marbec

MARINE BIODIVERSITY EXPLOITATION & CONSERVATION

POPULATION CHANGES IN SMALL PELAGIC FISH OF THE GULF OF LIONS: A BOTTOM-UP CONTROL?

C Saraux, E Van Beveren, P Brosset, S Bonhommeau, JM Fromentin

Small pelagics symposium 08/03/2016

IRD Institut de recherche pour le développement

Ifremer

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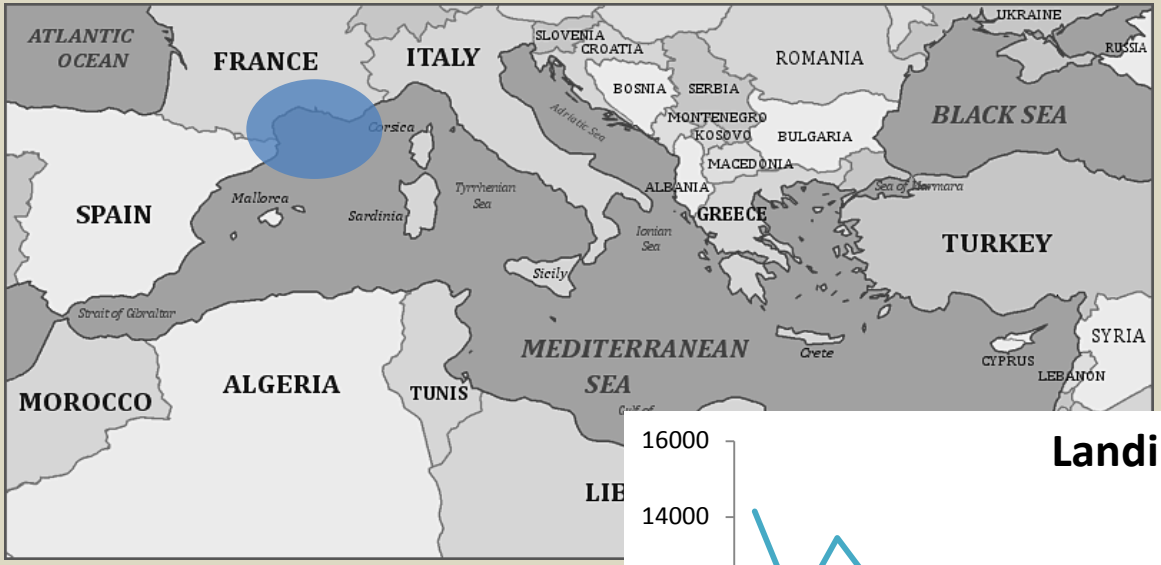
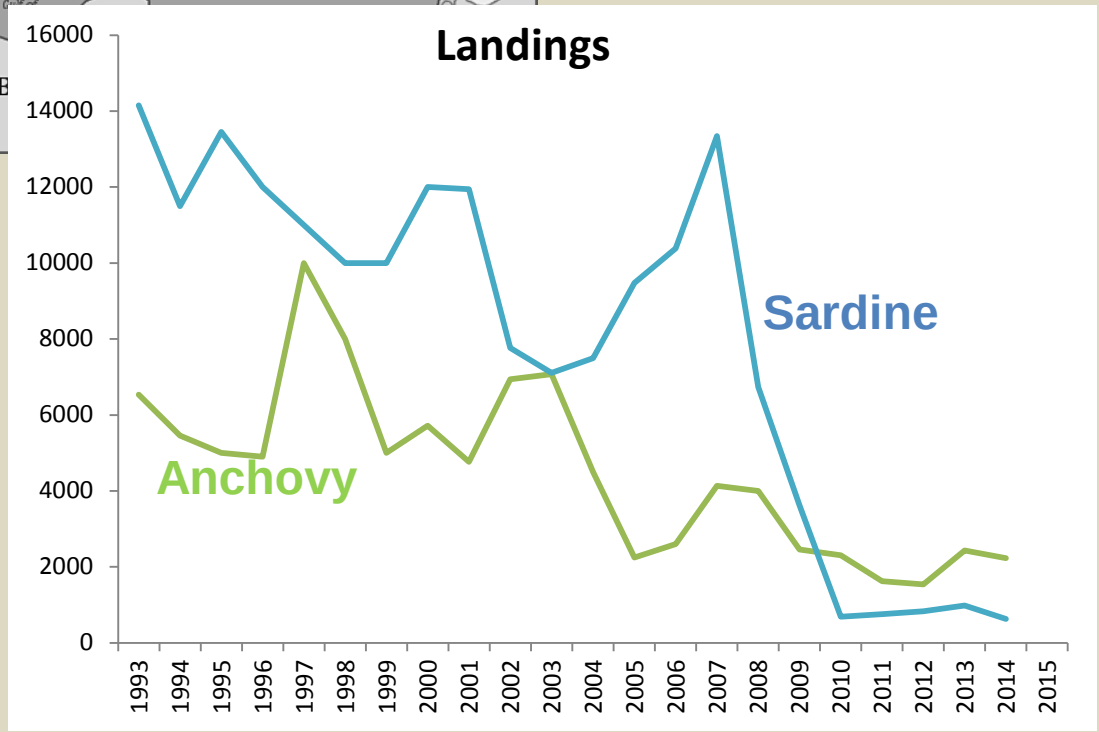
Background:





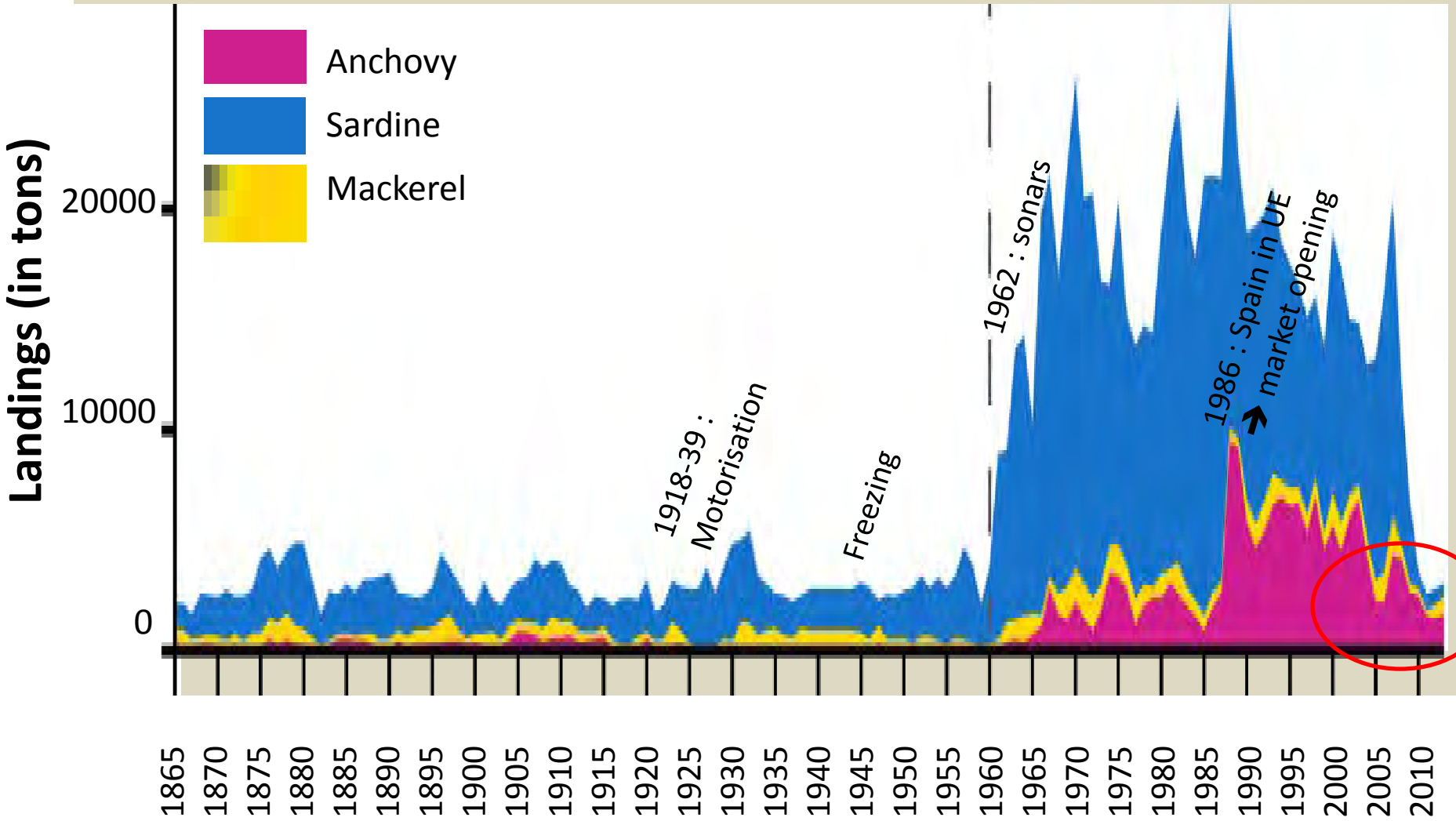
➔ Crash in landings

Background:

Historical landings 1865-2013:

