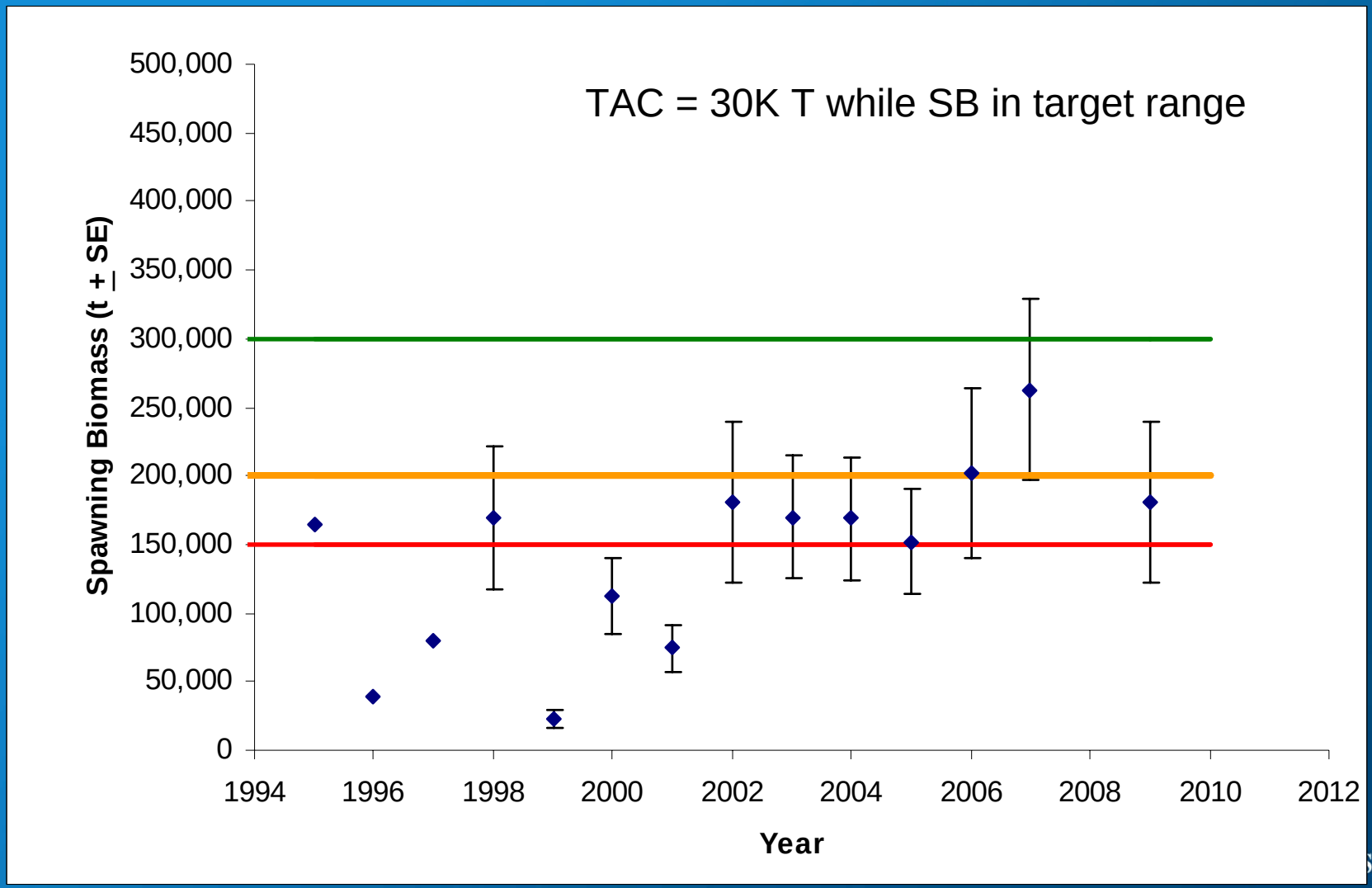
New Harvest Strategy



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