

An Overview of the Management of SA Sardine and Anchovy Fisheries

MARAM International Stock Assessment Workshop
Cape Town, 28th November – 2nd December 2011

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with thanks to Janet Coetzee for some figures



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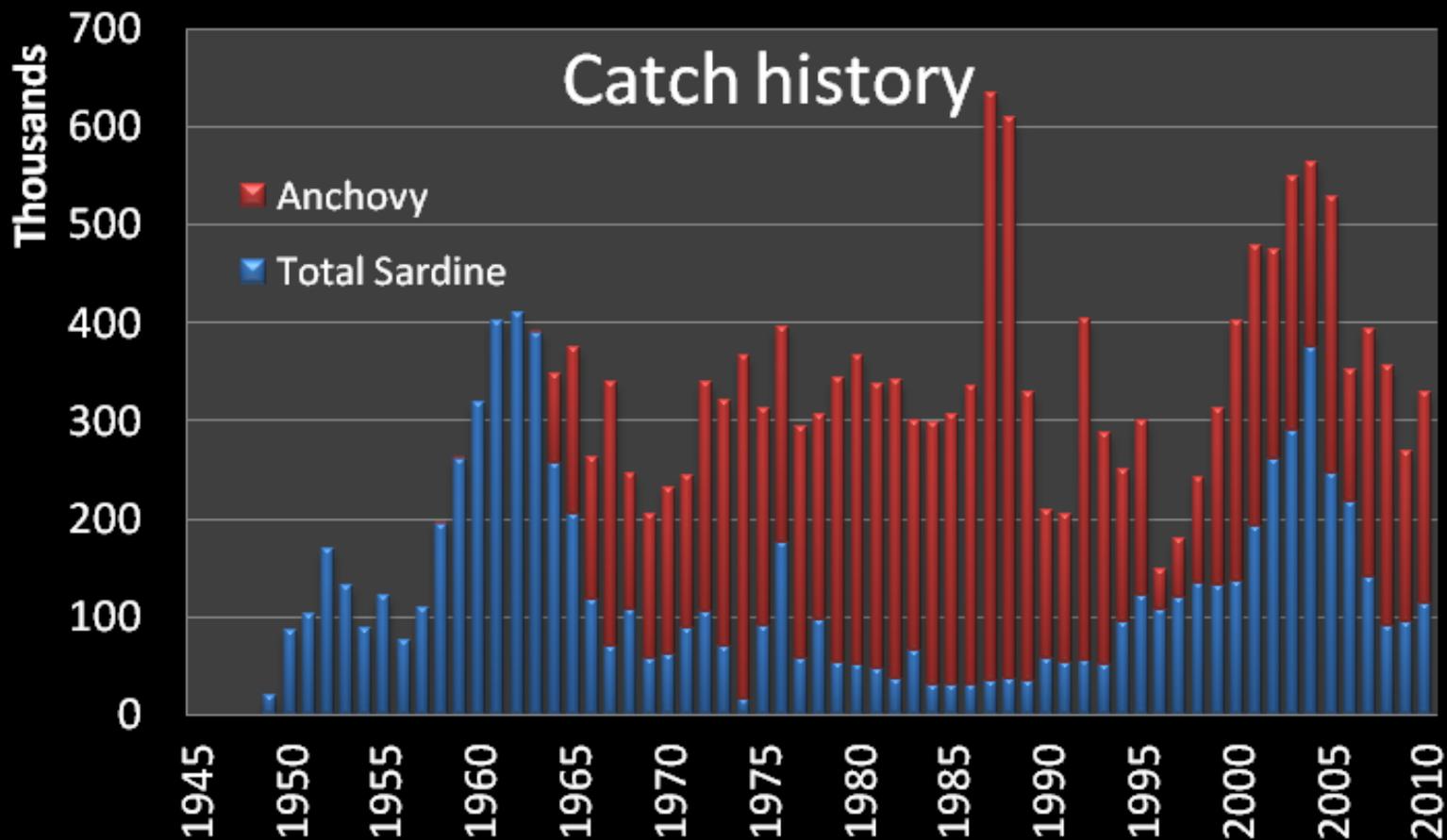
Outline

- Fishery and Data
- Resource Models
- OMP
- Key aspects of current revision
- Other related issues to be discussed