Present level lower than before 1960 → unusual situation

Van Beveren et al 2016



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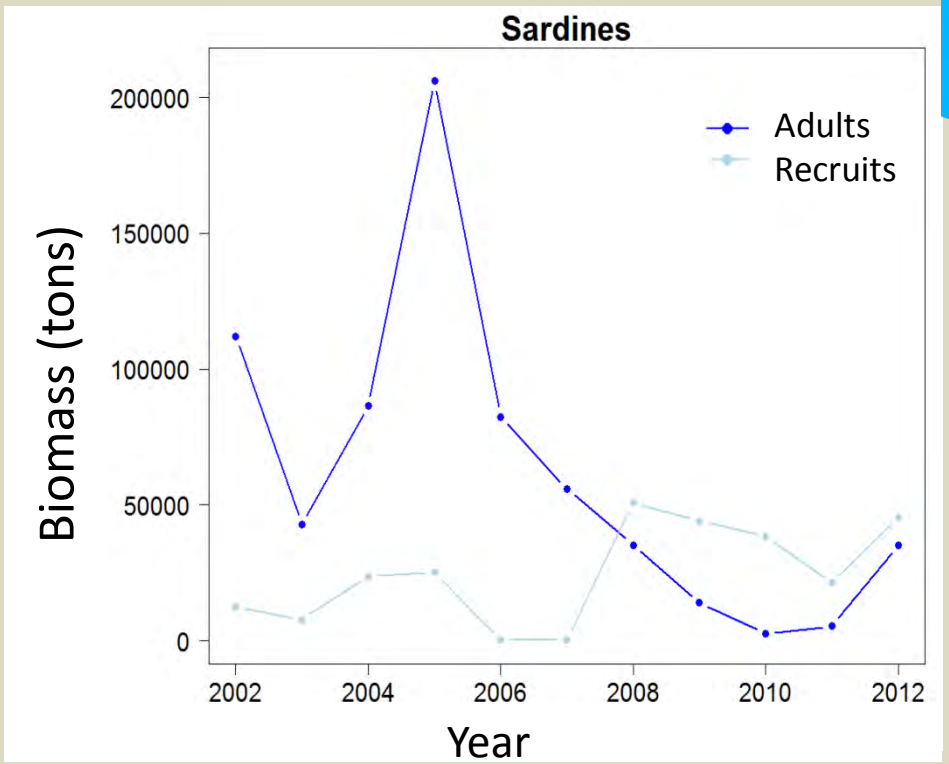
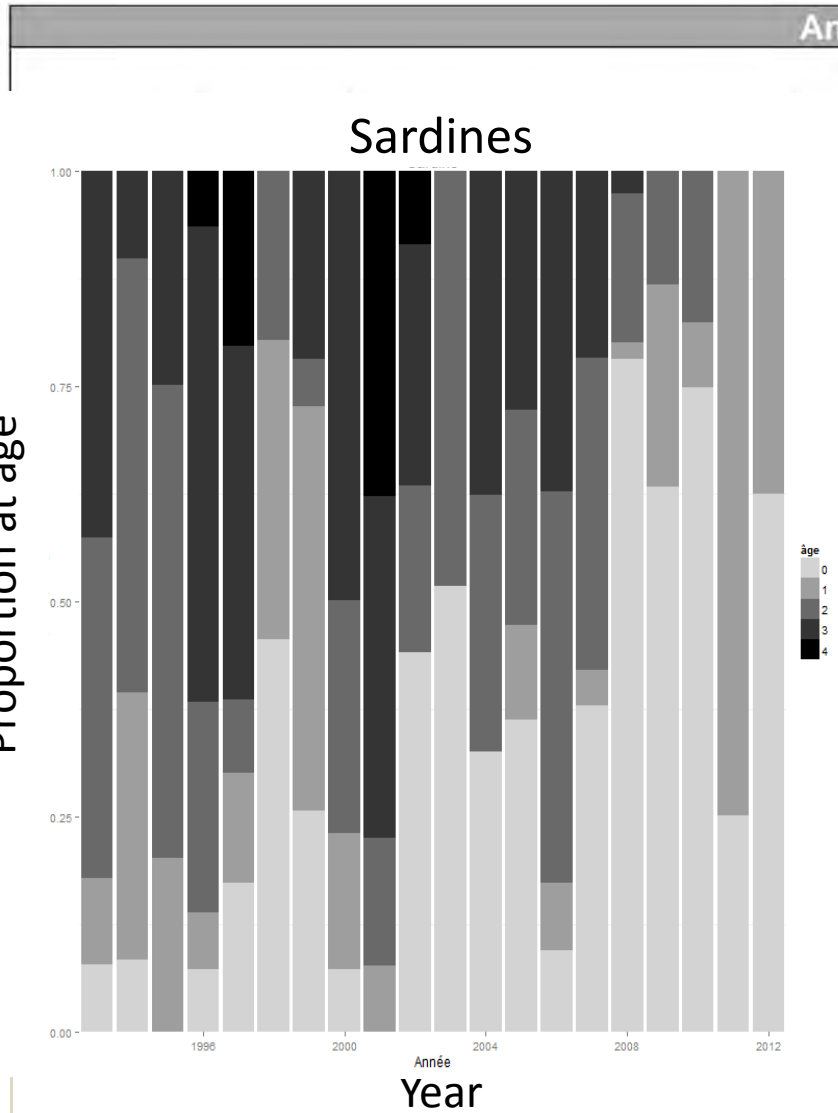


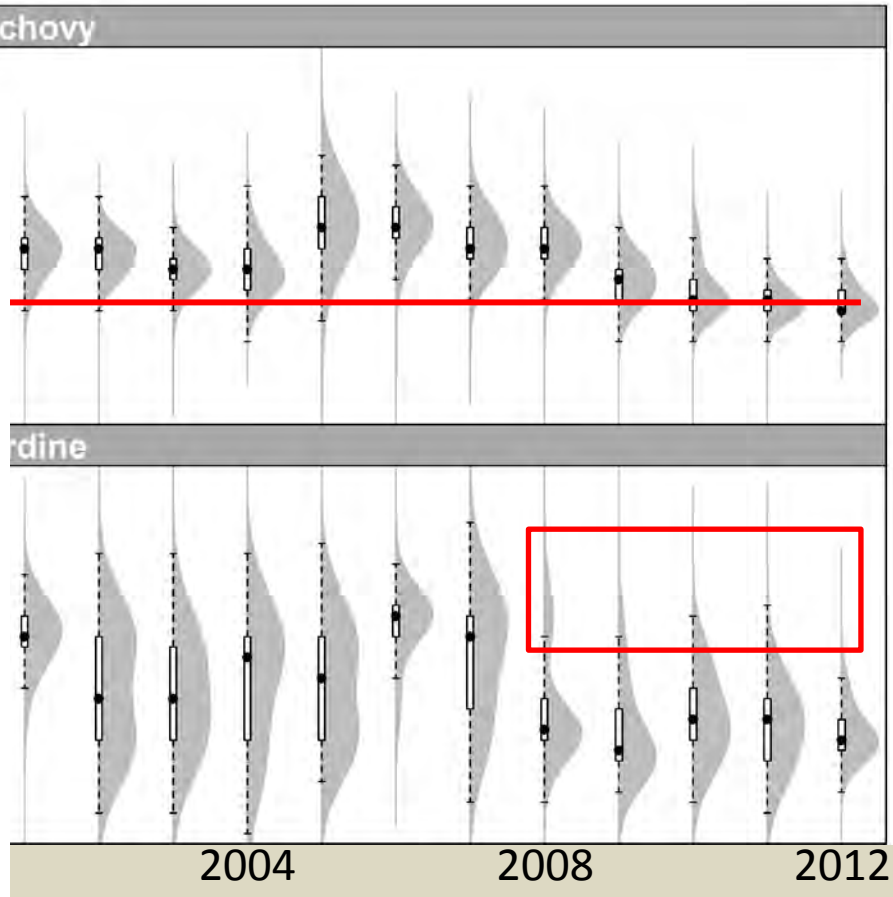
- Good recruitments
  ?????

ECOPELGOL
Project 2012-2015.

1. Changes in populations



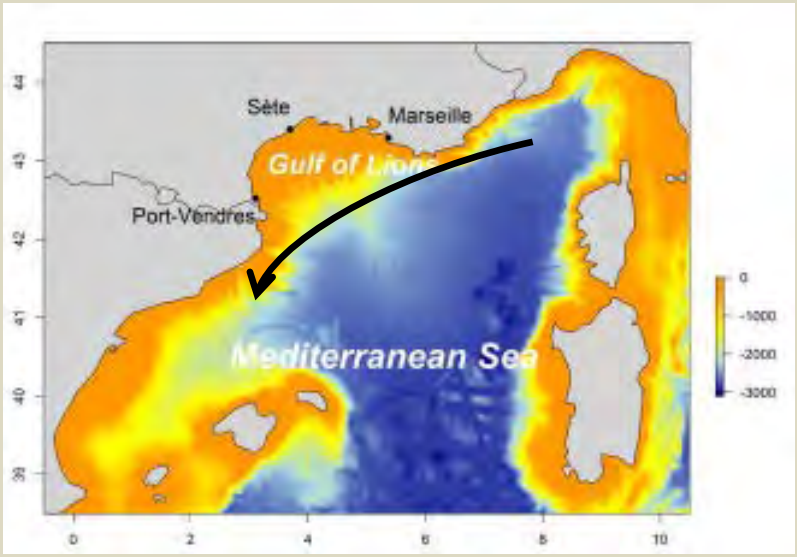
Size (cm)



Smaller fish
Disappearance of large old sardines

Van Beveren et al. 2014

Emigration or mortality?

