International Symposium
Victoria, BC, Canada
March 6-11, 2017
Drivers of dynamics of small pelagic fish resources

Intraguild Predation of Atlantic mackerel on early life stages of anchovy and sardine

E. Bachiller*, E. Cuende, P. Álvarez, A. Fontán, N. Rodriguez-Ezpeleta, U. Cotano

ebachiller@mail.com

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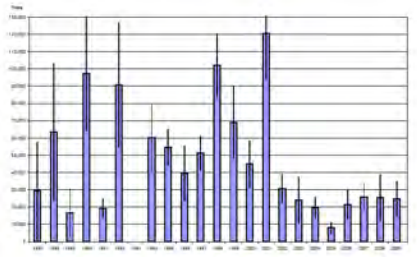
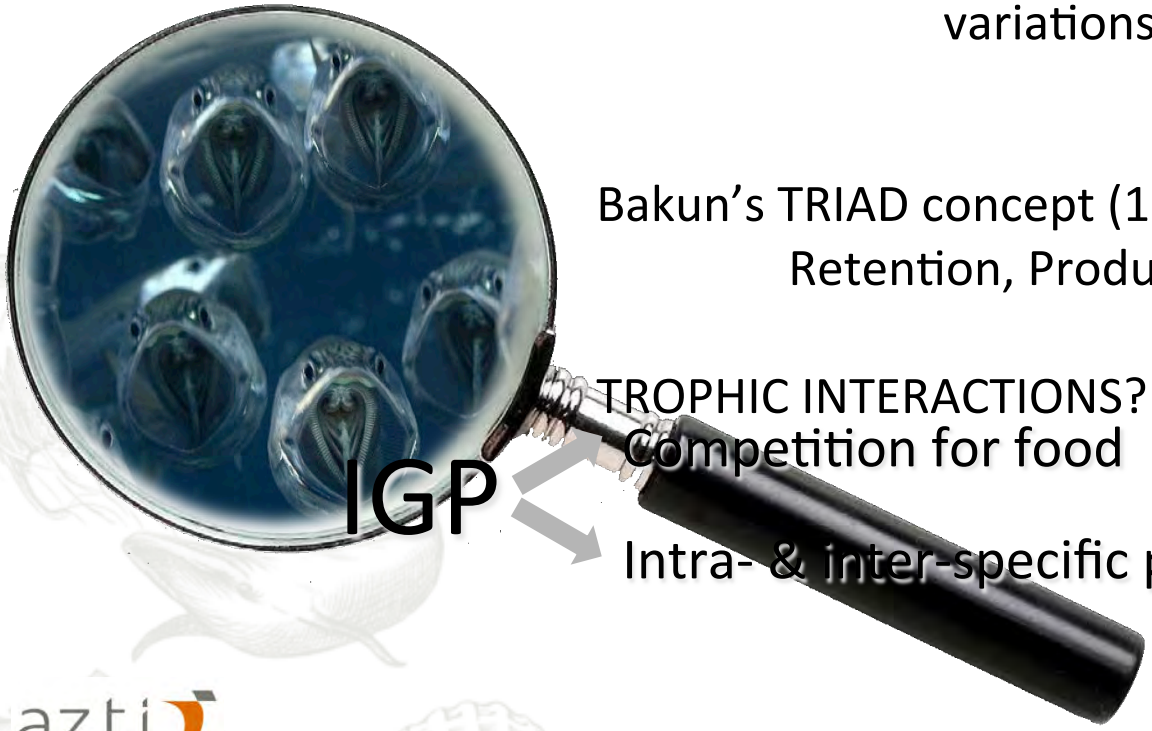
Intraguild Predation as regulation mechanism

Ecosystem-based fisheries management



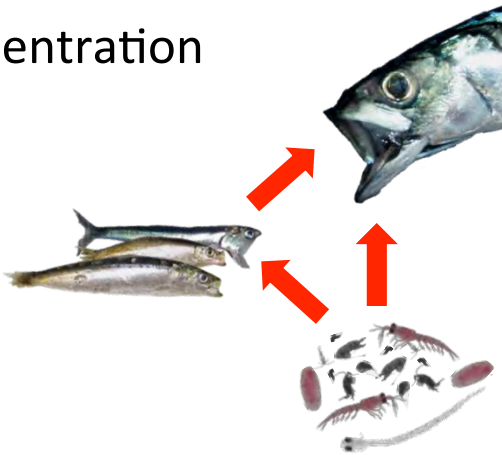
Inter-annual & long-term variations in small pelagic fish