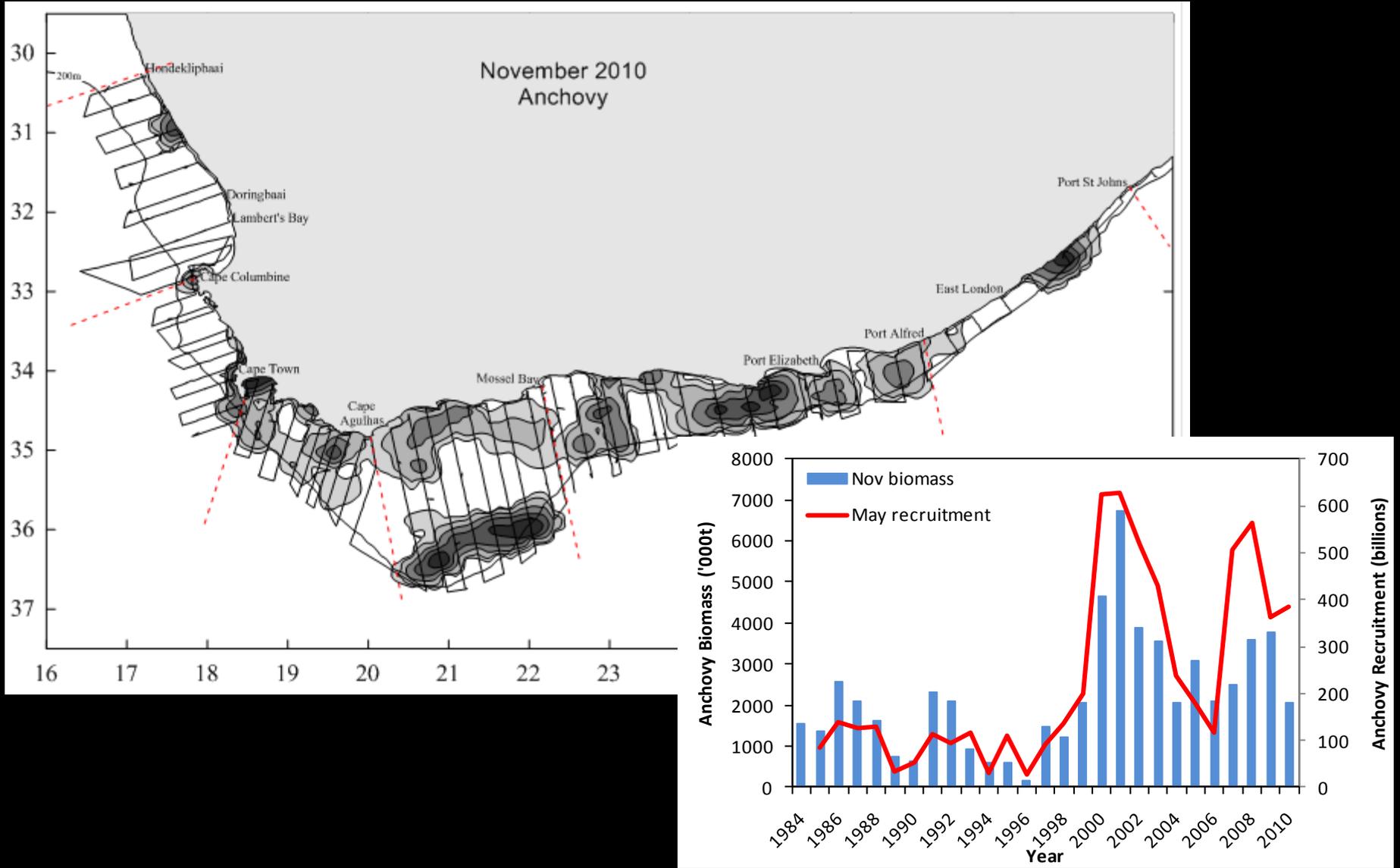
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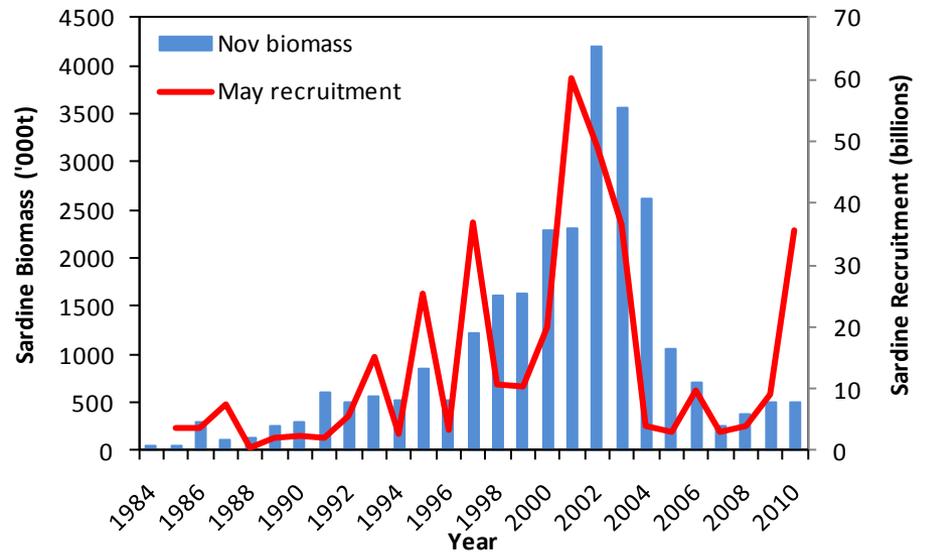
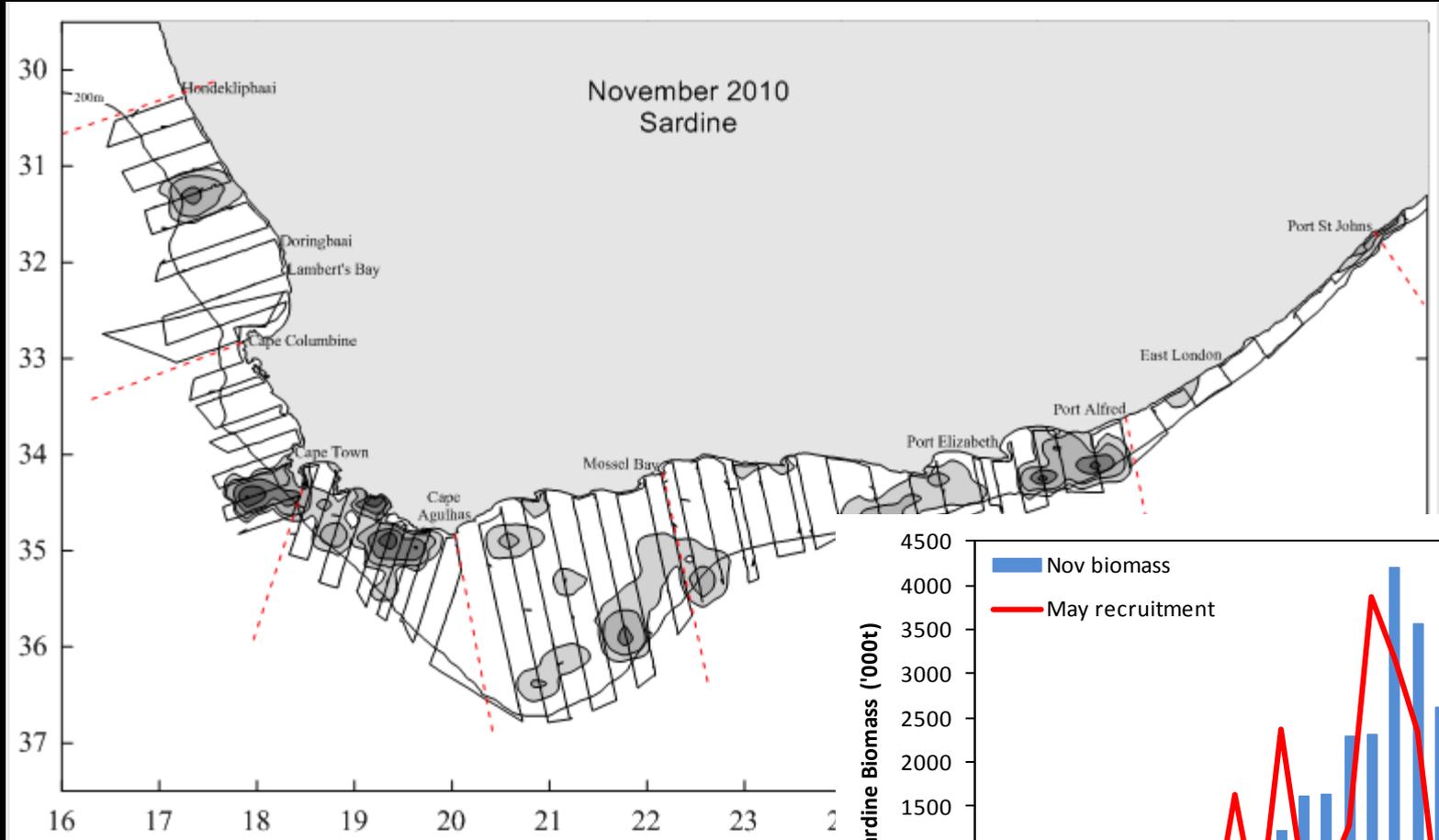
Catch History



