A summary of the South African sardine resource and fishery

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REPUBLIC OF SOUTH AFRICA
The South African sardine population is hypothesized to comprise multiple components, with semi-discrete stocks off the west, south and east coast that are not isolated but show some degree of mixing.
South African Sardine Distribution and Stock Structure

• The sardine multi-stock hypothesis was developed based on observations of significant spatial differences in a variety of sardine characteristics, including:
  – Life history characteristics (distribution patterns, spatially-separated spawning areas, different spawning seasons (Coetzee et al 2008; de Moor et al 2017)
  – Phenotypic meristic (e.g. gill raker and vertebral number; van der Lingen et al 2010; Idris et al 2016) and morphological (e.g. body shape, otolith shape) characteristics (Groenewald et al 2019)
  – Genetics - single nucleotide polymorphisms or SNPs (Teske et al 2018)
  – Parasite biotag loads (van der Lingen et al 2015; Weston et al 2015)
South African Sardine Distribution and Stock Structure

Sardine 2-component conceptual model

- A **West Coast** component that contributes to West Coast recruitment.
- A **South Coast** component that contributes to South Coast recruitment and West Coast recruitment (contributes ~ 8% to West Coast effective spawning biomass)
- Movement of fish from the West Coast to the South Coast at all ages informed by parasite data

Cape Agulhas

West Coast System

South Coast System

Passive transport/retention from West Coast component

Active recruitment to West Coast component

Active movement from West Coast component to South Coast component

Passive transport/retention from South Coast component

Active recruitment to South Coast component
Hydroacoustic Survey Estimates of Biomass

Sardine total survey biomass

Total Survey Biomass (million tonnes)

Sardine total survey biomass
Hydroacoustic Survey Estimates of Biomass

- Sardine total survey biomass
- Sardine survey recruitment

![Graph showing total survey biomass and survey recruitment](image_url)
Hydroacoustic Survey Estimates of Biomass

Sardine

West of Agulhas
East of Agulhas


0% 25% 50% 75% 100%

2000 2500 3000 3500 4000 4500

Thousand Tons

Sardine

West of Agulhas
East of Agulhas


0 500 1000 1500 2000 2500 3000 3500 4000 4500

Hydroacoustic Survey Estimates of Biomass
Small pelagics purse-seine fishery:
- Largest by landed mass
- 2nd largest by value
Sardine have also been commercially harvested off the south coast since the 1990s.
Sardine Fishery Background

109 long-term rights issued 2006-2020
• 86 active rights holders in 2016
• Rights range from 0.05% – 15% of the TAC
• Rights to 73% of the TAC is held by RHs from the West Coast

80% of the catch is canned
• 6 canning factories (5 on west coast)
• small pack and freeze processors (bait and human consumption)
Spatial Distribution of Directed Sardine Catches

Harvest proportion on west component much higher

Of concern given poor recruitment to west component in recent decade if this is a "feeder" to both coasts.
Directed Sardine Catch v TAC

Catch, TAC ('000 t)

>14 directed TAC

> 14 cm directed catch
**OMPs and Exceptional Circumstances**

**Directed sardine TAC and sardine TABs**

### Distribution of Projected November Biomass Under OMP-04

- **962 observed in Nov 2005**

### Survey estimated biomass

<table>
<thead>
<tr>
<th>Total</th>
<th>West of Cape Agulhas</th>
<th>East of Cape Agulhas</th>
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<tbody>
<tr>
<td>5%ile 10%ile 90%ile 95%ile 5%ile 10%ile 90%ile 95%ile 5%ile 10%ile 90%ile 95%ile</td>
<td></td>
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<tr>
<td>175.7 231.8 1328.1 1776.7 50.3 75.9 870.9 1258.6 45.5 59.6 611.9 821.3</td>
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- **<91 thousand tons**
- **<35 thousand tons**
- **<56 thousand tons**
OMPs and Exceptional Circumstances
Directed sardine TAC and sardine TABs

Uncertainties and Associated Concerns…

1) Updated assessment to 2018
2) Short-term projections
3) Modifications to assessment
4) Update assessment to 2019
5) Short-term projections

OMP-18

MARAM/IWS/2019/Sardine/P2

Exceptional Circumstances Dec 2018
Short-term fixed catch projection

MARAM/IWS/2019/Sardine/P3

Exceptional Circumstances Dec 2019
Short-term fixed catch projection
Assessment Details

• Age-structured production method framework, incorporating key elements of Statistical catch-at-age and Integrated Analysis methods
• Fit to survey estimates of recruitment and total abundance, catch data and length frequencies and parasite prevalence-at-length
• Estimate time-invariant growth curve with variability about length-at-age
Biomass “currencies”

• Total biomass:
  model estimated biomass (all $N \times w = B$)

• Spawner biomass:
  model estimated biomass contributing to spawning ($N \times w \times f = B^{sp}$)

van der Lingen et al. (2006)
Biomass “currencies”

• **Total biomass:**
  model estimated biomass (all N x w = B)

• **Spawner biomass:**
  model estimated biomass contributing to spawning (N x w x f = B^{sp})

• **Effective spawner biomass:**
  model estimated biomass on which recruitment to the west/south component is assumed to be dependent

• **Survey estimated (“observed”) biomass:**
  biomass estimated by the survey; typically an underestimate for sardine (B^{obs} = k*B)