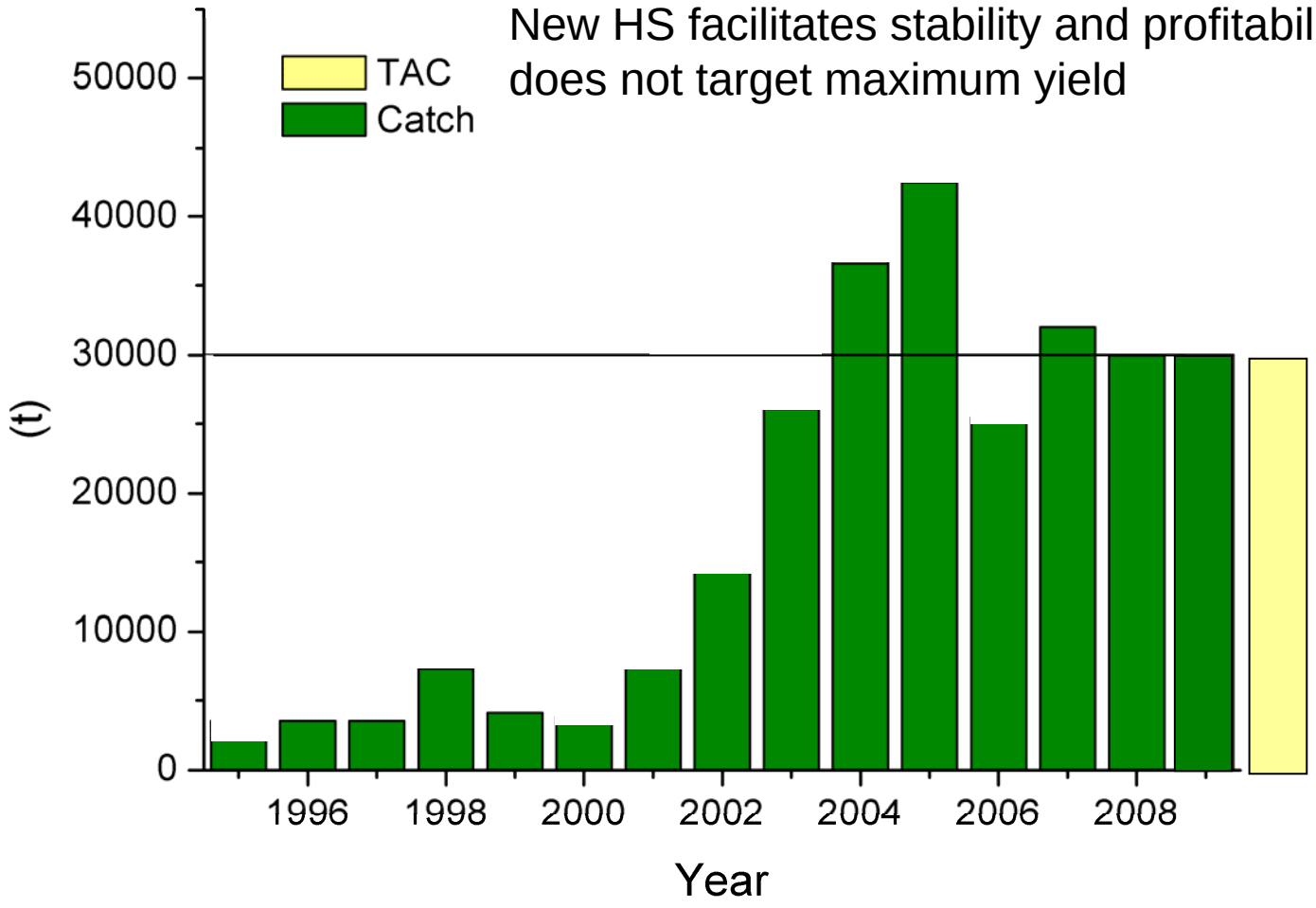

Why target stability instead of yield?