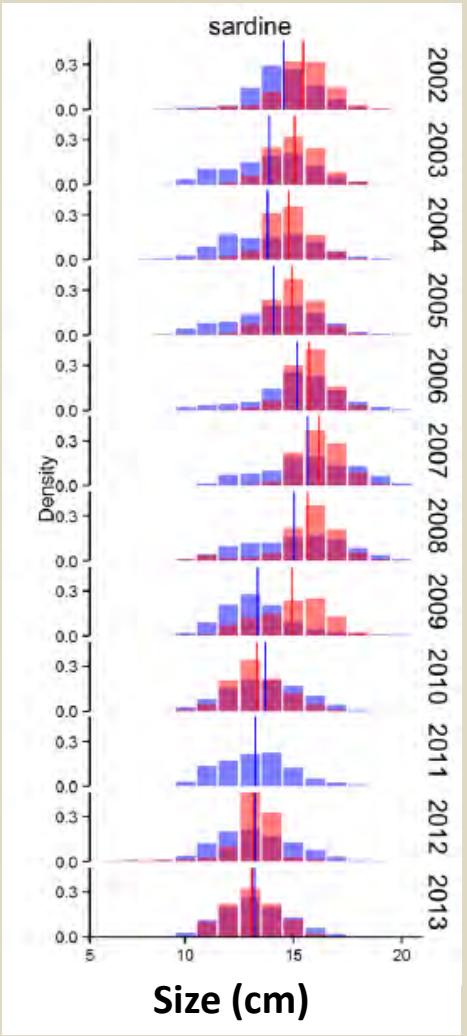


Most likely migration: towards Spain

Size distribution of French vs. Spanish landings:

➔ No appearance of large individuals in Spain

➔ Very similar distribution

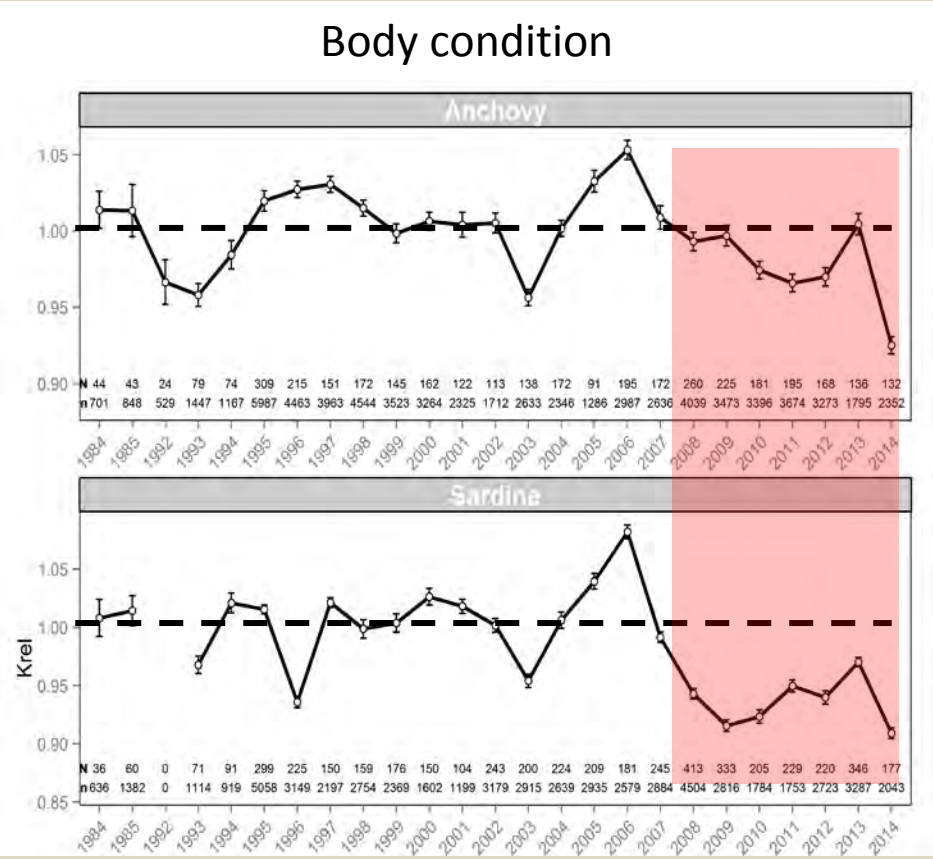


❖ **Mortality**

❖ **Problem occuring at a larger scale**

1. Changes in populations

Body condition



Body condition

= quantity of nutritional reserves

➔ proxy of available energy

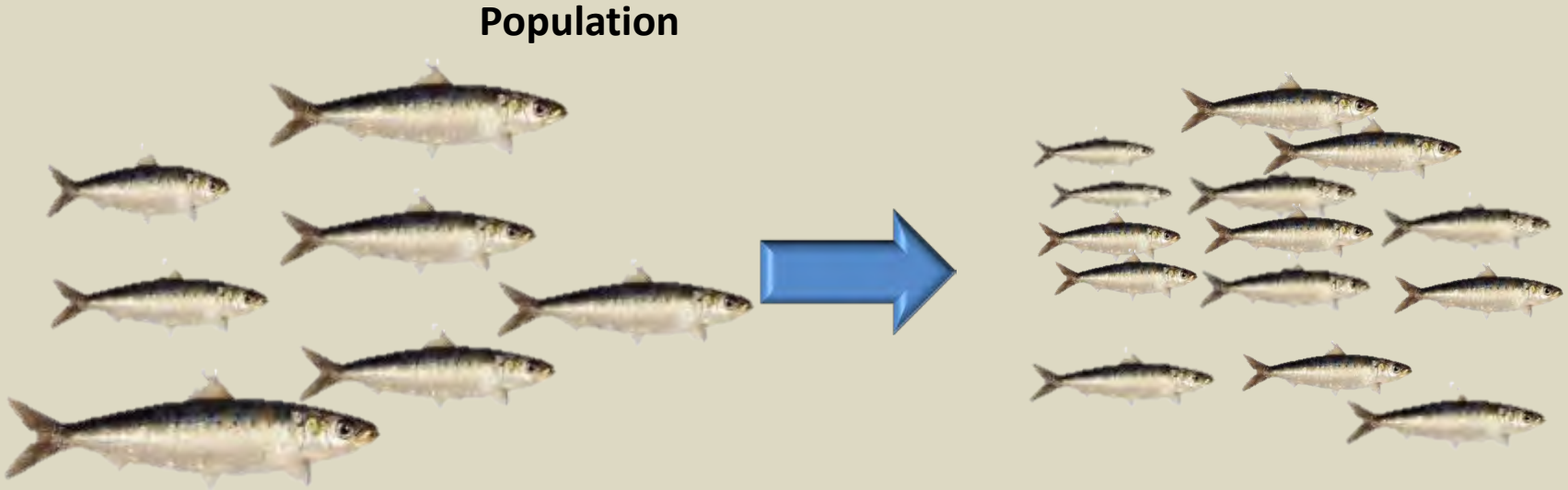
Estimated here by morphometrics
LeCren index

Decrease in condition higher in old individuals ➔ lower survival?

Van Beveren et al. 2014

Brosset et al 2015

1. Changes in populations



- More abundant
- Smaller (low growth & disappearance of older sardines)
- Leaner

Van Beveren et al. 2014

Main goals:

PREDATORS

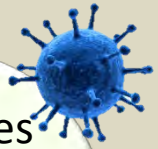
Predation by tuna or marine mammals

Fisheries effect

Top-Down

SMALL PELAGICS

Diseases

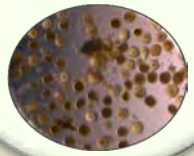


- ✓ Virus
- ✓ Bacteries
- ✓ Parasites

Population characteristics

- ✓ Size
- ✓ Age
- ✓ Condition
- ✓ Growth

Trade-off with reproduction



Bottom-Up

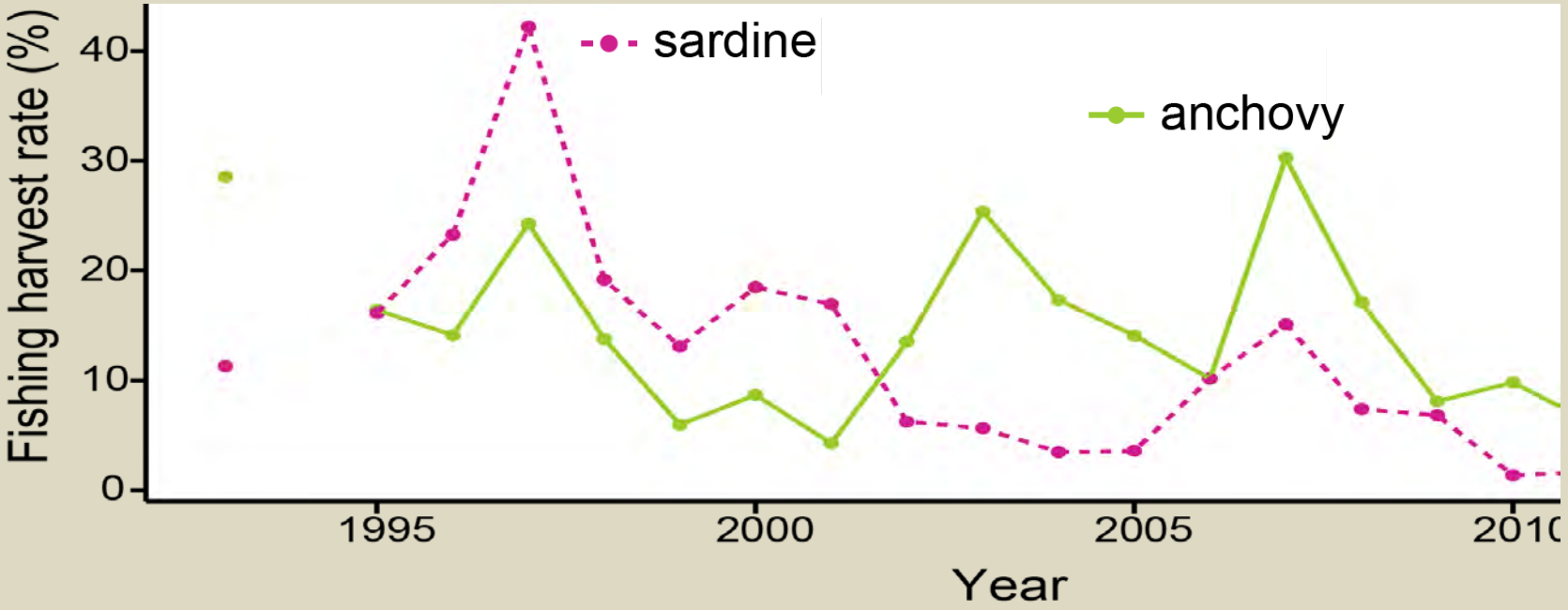
PREY

Climate and Plankton effect

2. Top-down processes?

a) Fisheries?