Hydro-acoustic Surveys



Hydro-acoustic Surveys



Ageing

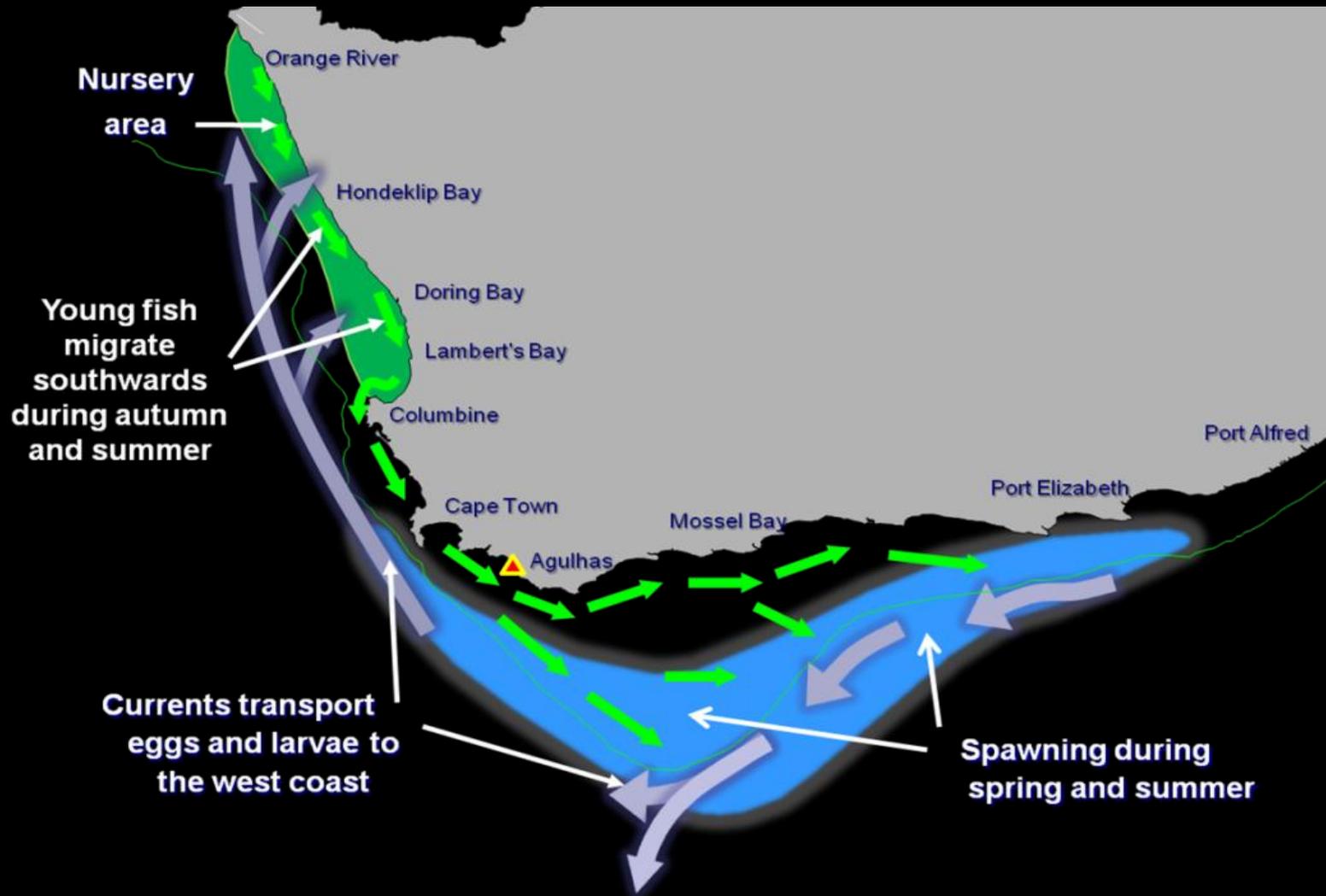
- Anchovy – very limited
 - Average of November 92-95 ALKs used
 - (cut-off lengths used for commercial catch)
- Sardine – still limited
 - ALKs read by 3 different readers, we use 1 set
 - November surveys 93, 94, 96, 01, 03,04, 06-10
 - Commercial – some months between 04-09