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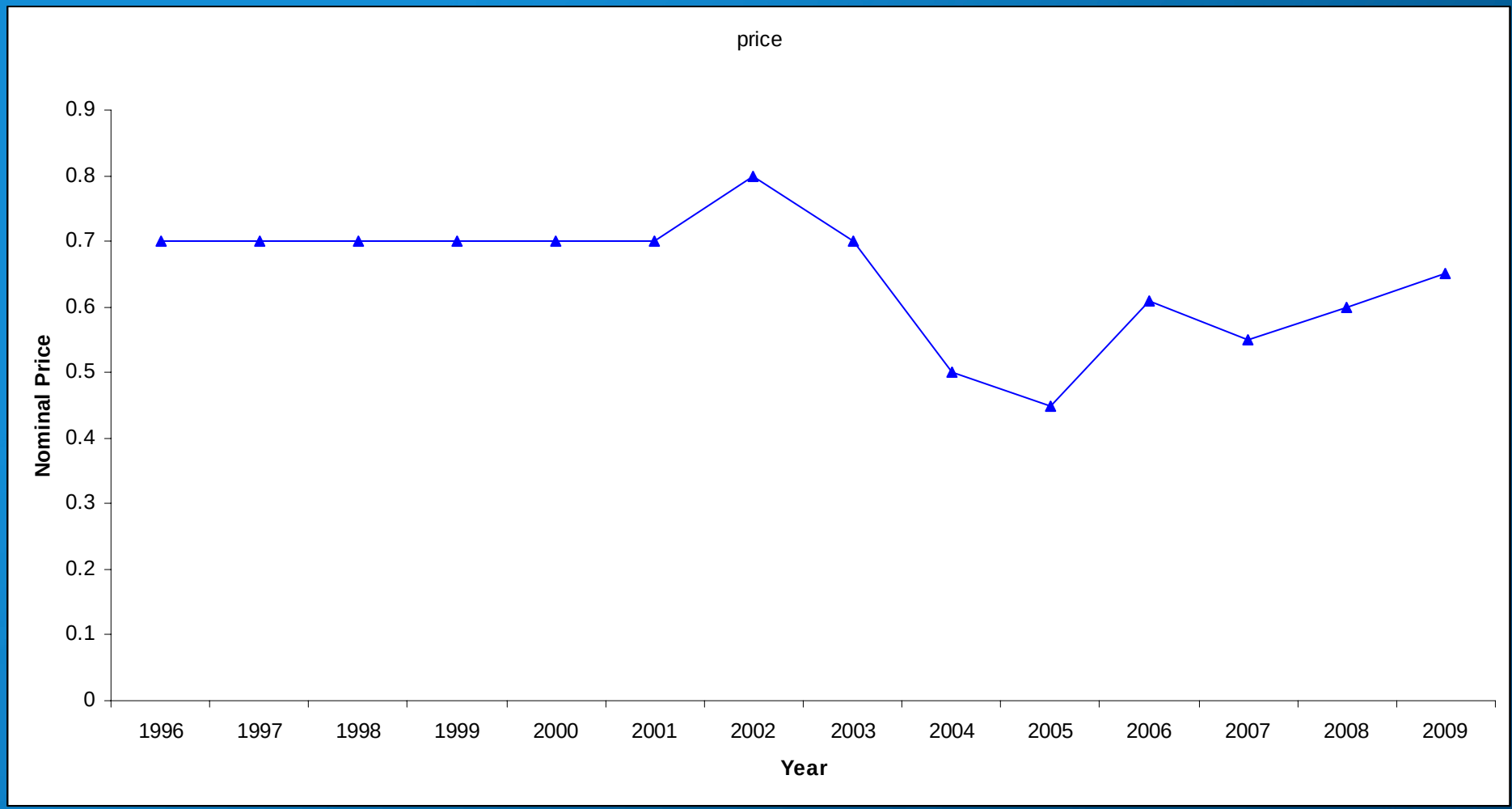
Supply (and demand) impact on nominal price



- Price for fodder, does not reflect increase proportion of product going to value adding at increased price to fishers