Low exploitation rate



Low size selectivity

No temporal covariation between fishing pressure and fish biomass

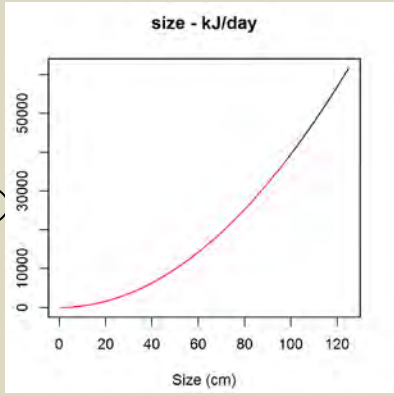
Fisheries effect probably low

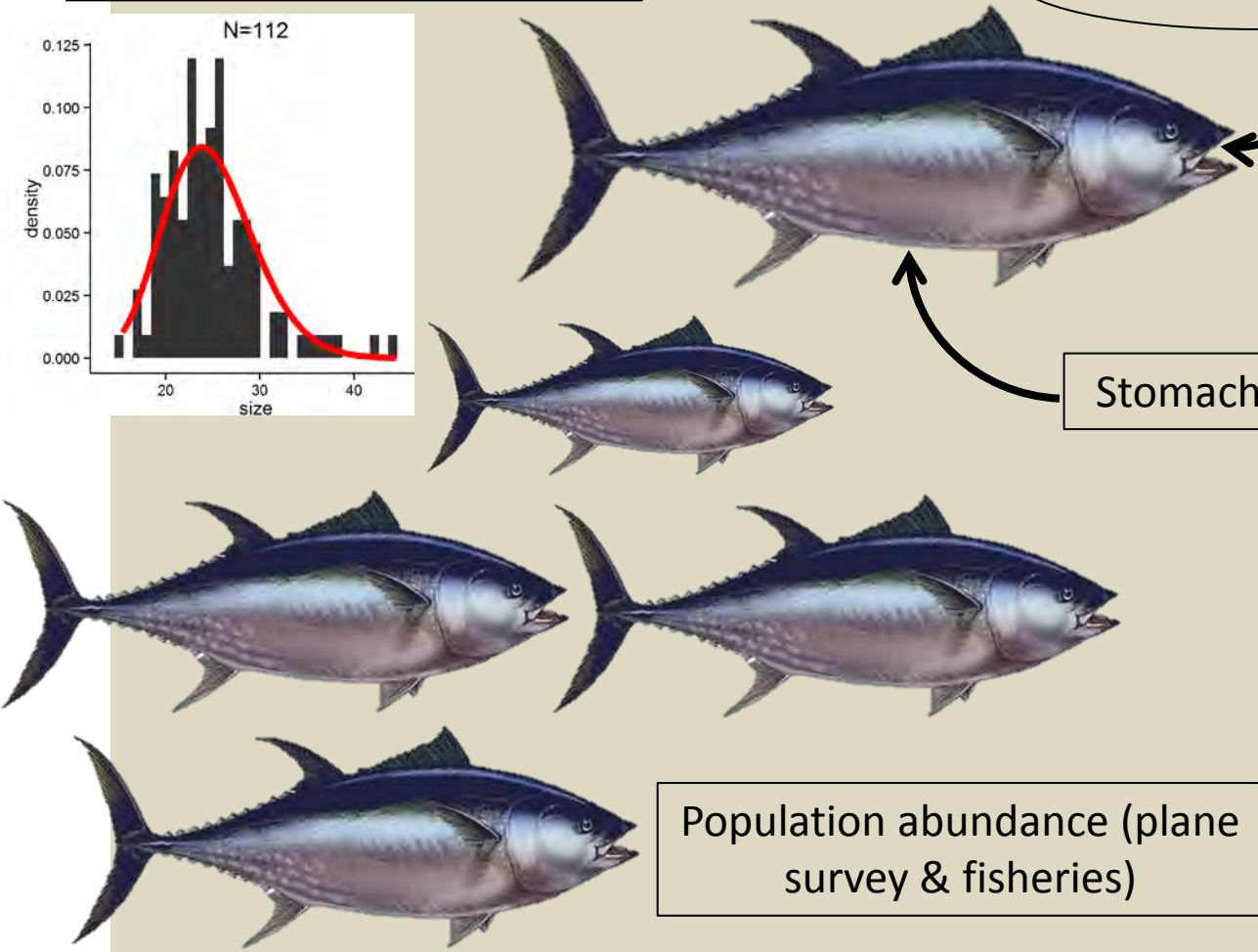
2. Top-down processes?

b) Predation by tuna?

Size distribution of the tuna pop (fisheries)

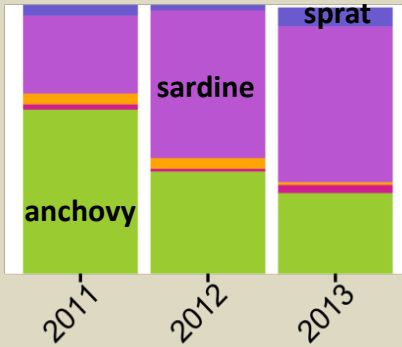
DEB ➔ Calories



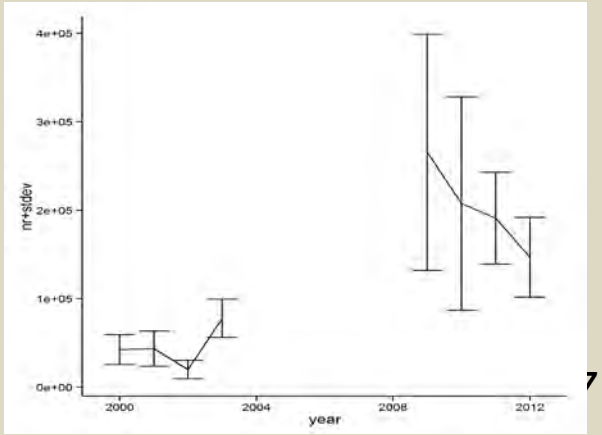


Stomach contents

%M

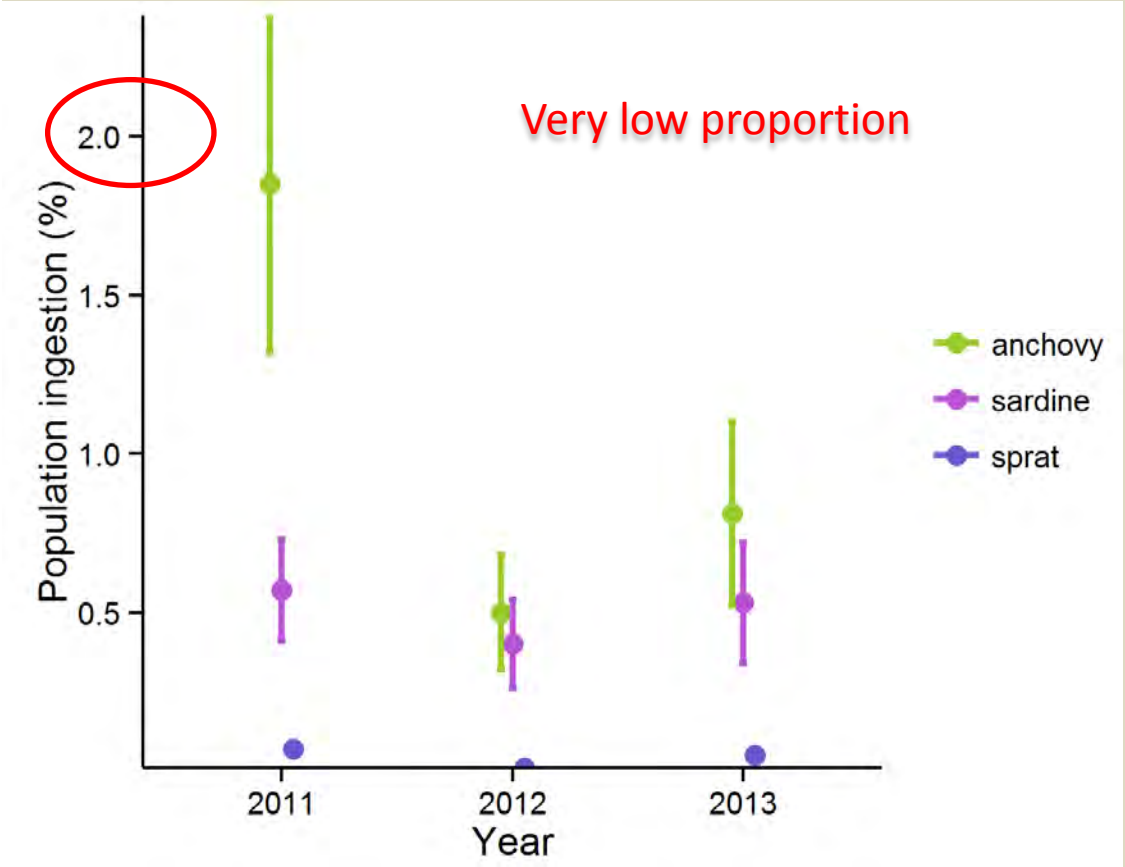


Population abundance (plane survey & fisheries)



2. Top-down processes?

b) Predation by tuna?



