


# Indicators for student reflection through summer school



# Summer School Resources

- ▣ Shannon et al. 2010 paper on ecological indicators in upwelling ecosystems (this provides a good biological and indicators context)
- ▣ Lockerbie and Shannon 2019 paper using Ecosim to explore possible climate change impacts on the ecosystem and fisheries
- ▣ Indicator time series as used in Shannon et al. 2010 and Coll et al. 2016 papers – please note these are CONFIDENTIAL and only for your use in this summer school. Any other use or replication of these data sets MUST be discussed with Lynne Shannon and prior permission requested for their use (otherwise our legal agreement with the government departments will be compromised!!)

# Dissemination of information - [www.indiseas.org](http://www.indiseas.org)



Indicators for the seas

**indiSeas**

FRANÇAIS  
ESPAÑOL  
ENGLISH

**STATUS OF MARINE ECOSYSTEMS**

To view an ecosystem and a evaluation of its state, click on the corresponding location in the world map or consult the list below.

[Ecosystems](#)

**COMPARATIVE APPROACH**

Select and compare the states and trends of several ecosystems (pie diagrams and time series)

[Compare](#)

**ABOUT indiSeas**

Methods details  
About us

South Africa  
Southern Benguela

Copyright | Contacts | Partnership | Site map

The screenshot displays the 'indiSeas' website interface. At the top left, there is a logo for 'Indicators for the seas' and 'indiSeas'. On the top right, there are language options: 'FRANÇAIS', 'ESPAÑOL', and 'ENGLISH'. The main content area is divided into three sections: 'STATUS OF MARINE ECOSYSTEMS', 'COMPARATIVE APPROACH', and 'ABOUT indiSeas'. The 'STATUS OF MARINE ECOSYSTEMS' section includes a description and a button labeled 'Ecosystems'. The 'COMPARATIVE APPROACH' section includes a description and a button labeled 'Compare'. The 'ABOUT indiSeas' section includes links for 'Methods details' and 'About us'. A large world map is centered on the page, with a callout box highlighting 'South Africa' and 'Southern Benguela'. A smaller inset map is visible in the bottom right corner of the map area. At the bottom of the page, there is a footer with the text 'Copyright | Contacts | Partnership | Site map'.

# EXAMINING INDICATORS OF FISHING EFFECTS ON MARINE BIODIVERSITY: THE SOUTHERN BENGUELA IN THE GLOBAL COMPARATIVE CONTEXT