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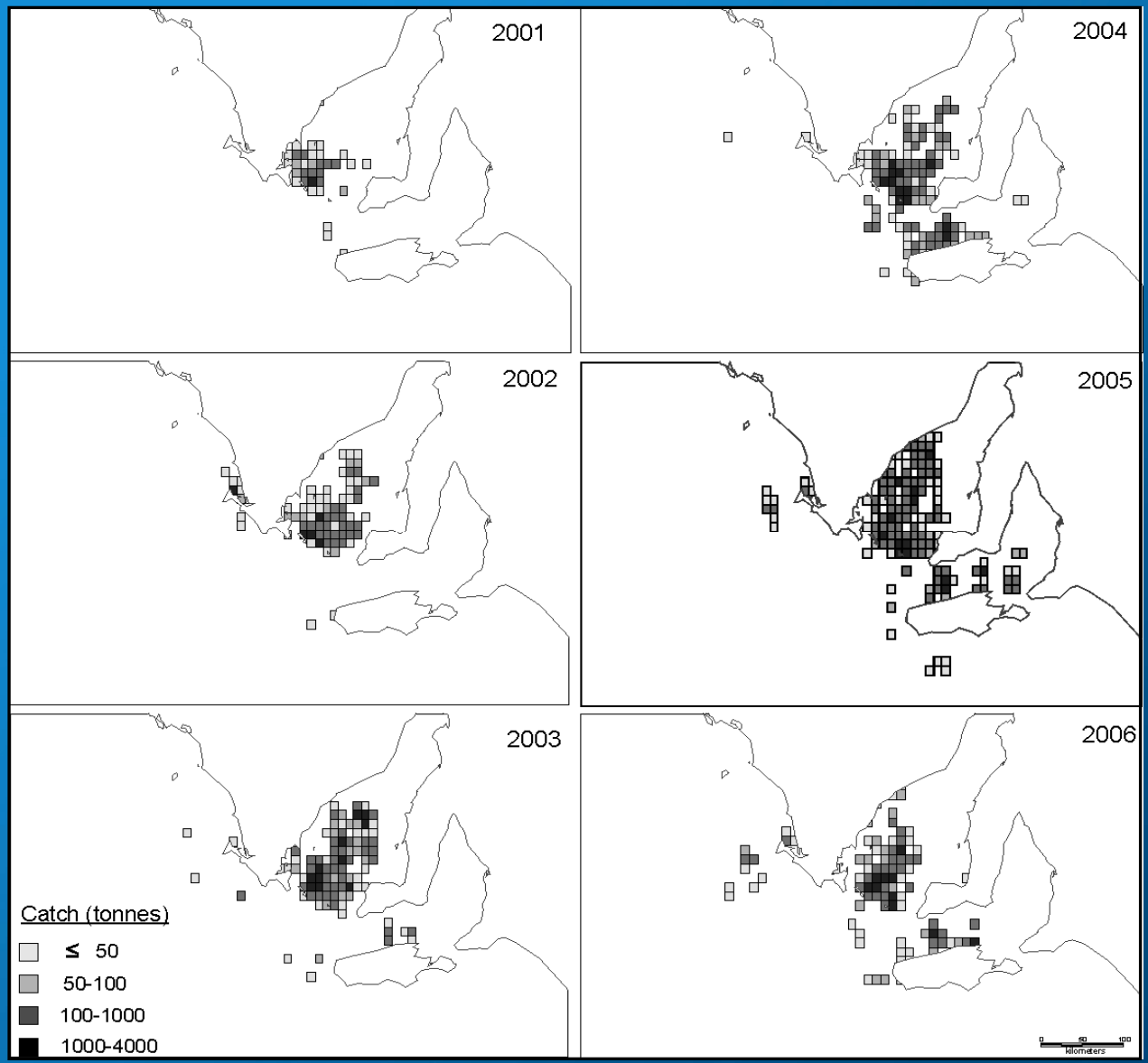
Increased catches also increased unit production costs (especially fuel)