Oppurtinistic, no size-selectivity

Similar approach on doplhins predation

- Plane and boat survey -> dolphin abundance
- Stomach content
- Simple allometric energetic model

Lot of simulations

➔ Population ingested even lower

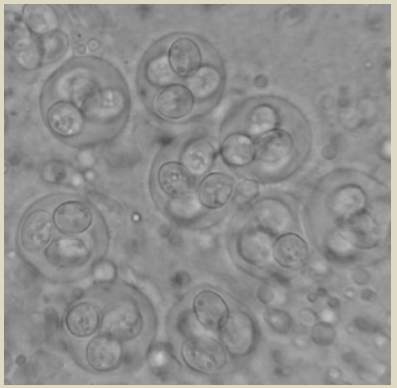
Predation pressure very low

Van Beveren et al. 2017
Queiros et al. in prep

3. Pathogens and diseases?

1 year monthly sampling (2014-2015):

1) Fresh samples from fisheries (9 * 150 sardines)
2) Large band search (bacteria, parasites & virus)
3) Tissue analyses (autopsy et histology)



Results :

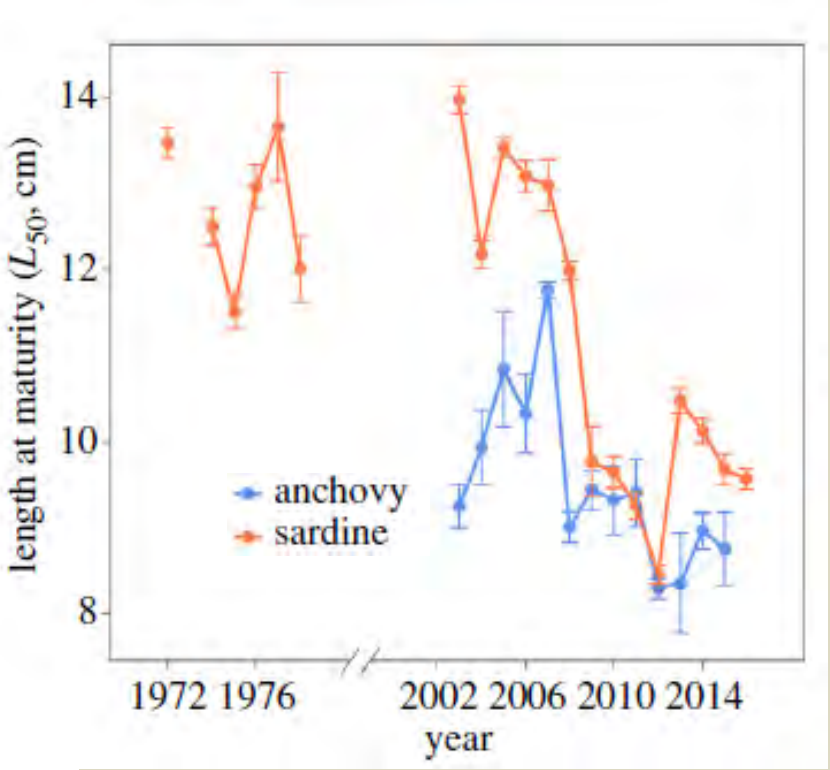
- No macro-parasites
- No virus: whether on culture or by specific PCR (NODA & herpes)
- Very low prevalence of lesions on tissues
- Presence of few bacteries
- Micro-parasites (Prevalence = 77%) ➔ unidentified or coccidies in the liver

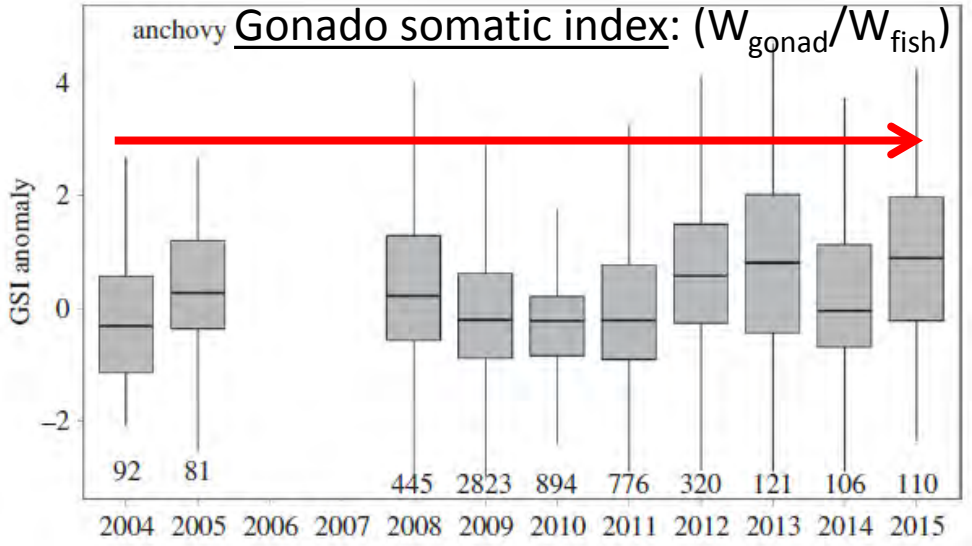
Few pathogens, no correlation with fish size or condition and very few lesions. Only micro-parasites.

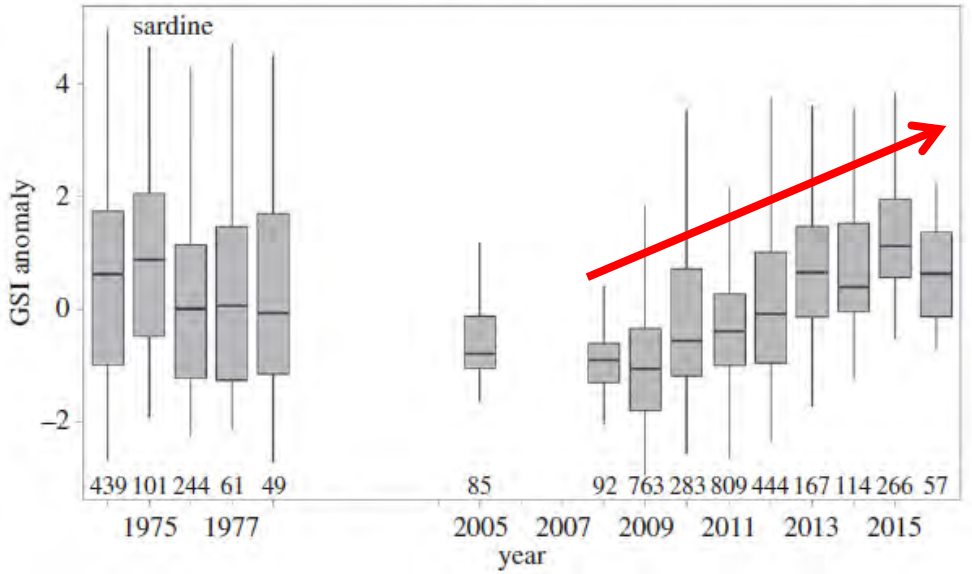
Comparison with other places ➔ Anyone interested???

Van Beveren et al. 2016

4. Trade-off maintenance / reproduction







- Start reproducing earlier
- Maintain investment

Increase in reproductive effort despite low condition.
At the expense of survival?

5. Bottom-up processes

Change in diet?

$$\delta^{13}C_{Sample} = \left\{ \frac{\left(\frac{^{13}C}{^{12}C}\right)_{Sample}}{\left(\frac{^{13}C}{^{12}C}\right)_{Reference}} - 1 \right\} * 1000$$

Stable Isotopes

Stomach contents

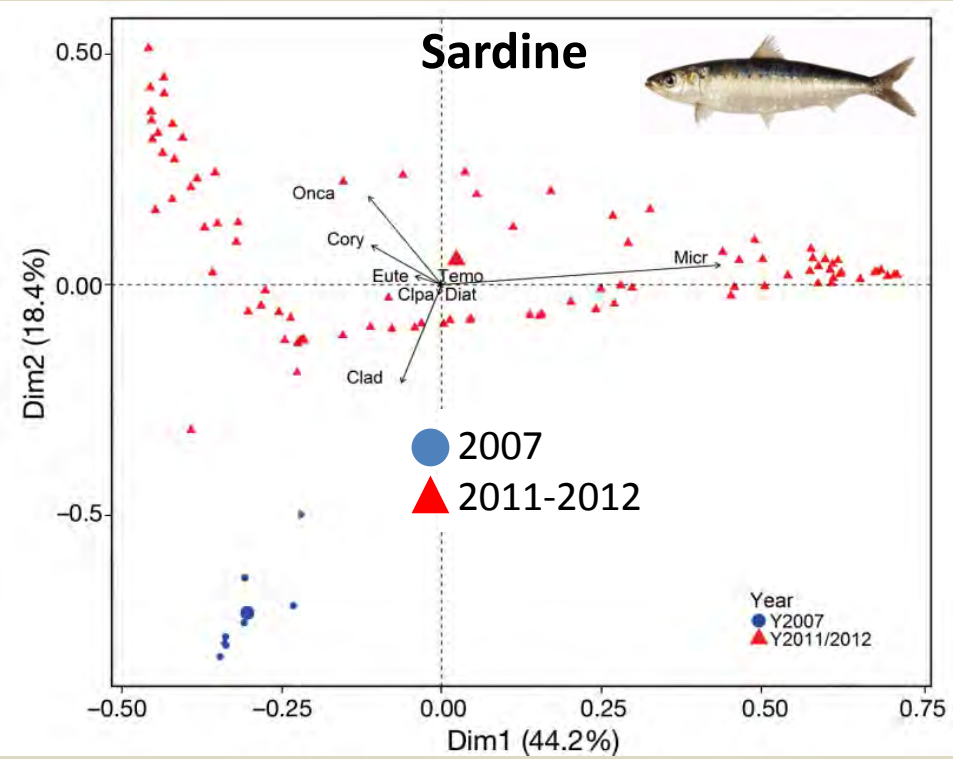
Brosset et al. 2015
Brosset et al. 2016

5. Bottom-up processes

Stable isotopes

- Smaller isotopic niche, lower δC value
- Higher overlap with sprat ➔ competition?