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Yunne Shin, Alida Bundy

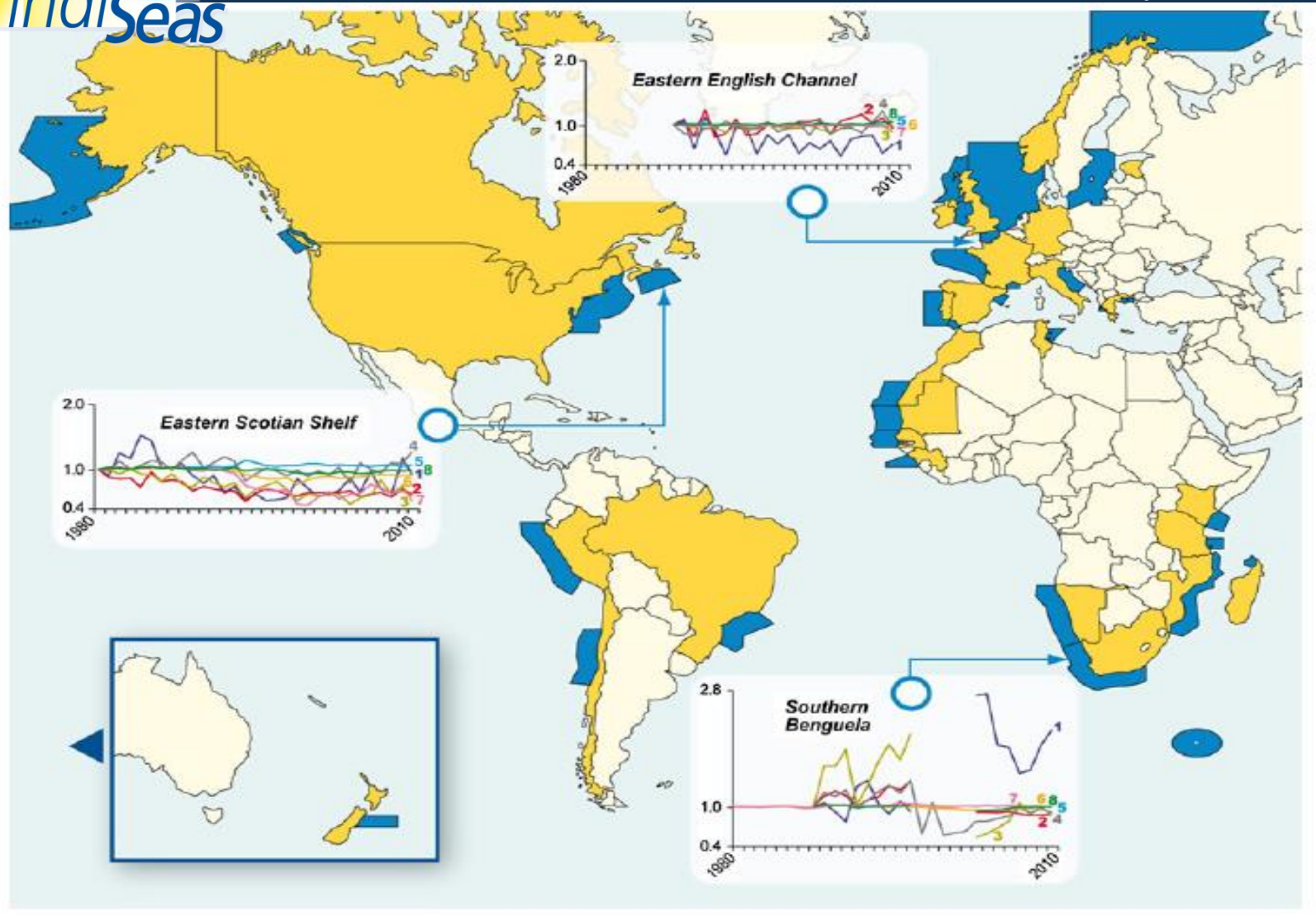
# IndiSeas (2005-2009; 2010-2014):

An international WG to gather and share indicator expertise across marine ecosystems` and member institutions to:

1. Develop a set of **synthetic ecological indicators** that are tractable and measurable for an extended range of ecosystems, and are meaningful to the public at large, and to managers
2. Build a **generic dashboard** using a common set of interpretation and visualisation methods
3. Evaluate the **exploitation status** of marine ecosystems in a **comparative framework**
4. Complement the evaluation and communication of the ecological status of marine ecosystems subject to **multiple drivers** (fishing, climate) in support of EAF (decision-making process)