Maintaining high catches may have required spatial management

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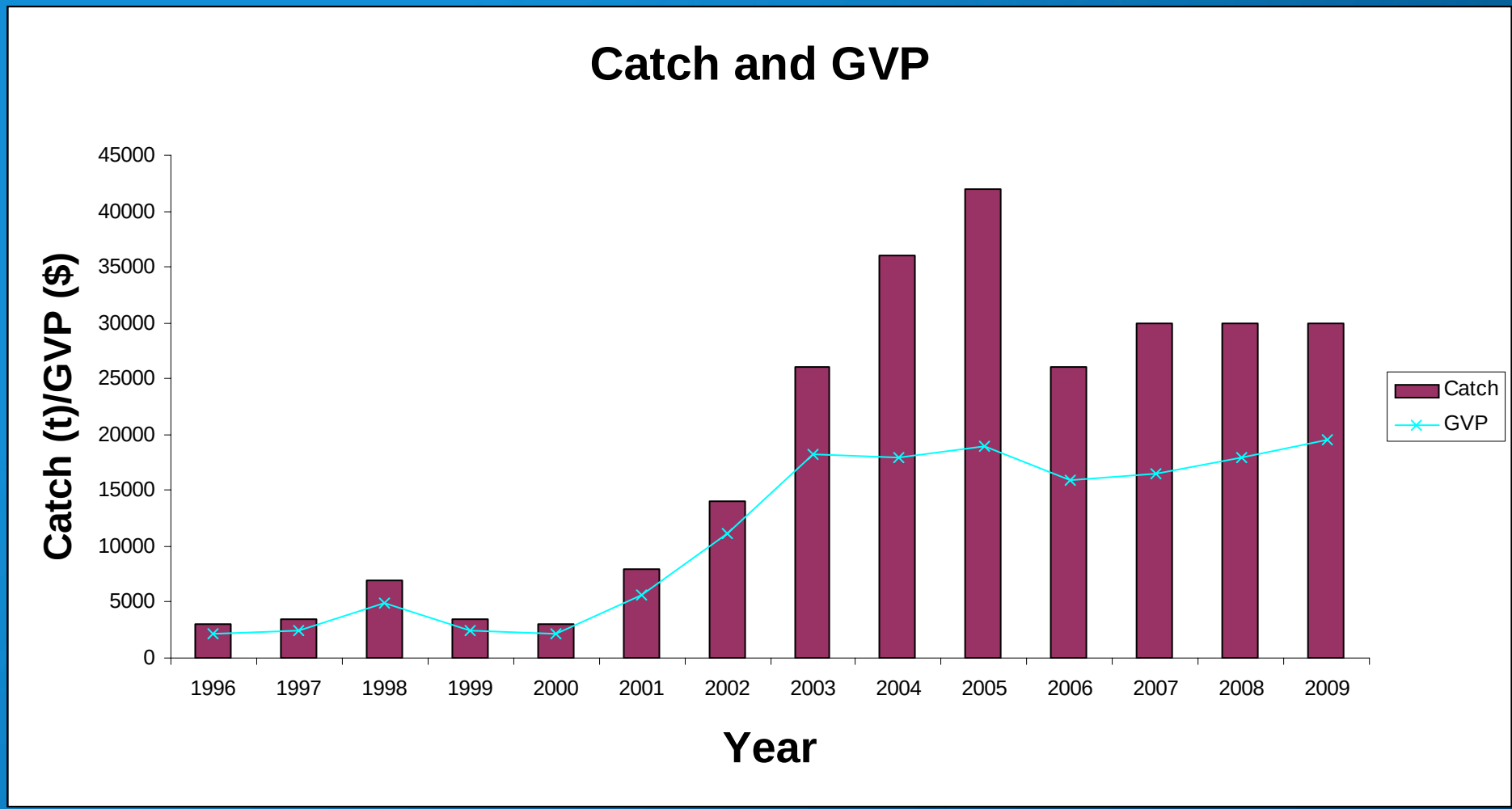

Does not capture increased proportion/price of catch going to value adding ie GVP is increasing more than graph suggests

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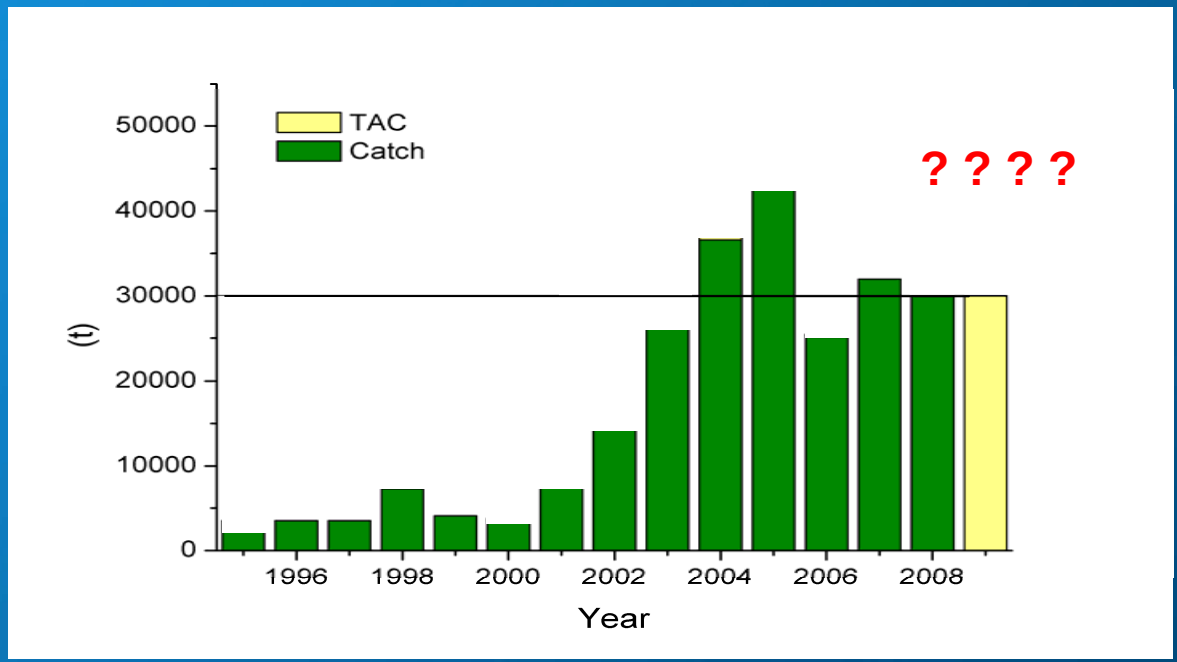
Main Benefits of ITQs