Stomach contents: after 2010 vs. past



Segregated by period

- Sardines: ➔ fewer cladocerans.
- Anchovy: ➔ smaller copepodes.

Changes in diet: smaller, less energetic prey

Brosset et al. 2016

Summary

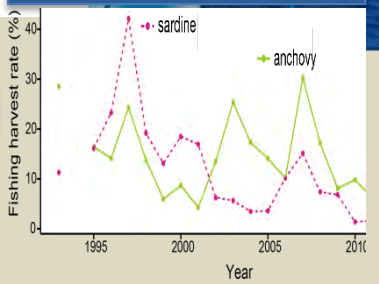
PREDATORS

Stomach contents, energetic models, population census

Predation by tuna or marine mammals

Fisheries effect

Harvest rate



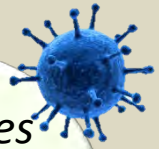
Top-Down

SMALL PELAGICS

Bottom-Up

PREY

Diseases

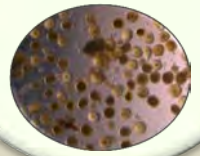


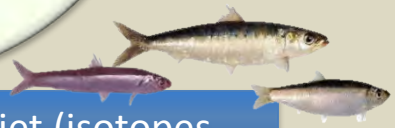
- ✓ *Virus*
- ✓ *Bacteries*
- ✓ *Parasites*

Population characteristics

- ✓ Size
- ✓ Age
- ✓ Condition
- ✓ Growth

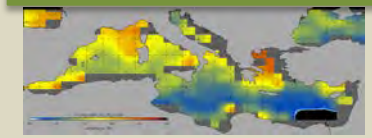
Trade-off with reproduction





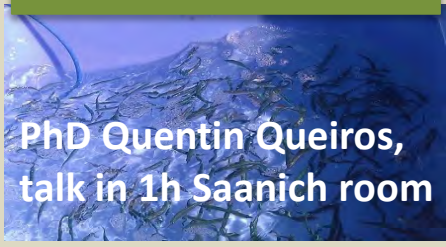
Diet (isotopes, stomach contents)

In situ & modelled plankton fields



Plankton effect

Experiments



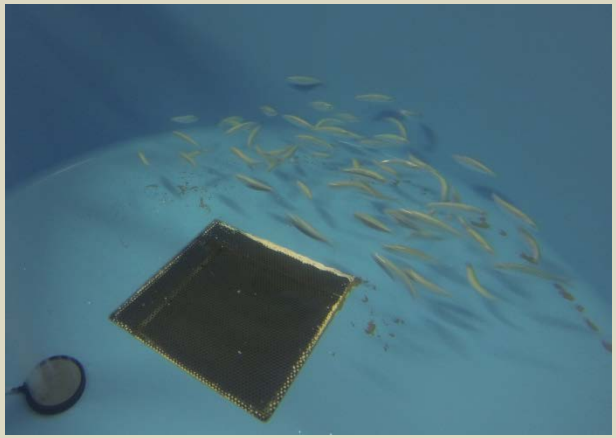
Thanks to…

Elisabeth Van Beveren

Pablo Brosset

FRANCE FILIERE PECHE

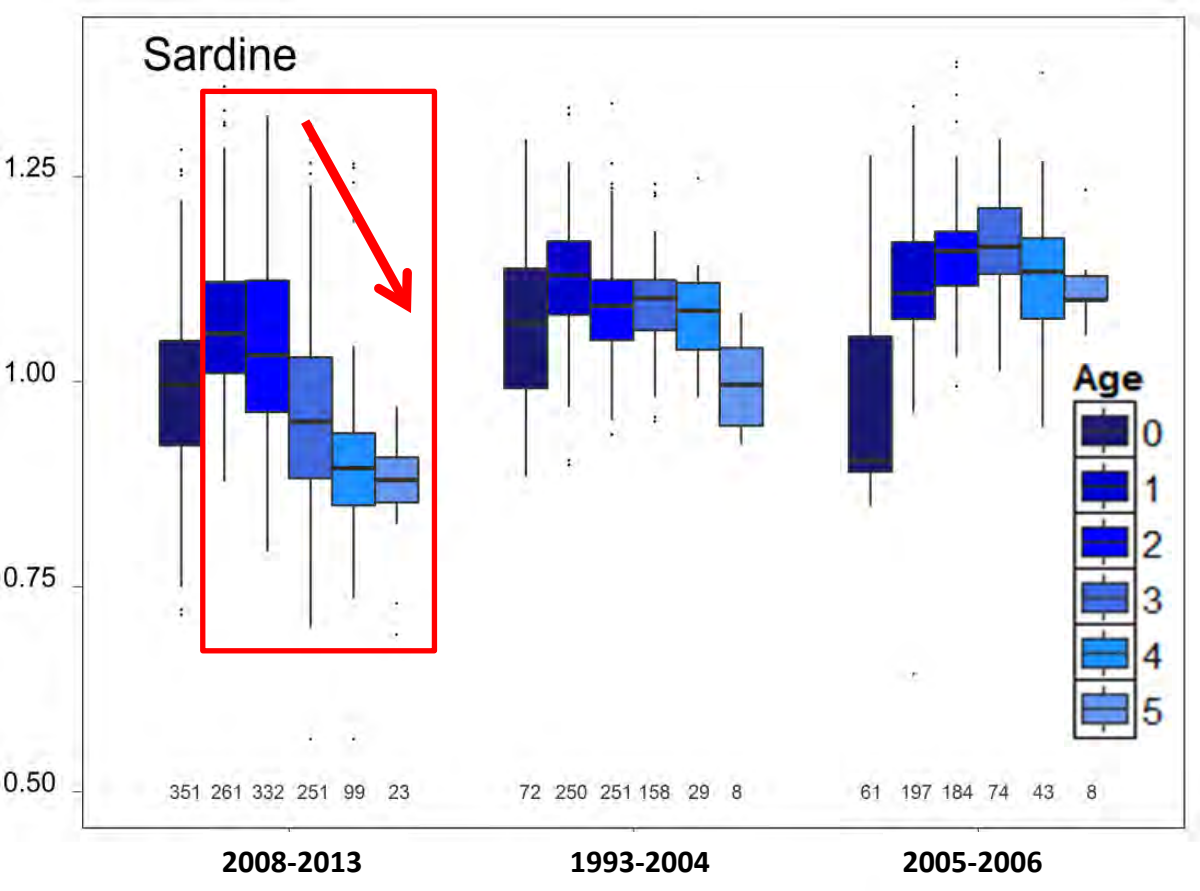
LANGUEDOC-ROUSSILLON
LA RÉGION MIDI-PYRÉNÉES



You!

1. Changes in populations

Link between condition and age



Decrease in condition higher in old individuals ➔ lower survival?

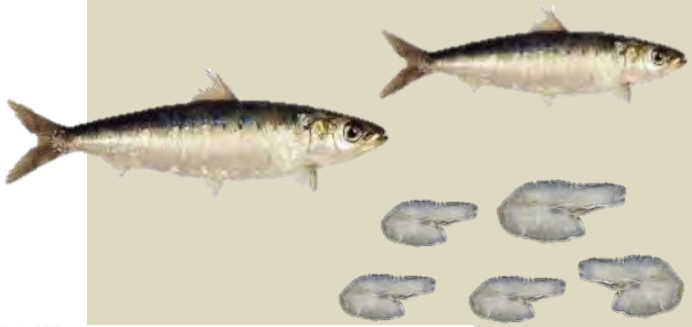
Brosset et al 2015

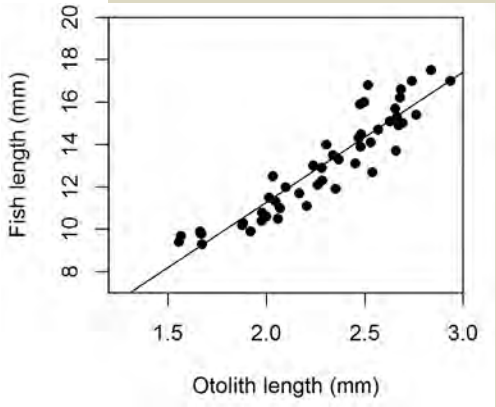
3. Top-down processes?