# IndiSeas: Comparative Approach

Across 35 marine ecosystems



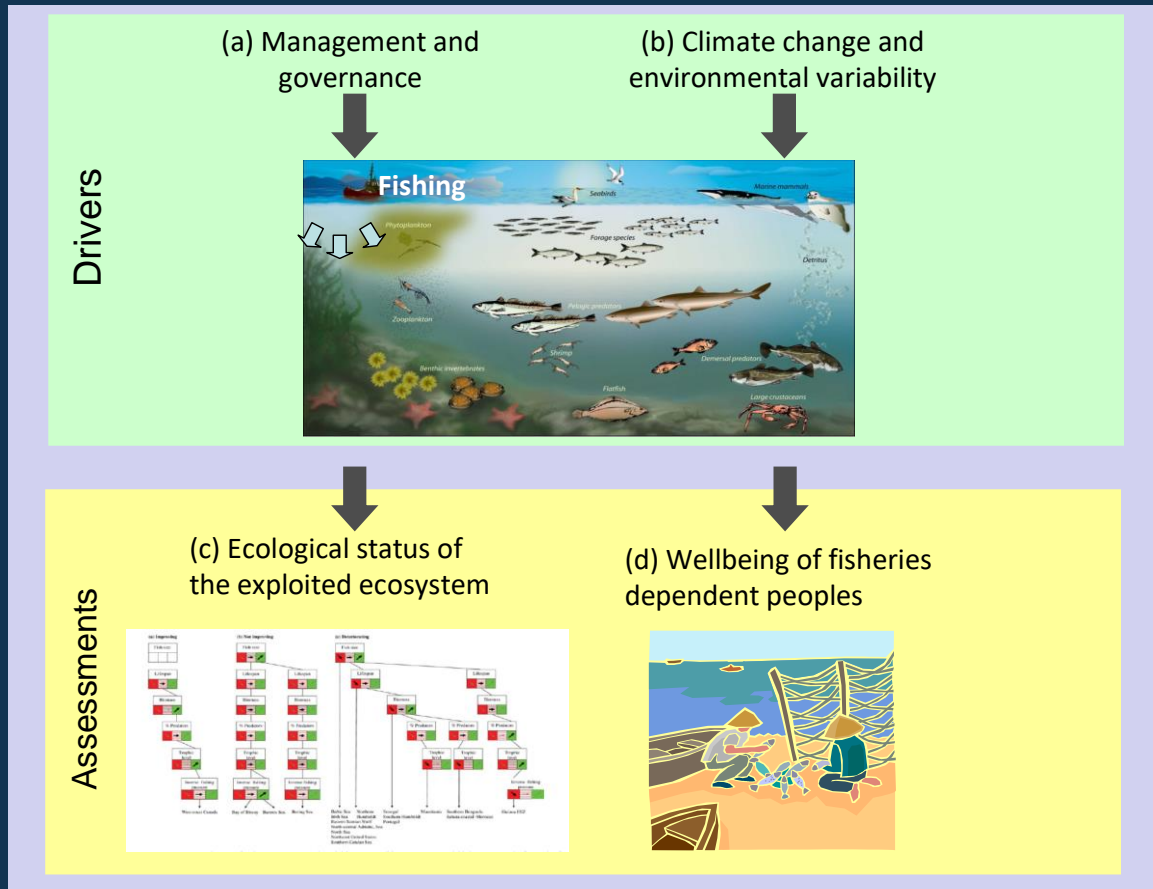
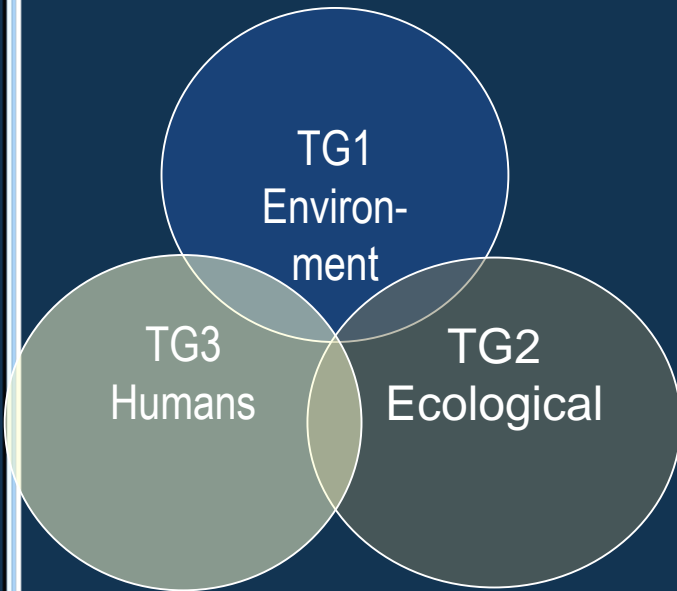
Shin et al. 2010. ICES Journal of Marine Science

Shin et al. 2012. Reviews in Fish Biology and Fisheries

# Integration of indicators

Global assessments of the status of marine exploited ecosystems and their management: what more is needed? Bundy et al. 2012

Different dimensions of the physical-ecological-human system



# IndiSeas1: Ecological Indicators

<u>Indicator</u>	<u>Headline label</u>	<u>Data source</u>	<u>State/Trend</u>
Mean length	<b>Fish size</b>	research surveys	S, T
Trophic level of landed catch	<b>TL</b>	recorded landings	S, T
Proportion under/moderately exploited species	<b>% healthy stocks</b>	FAO list + local expertise	S
Proportion predatory fish	<b>% predators</b>	research surveys	S,T
Mean life span	<b>Lifespan</b>	research surveys	S,T
1/CV Biomass	<b>Biomass stability</b>	research surveys	S
Biomass of surveyed species	<b>Biomass</b>	research surveys	T
1/(landings/Biomass)	<b>Inverse fishing pressure</b>	recorded landings; research surveys	T