Bakun's TRIAD concept (1993):
Retention, Production, Concentration

TROPHIC INTERACTIONS?
Competition for food

Intra- & inter-specific predation



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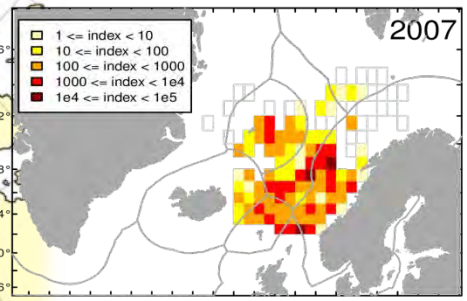
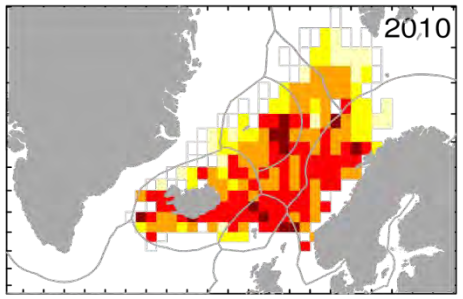
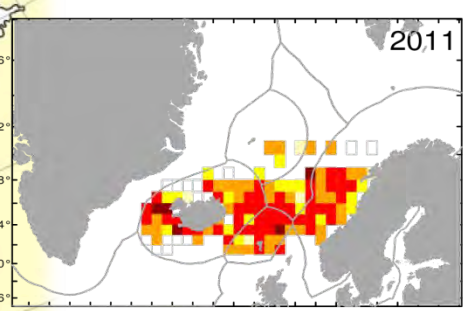
Northeast Atlantic mackerel

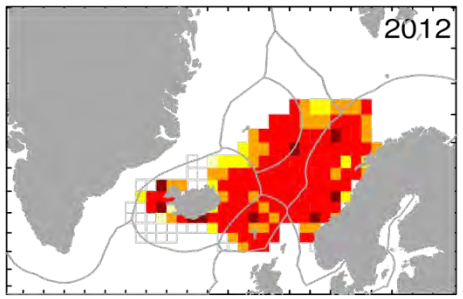
Summer
Feeding
Migration

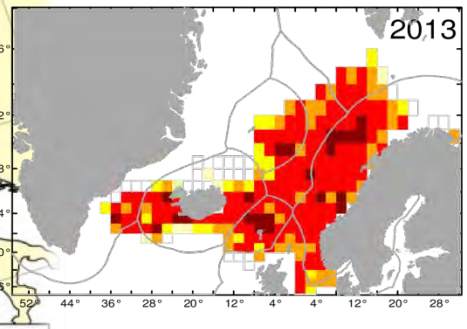
Maturity:
age 2-3yr

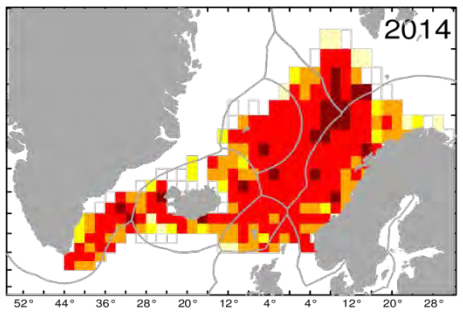


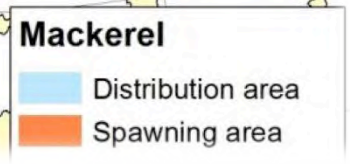












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NEA mackerel: trophic studies

- Trophic niche breadth ↑
- Stom.contents↔available prey
- Feeding incidence ↑
- Consumption rate ↑

PLOS ONE

RESEARCH ARTICLE

Feeding Ecology of Northeast Atlantic Mackerel, Norwegian Spring-Spawning Herring and Blue Whiting in the Norwegian Sea

Eneko Bachiller*, Georg Skaret, Leif Nøttestad, Aril Slotte

Pelagic Fish Research Group, Institute of Marine Research (IMR), PO Box 1870, Nordnes, NO-5817, Bergen, Norway

Bioenergetics modeling of the annual consumption of zooplankton by pelagic fish feeding in the Norwegian Sea

Eneko Bachiller[1,2,*], Kjell R. Utne[1], Tennis Jansen[3,4], Geir Huse[1]

ICES Journal of Marine Science

ICES Journal of Marine Science; doi:10.1093/icesjms/fss171

Allometric relations and consequences for feeding in small pelagic fish in the Bay of Biscay

Eneko Bachiller* and Xabier Irigoien†

Marine Research Division, AZTI Foundation, Herrera Kaia Portualdea, z/g 20110, Pasaia (Gipuzkoa), Spain

Vol. 534: 179–198, 2015
doi: 10.3354/meps11375

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published August

Trophodynamics and diet overlap of small pelagic fish species in the Bay of Biscay

Eneko Bachiller[1,2,*], Xabier Irigoien[1,3]

[1]Marine Research Division, AZTI Foundation, Herrera Kaia Portualdea, z/g 20110, Pasaia (Gipuzkoa), Spain