Still problematic, but improving (we hope😊)

Stock Structure

- Current default is a single stock for each species
- A multi-stock structure for sardine is being explored (discussion to come)

Annual recruitment pattern

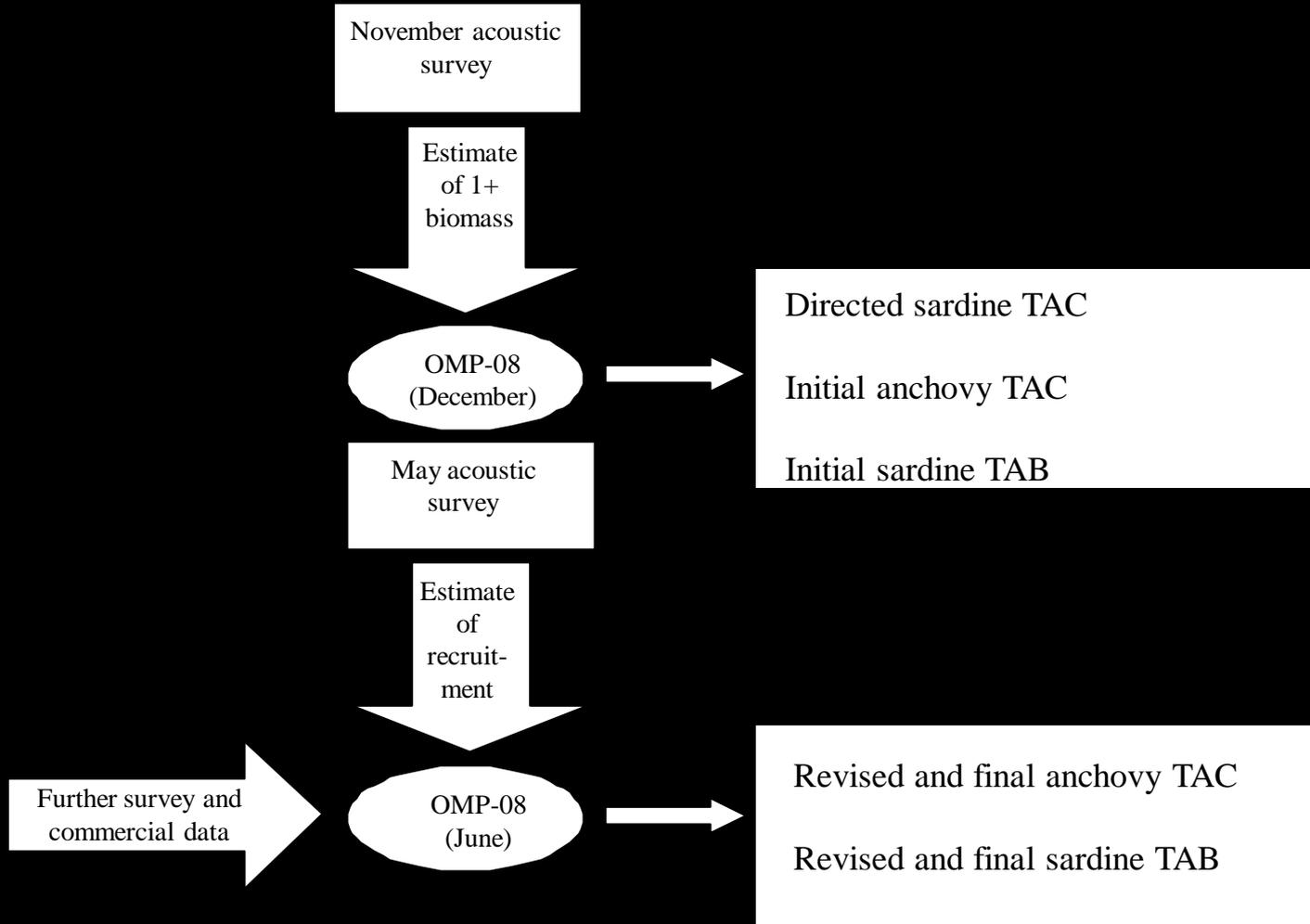


Trade-off

- The anchovy fishery is a recruit fishery – mainly fishmeal
- Sardine fishery is an adult fishery – mainly canned fish and bait
- Juvenile anchovy and juvenile sardine school together
- When targeting juvenile anchovy, sardine recruits are caught as bycatch
- By-catch of juvenile sardine impacts negatively on future biomass of adult sardine