Calculation of indicators with **standardized procedures**

**Current states S** (2008-20010) and **longer/recent trends T** (1980-2010 and 2001-2010)

All indicators assumed to **decrease with increasing fishing pressure**



# Additional Biodiversity & conservation-based indicators

New indicator

What it measures

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Flagship species

Change in relative abundance/B of a commercial & non-commercial flagship species

Mean intrinsic vulnerability index of fish catch

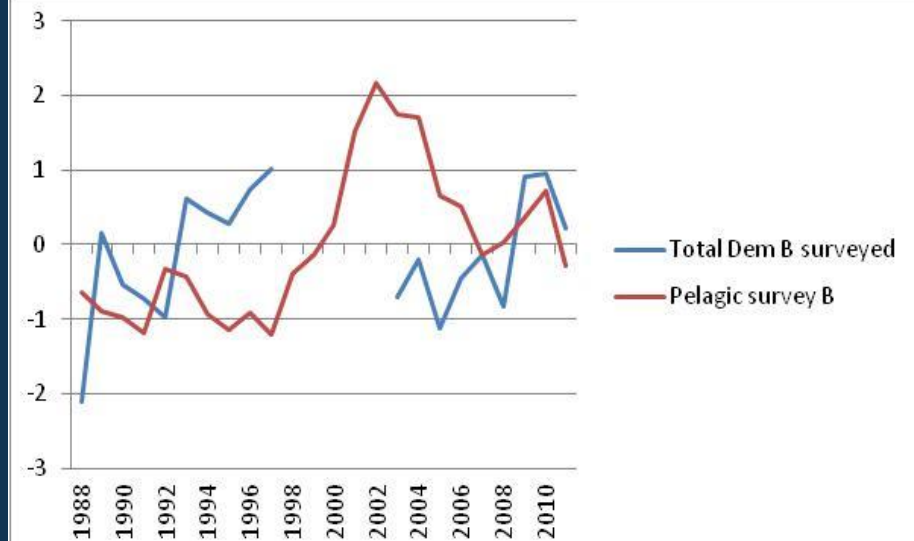
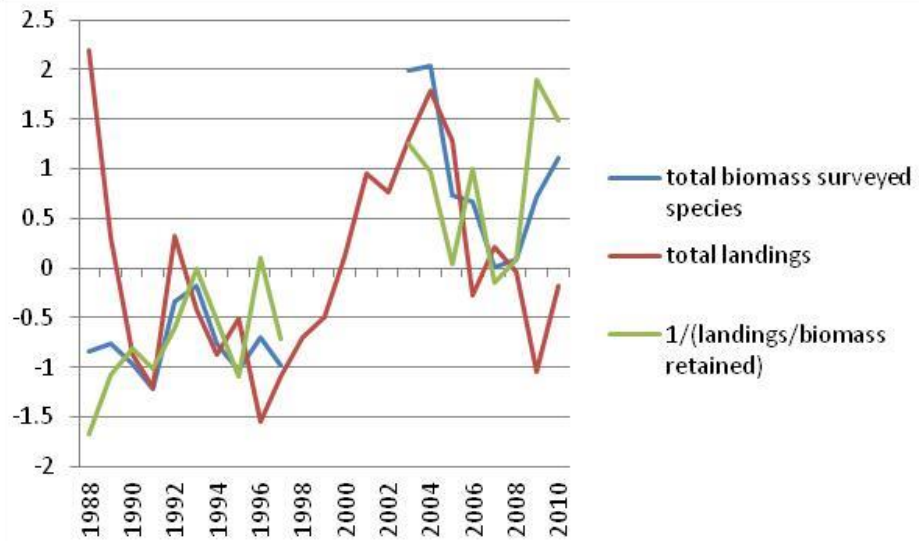
Vulnerability of fish caught, based on life history traits and ecological characteristics of individual species (Cheung et al. 2007)