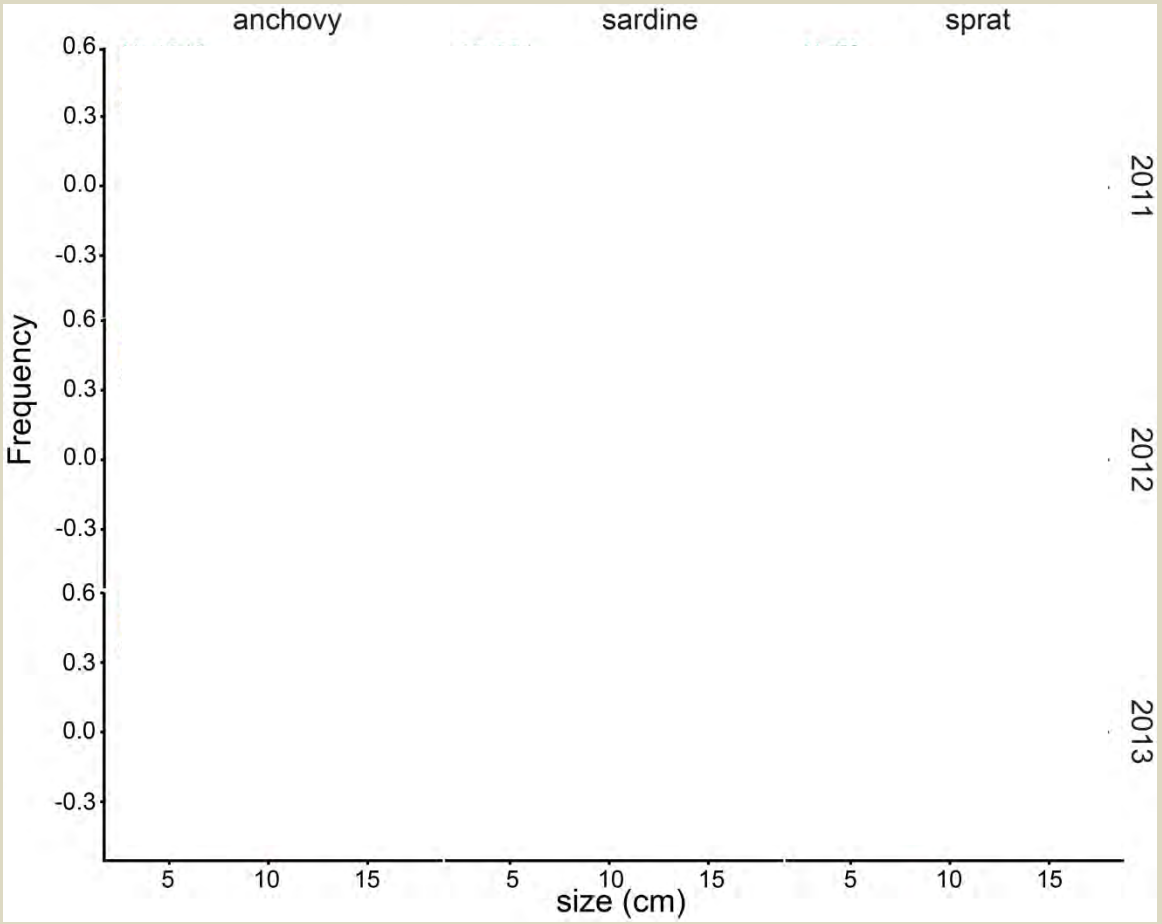
b) Predation by tuna?

On size distribution

Stomach contents







Opportunistic, no size selectivity

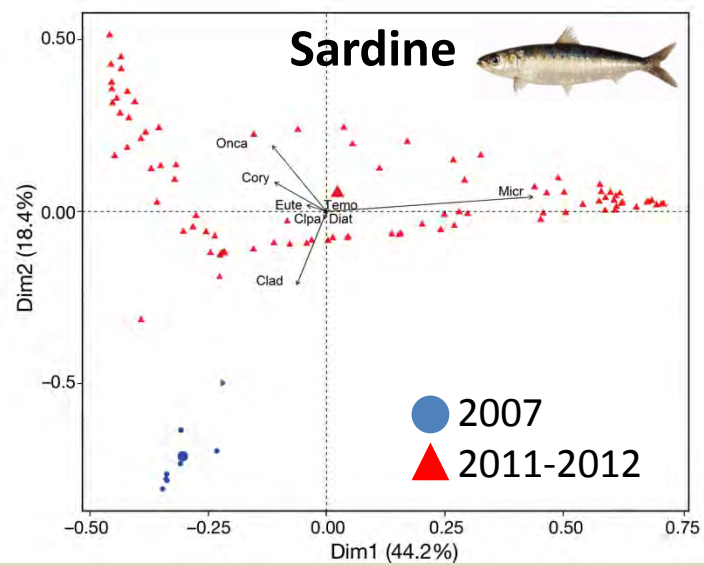
Van Beveren et al. 2017

5. Bottom-up processes

Stable isotopes

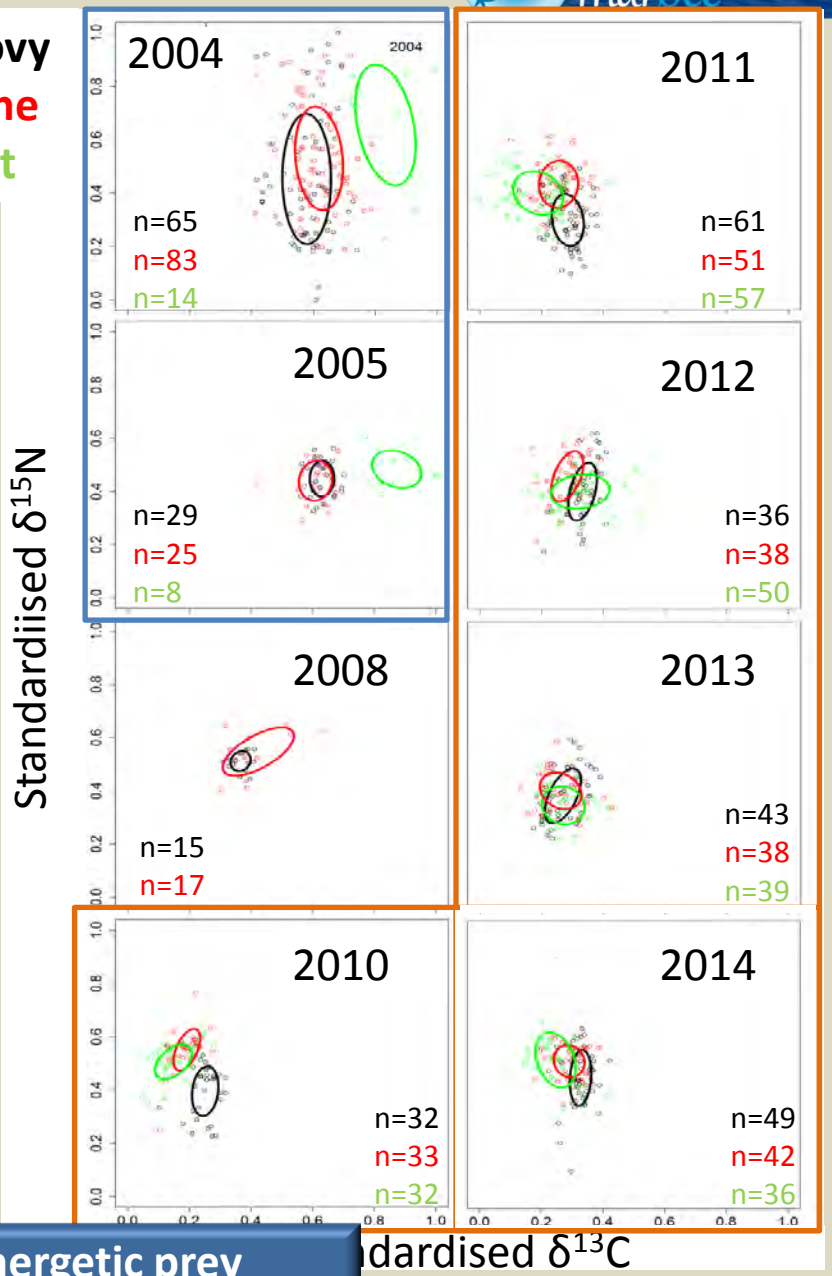
- Smaller isotopic niche, lower δC value
- Higher overlap with sprat ➔ competition?

Stomach contents: after 2010 vs. past



- Sardines: ➔ fewer cladocerans.
- Anchovy: ➔ smaller copepodes.