➔ Trade-off between anchovy and sardine catches

TAC schedule during season



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Anchovy Operating Model

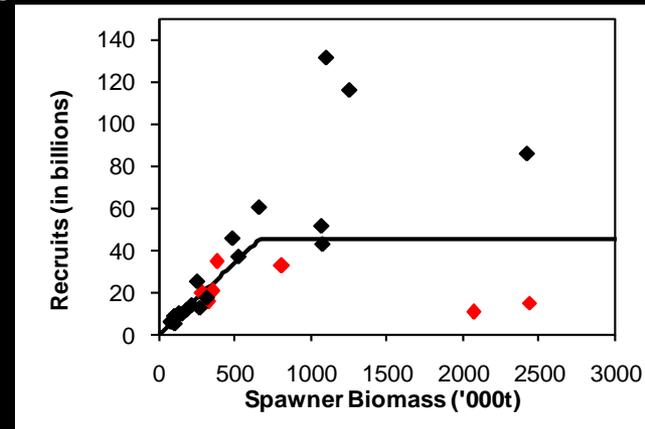
- Nov 1983 – Nov 2010
- Annual time step
- Juvenile and 1-year-old catch taken in an annual pulse
- Conditioned to survey 1+ biomass, recruitment, DEPM estimates of SSB, prop-at-age 1 in Nov
- Hockey stick S/R relationship

Sardine Operating Model

- Nov 1983 – Nov 2010
- Quarterly time step
- Catch-at-age taken in a pulse each quarter
- Conditioned to survey 1+ biomass, recruitment, prop-at-age in Nov survey and in quarterly catch, prop-at-length when ALKs not available
- Hockey stick S/R relationship

Some Discussion Points

- How to estimate σ_R in the absence of a minimum in $-\ln L$
- Temporal variation in M_{juvenile} and M_{adult}
- S/R relationship, and how to handle “boom” periods
- Sardine: Following “boom”, 6 of following 7 years below average recruitment



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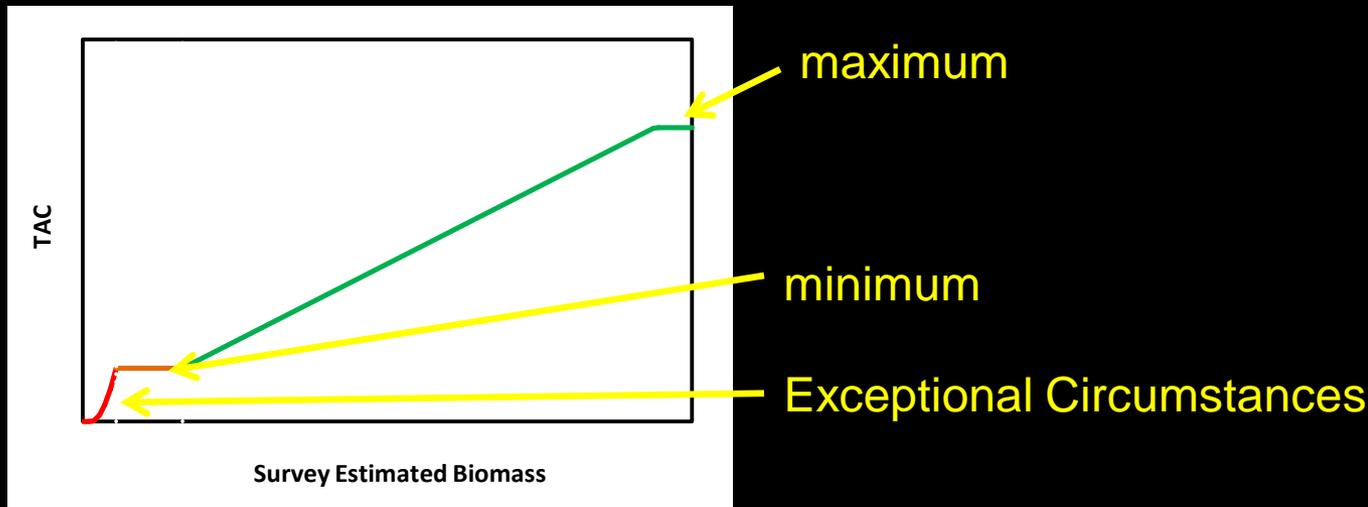
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OMP History

- Jointly managed since 1994 (OMP-94)
- 1997: Sardine-only OMP (anchovy fishery initially closed, then opened following above-average recruitment)
- 1998: 'hybrid' OMP
- OMP-99, OMP-02, OMP-04, OMP-08