Proportion of exploited species with declining biomass

Estimates what proportion of exploited species shows a declining trend over time

# TG2 - Biodiversity & conservation-based indicators (continued)

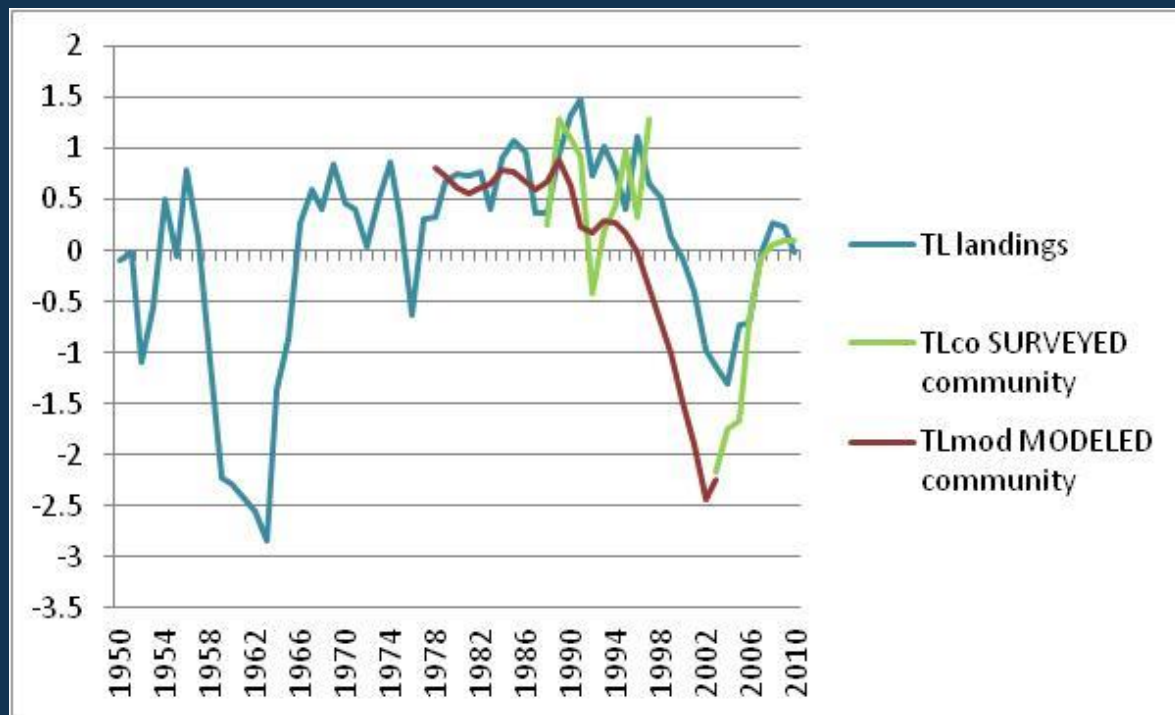
New indicator	What it measures
MTI	Mean trophic level of landed catch of organisms at TLs $\geq 3.25$
TL community	Mean TL of the surveyed community
Discards*	% discarded catch over total catch in recent years