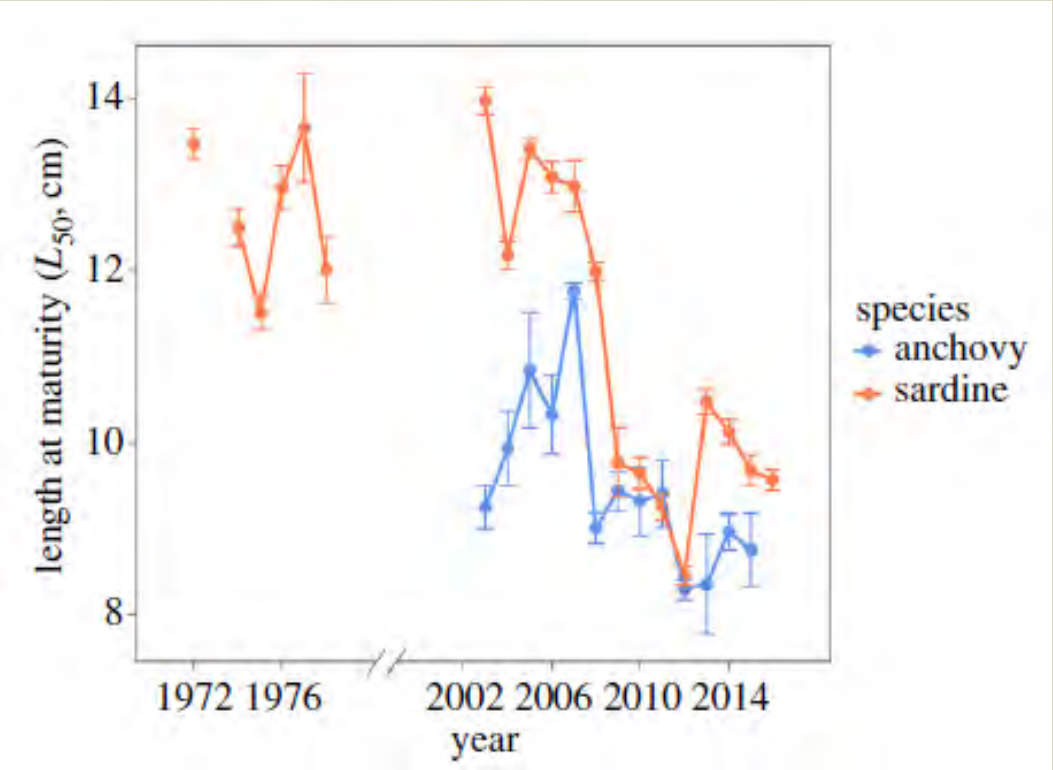
Anchovy
Sardine
Sprat



Changes in diet: smaller, less energetic prey

Brosset et al. 2016

4. Trade-off maintenance / reproduction



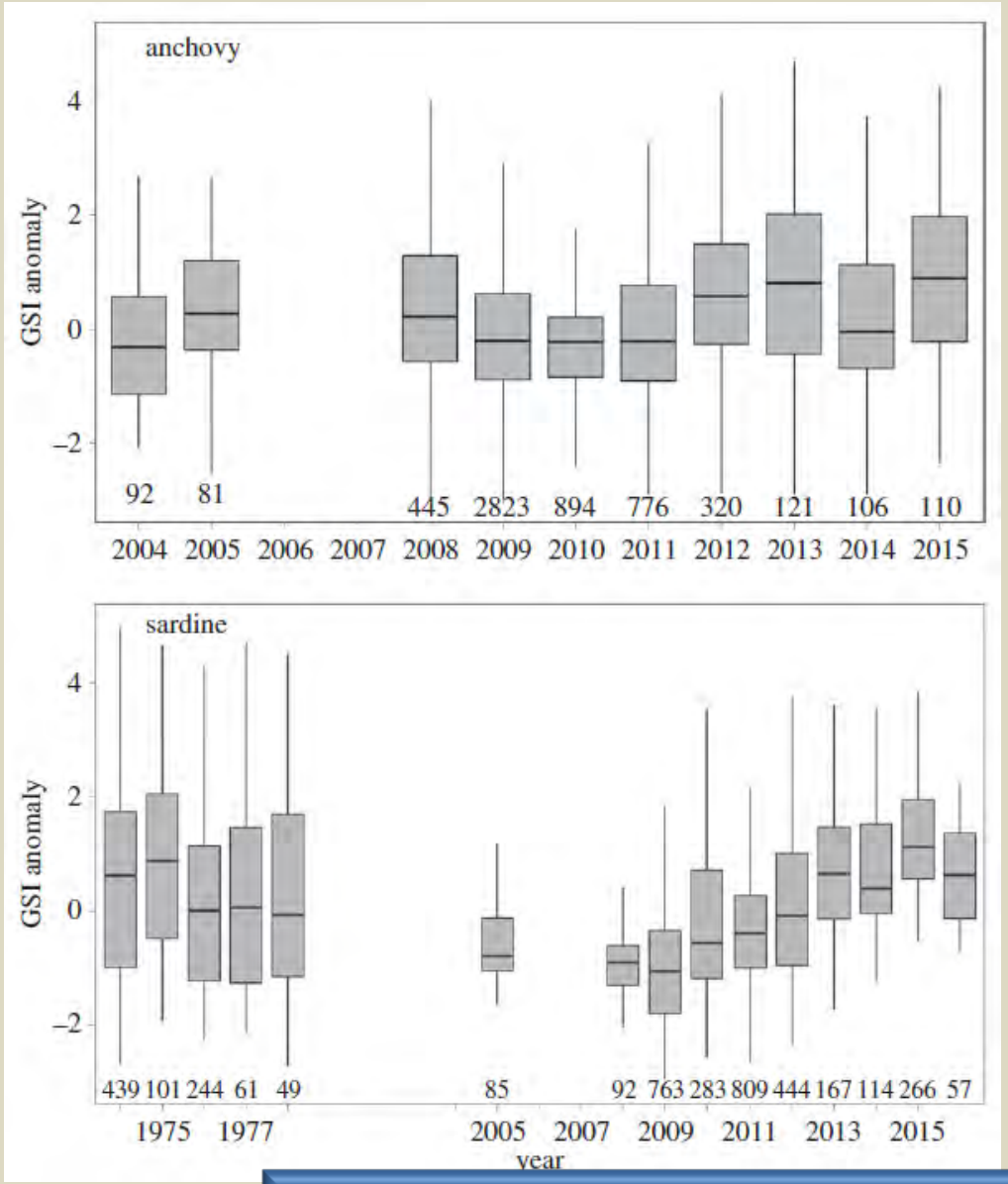
Size at first maturity:

- Sardine: 9/10cm now *vs*. 13cm in the past
- Anchovies: 9cm now *vs*. 11cm in the past

Start reproducing much earlier

Brosset et al. 2016

4. Trade-off maintenance / reproduction

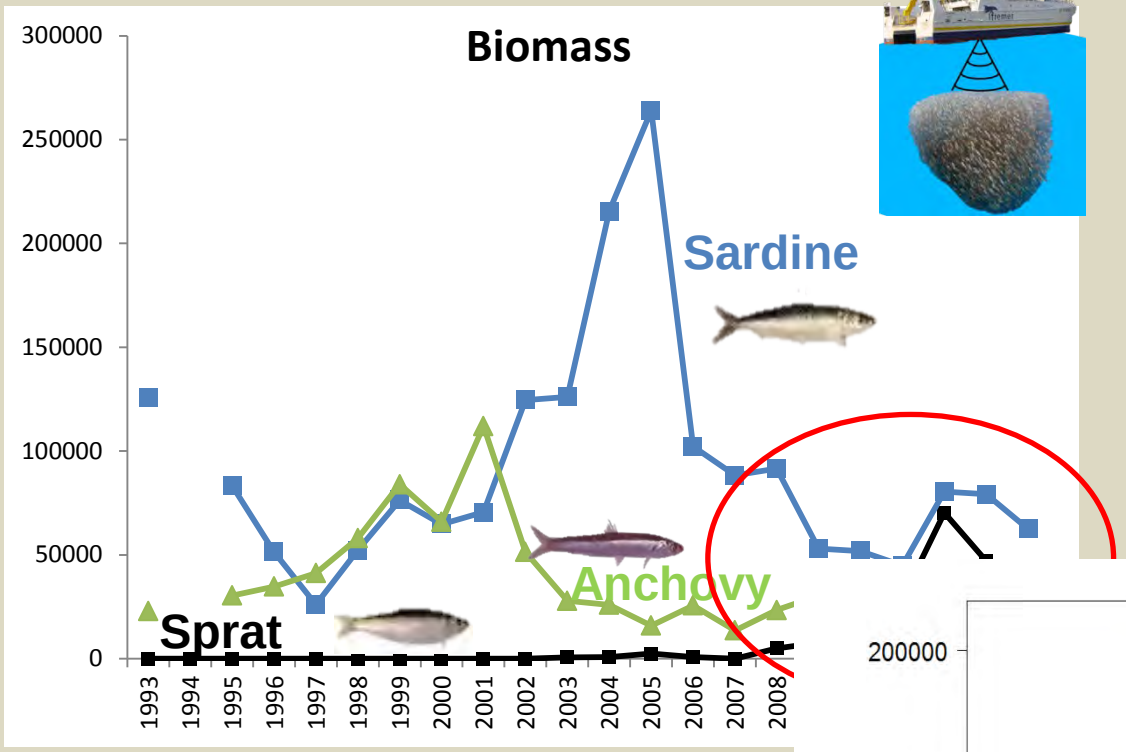


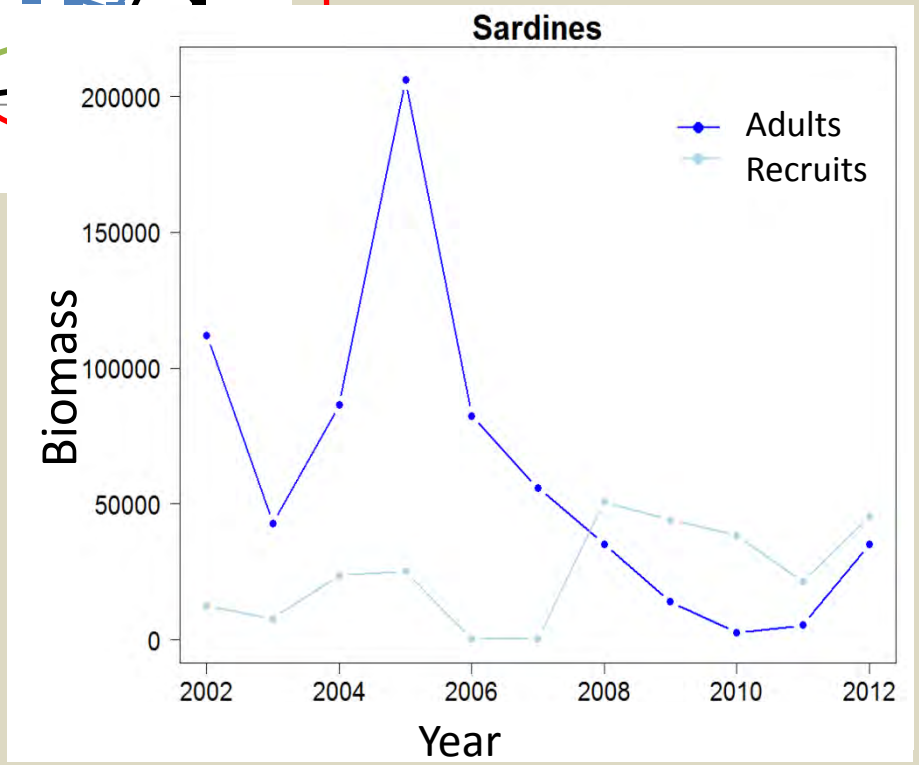
Gonado somatic index: (W_{gonad}/W_{fish})

- Stable in anchovy
- Stable if not increasing in sardines

Increase in reproductive effort despite low condition.
At the expense of survival?

Background:





- Low/Intermediate biomass
- Good recruitments

?????

ECOPELGOL
Project 2012-2015.