Harvest Control Rules

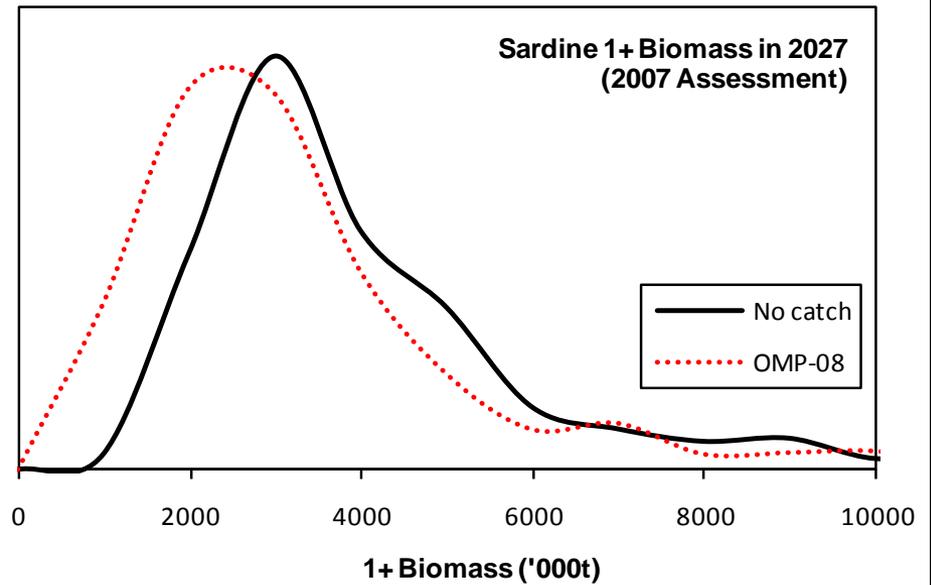
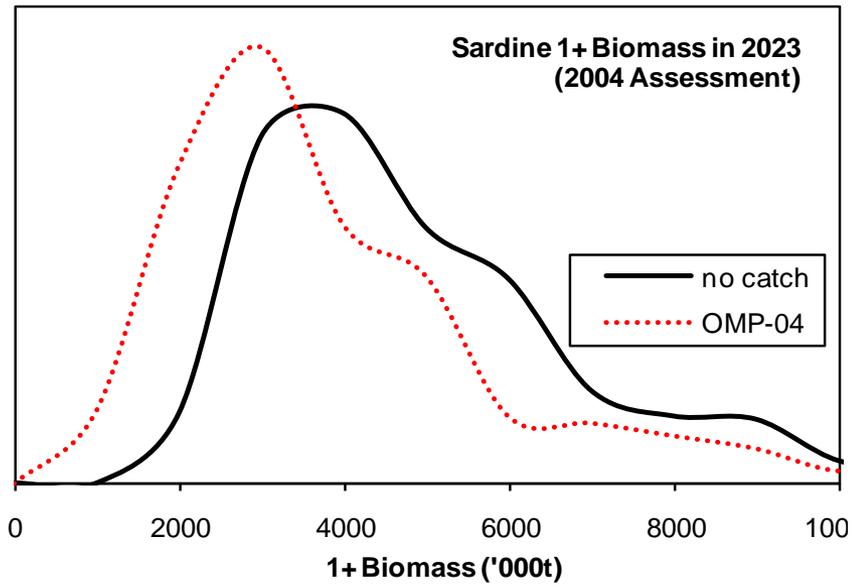
- TAC/Bs
- Empirical HCRs; key inputs estimates of stock abundance from surveys
- Biannual (anchovy, sardine bycatch)