Biomass of pelagic&demersal fish higher in 2000s cf. 1980s&1990s

Landings fluctuate but lower in late 2000s cf. Late1980s

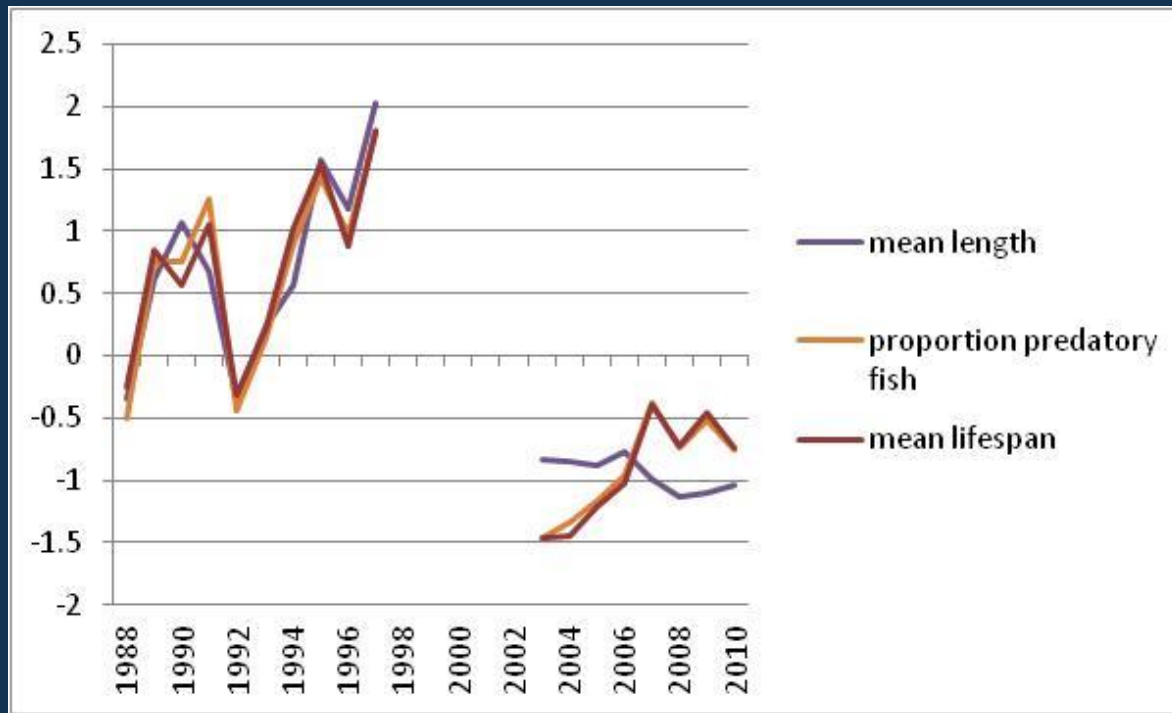
- small pelagic fish increased in importance
- predatory fish decreased (see later),especially snoek, hake, demersal fish & chondrichthyans



$TL_{model}$  closely reflects trends in  $TL_{catch}$  and  $TL_{surveys}$

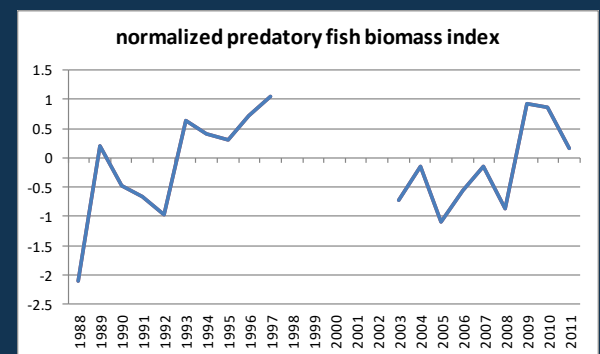
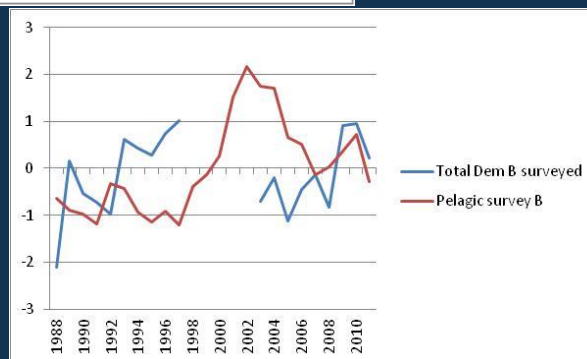
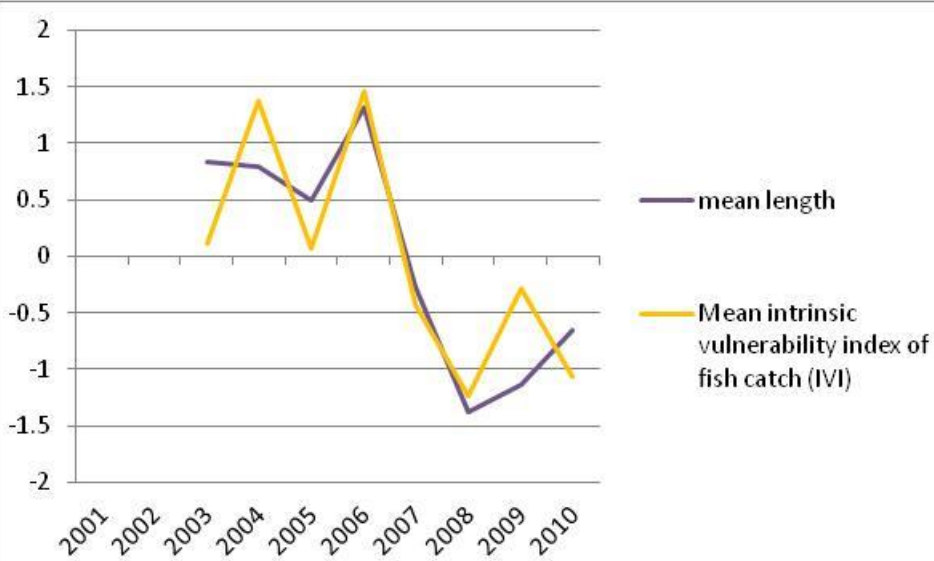
High catches of sardine in early 1960s reflected as noticeable dip in  $TL_{catch}$