1. Allowed fishery to adopt a low risk, low cost, high price and high profit harvest strategy

Alternative, under competitive quota, fishers would probably have chosen to adopt a higher yield (higher risk) strategy, ie with higher catch, lower prices, higher operating costs, higher investment in research (requirement in SA) and **lower profits**



Also lower stability? Business implications, especially for value-adding

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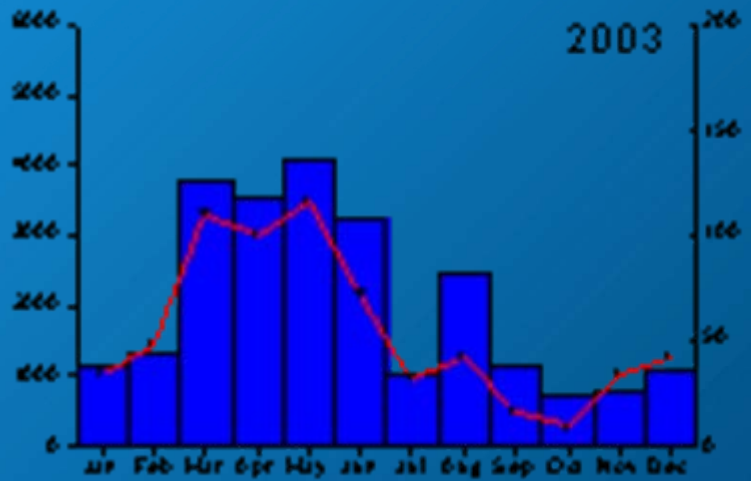
Main Benefits of ITQs (cont)

2. Allows fishers to hold back catching to match fodder requirements of tuna farms
Under ITQs tuna farmers and fishers can plan feeding/catching regimes for entire season

Alternative - Catch caught competitively early in season, sold cheaply, reduced profitability



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Main Benefits of ITQs (cont)

3. Allowed diversification and value adding

Three large ($M) processing factories targeting pet food, recreational bait and human consumption markets (Price to fishers ~85c/kg, expect $1 soon).

Higher price for fishers, many onshore jobs, maximum benefit to community. Export $.

Possible because **processors can access product most of year** (still low catches Aug Sept)

Alternative – No guarantee of year round supply, industry remains focused on providing fodder to mariculture industry, fails to maximise economic benefit to fishers and community, risks relying on single market (further cuts in tuna quota could have severe impact)

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Main Benefits of ITQs (cont)

4. Higher prices provides opportunity to support higher costs whilst maintaining profits – hence able to support acquisition of additional information (research) and higher operating costs associated with higher catches.

NB Principal: Risk/Catch is balanced with Cost/Information (Most impact in user pays, cost recovery environment like SA)

ITQs allow for profitable growth of industry – positive feedback loop – higher prices maintain profitability despite cost increases that are associated with higher catches

Alternative - remain low risk industry with low catches because low prices can't support higher operating and research costs that are required to support higher catches (risk)

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Main Benefits of ITQs (cont)

5. Only catching what market requires, maximising economic benefits to community and making the most of fish that are caught **improves image of fishing industry**

Worldwide, the fishing industry needs to improve its image

Alternative – high risk industries, which aim to maximise yield but are marginally profitable and deliver limited benefits to the community **are justifiably unpopular**

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Problems with ITQs

1. Some fishers don't like ITQs and enjoy competing for catches (philosophical opposition)

Solutions

Objective benefit-cost analysis of ITQs (be pragmatic)

Compete for profits

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Problems with ITQs (cont)

2. Allocating ITQs is difficult

Everybody wants a bigger cut, this creates conflict and is the major negative issue

Solution

Establish independent allocation panel

Get fisher input to establishing allocation model

Have appeal process

Fishers can buy additional ITQs

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Conclusions and final comments

- ITQs have enhanced development of SASF
- Same effect in other quota fisheries in SA (and Aust)
- All SA TACs are associated with ITQs (no competitive quotas)
- Same for most (all?) Australian quota fisheries
- Competitive quotas are economically inefficient – not endorsed by SA government, industry or broader community
- ITQs help explain the relative economic success of the SASF and other SA fisheries (cost recovery also helped)
- ITQs - challenging but rewarding to implement

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