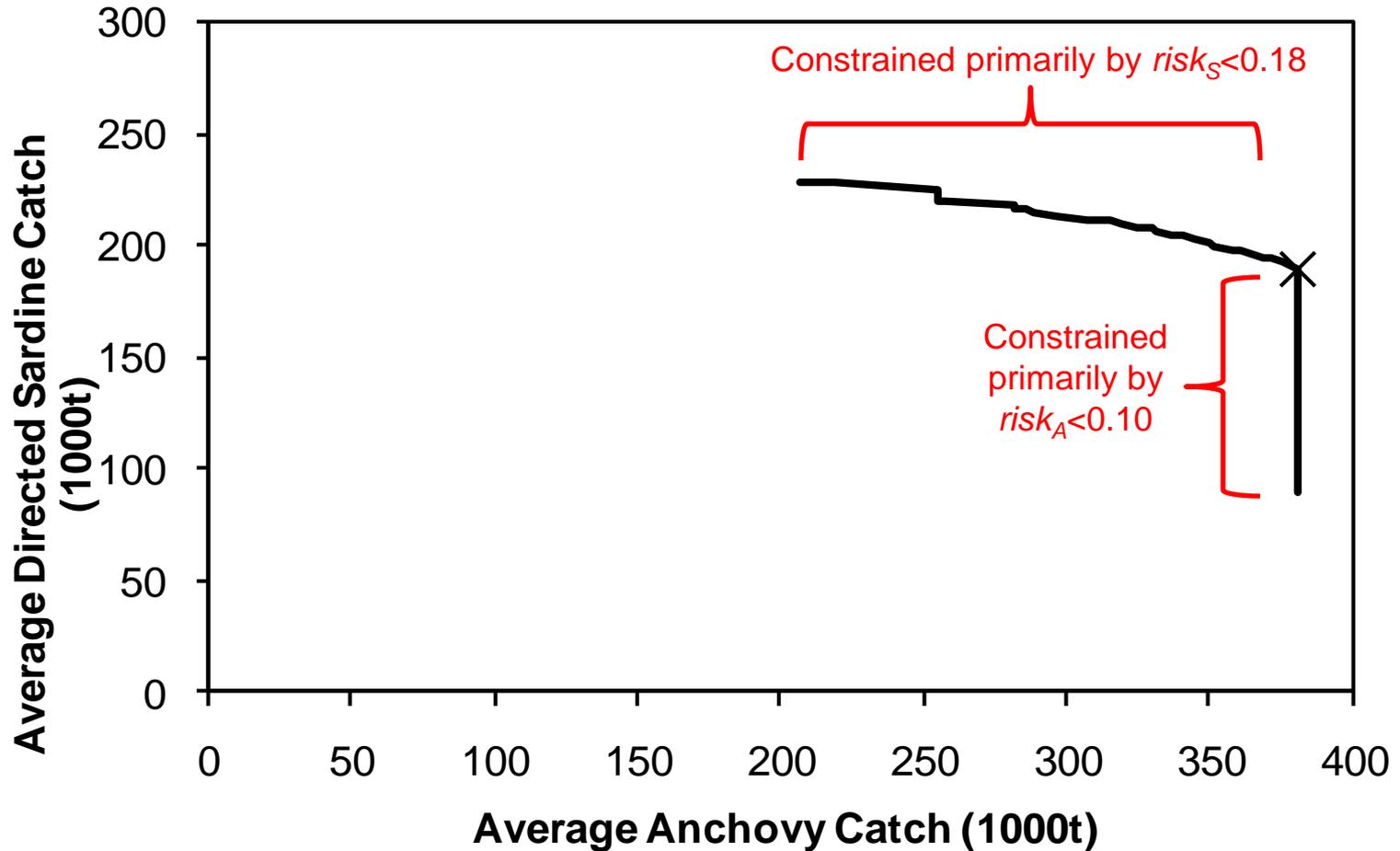
Risk

- We tune the MP by constraining risk to a maximum for sardine and anchovy
- **Main objective**: secure against this risk rather than explicitly aim at some target biomass.
- $risk_S$ - the probability that adult sardine biomass falls below the average adult sardine biomass over November 1991 and November 1994 at least once during the projection period of 20 years.
- $risk_A$ - the probability that adult anchovy biomass falls below 10% of the average adult anchovy biomass between November 1984 and November 1999 at least once during the projection period of 20 years.