All TL indicators tracked increase in abundance of small pelagic fish in early 2000s and subsequent “return to normal” abundance levels coupled with the start in recovery of several line fish stocks in recent years



Mean length, proportion of predatory fish in pelagic&demersal surveys, & mean lifespan of fish in pelagic & demersal surveys have all declined.

Despite proportion of predatory fish and mean life span in surveyed species increasing again by the late 2000s when pelagic fish returned to more ave. levels, these indicators still lower than previous 2 decades

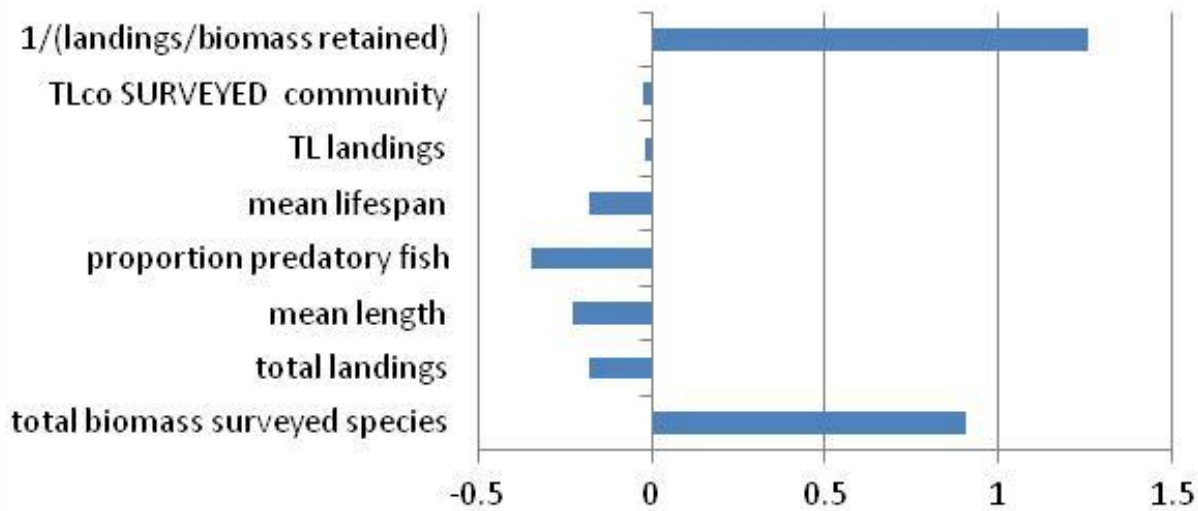


IVI & mean length not merely reflecting trends in small pelagics

- they remain at low levels well after temporary upsurge in small pelagics in early 2000s.

Neither do they correspond to what may be expected from the increasing trend in survey biomass of demersal fish, or of predatory fish biomass in demersal surveys over the last decade.

## relative change in state (late 80s-late 2000s)



### In the period 2004-2010:

Inverse fishing pressure was increasing (good),

TL surveys and landings increased

Mean lifespan (surveyed fish) increased

% Predators in surveys increased

Fish size (surveyed fish) decreased

landings declined

Biomass decreased

# Summary: Southern Benguela

Ecological indicators may be suggesting deterioration of ecosystem state in recent years e.g. mean length of fish in demersal&pelagic surveys strongly declined which may be cause for concern

However, mixed signals e.g. fishing pressure lightened late 80s to 2010,

and from 2003, IVI strongly declined , reflecting less fishing on ecologically sensitive species (possibly due to removal of vulnerable spp. by historical fishing).

Thus we might rather conclude that the system is not improving and that fishing patterns and signals from ecological indicators need careful monitoring