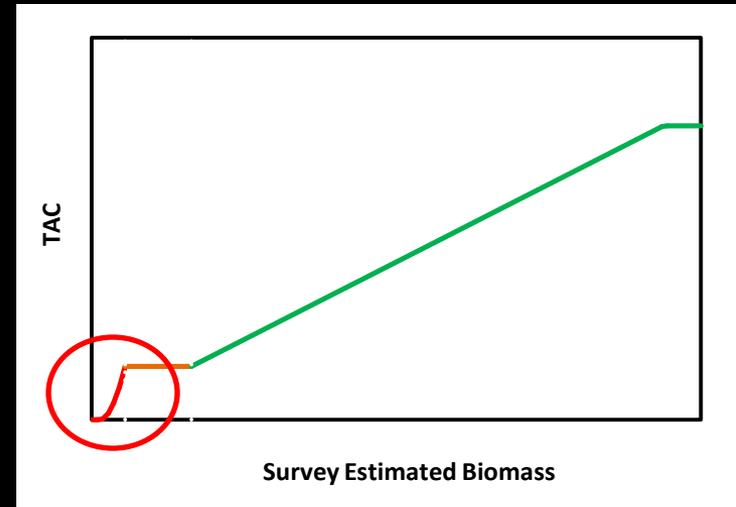
Risk



Sardine – Anchovy Trade-Off



Exceptional Circumstances

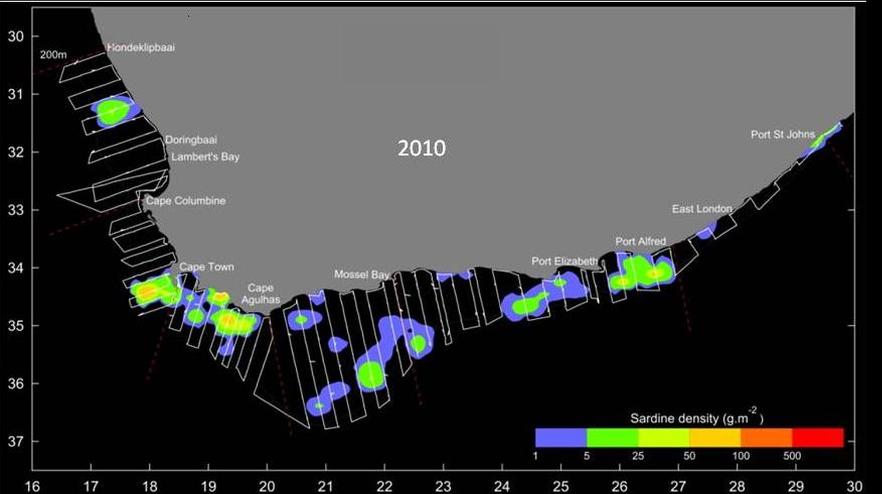
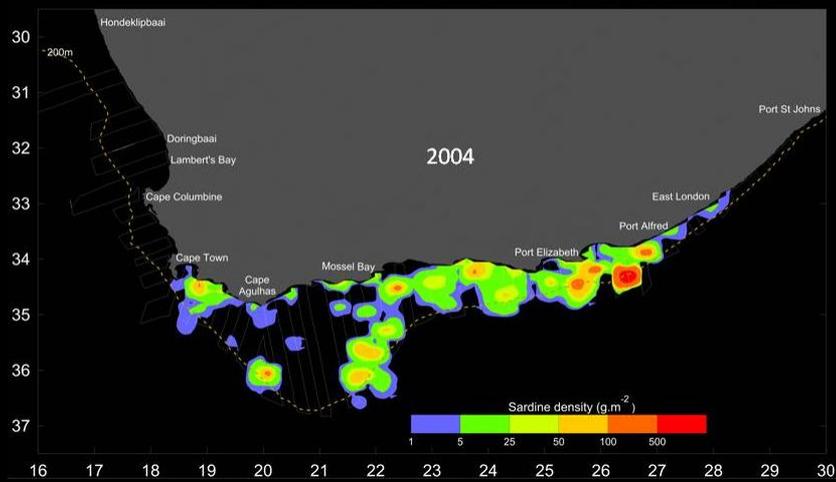
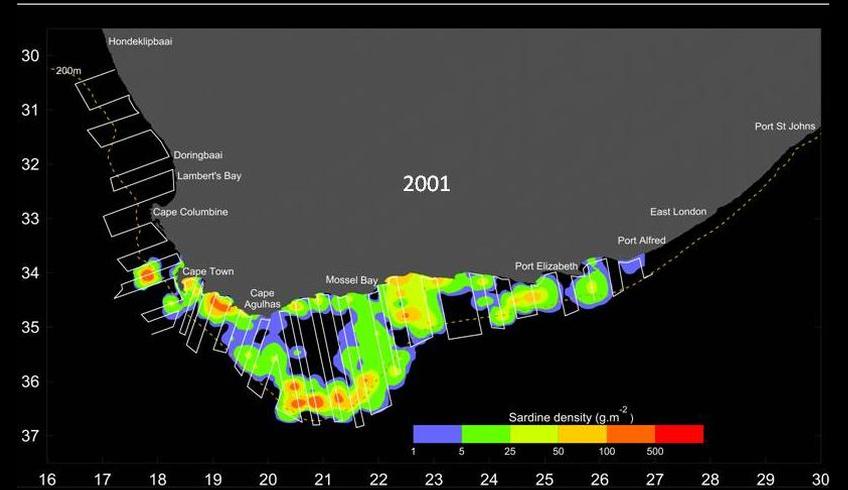
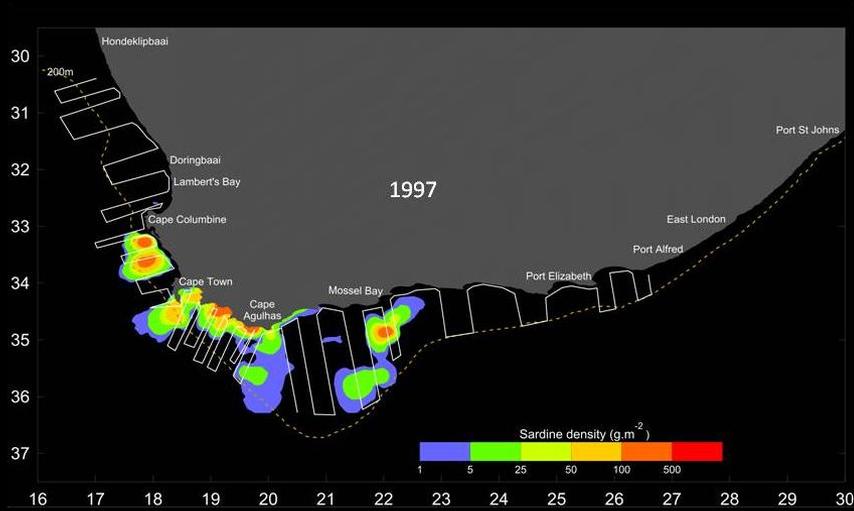


- Below EC threshold TAC is rapidly decreased
- $TAC = 0$ at 0.25 of EC threshold
- Sardine EC threshold = 300 000t
- Anchovy EC threshold = 400 000t

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Distributional Shift



Spatial Management

- Larger older fish are caught more in the east
- Two discrete sardine stocks unlikely
- Two mixing sardine stocks
 - relatively simple hypothesis to start with

Some Key Issues for Discussion

- Projections (e.g. S/R relationships)
- Assigning relative plausibility to constant vs time-varying M
- Assigning relative plausibility to sardine single vs two stock models
- Performance stats (particularly for 2 stock hypothesis)
- Control rules given possible spatial management with two zones
- Update of risk definition and/or thresholds

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MSC

- 75% of K escapement targets
- Current escapement targets (output from models as a result of chosen risk thresholds) at 61% of K for anchovy and 68% of K for sardine
- Catch losses of 15-30% if current target levels were replaced with 75%K
- K estimates very sensitive to assumed stock-recruitment relationship

Horse Mackerel

- Juvenile horse mackerel Precautionary Upper Catch Limit for Pelagic Fishery is 5000t
- PUCL increased to 12 000t in 2011
- To reduce bycatch, area closed when bycatch percentage $> 20\%$ and stays closed for a week
- Spatial closures severely restricted the anchovy harvesting in 2011

Penguins

- What is the extent of linkage of recent penguin declines likely as a result of increased adult mortality to lower sardine availability
- In particular, is this a problem of overfishing and/or the distributional shift?

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Thank you for your attention!