[2]Present address: Pelagic Fish Research Group, Institute of Marine Research (IMR), PO Box 1870, Nordnes 33, 5817 Bergen, Norway

[3]Present address: King Abdullah University of Science and Technology (KAUST), Red Sea Research Center, 23955-6900 Thuwal, Saudi Arabia

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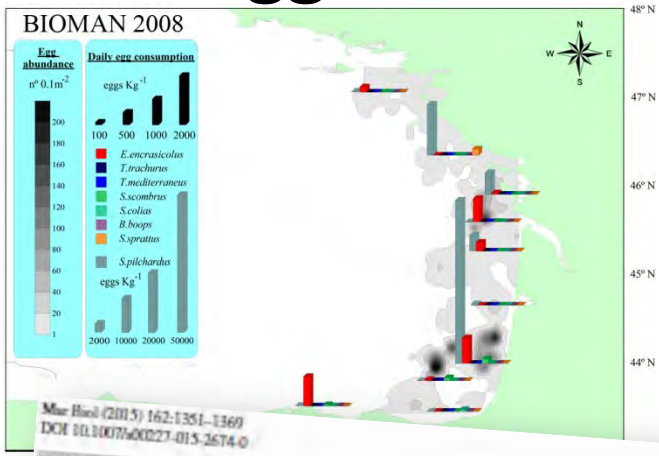
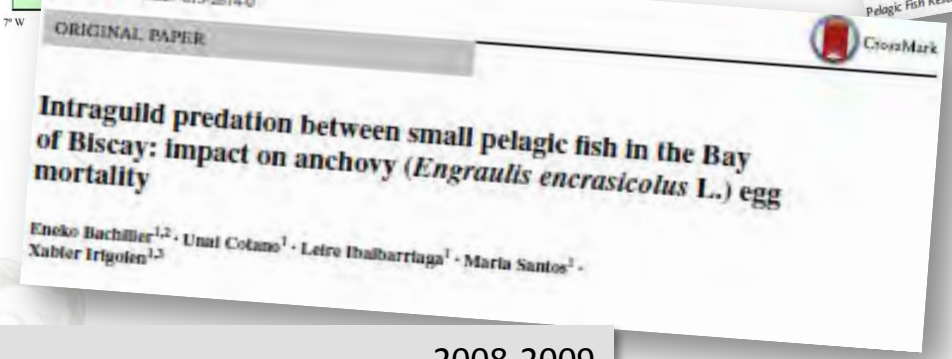
Fish egg & larvae predation by adult NEA mackerel



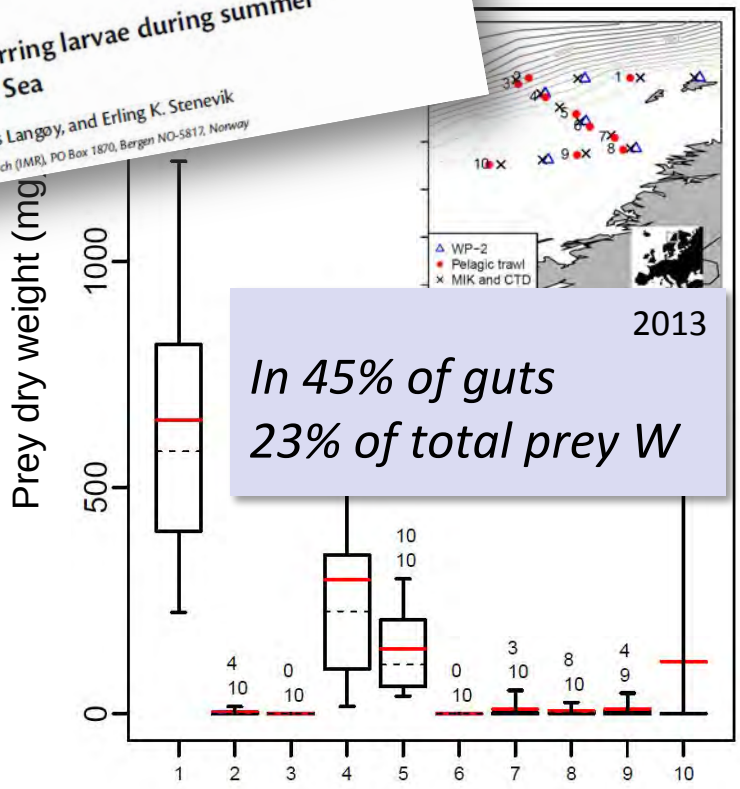


2008-2009

P_c (ane) = 36%

P_c (ane) *due to MAC* = 7%

$O_{mac\text{-}ane}$ ↓



2013

In 45% of guts

23% of total prey W

- Opportunistic predation (BoB & NS)
- Spatial overlap↑ potential effects↑

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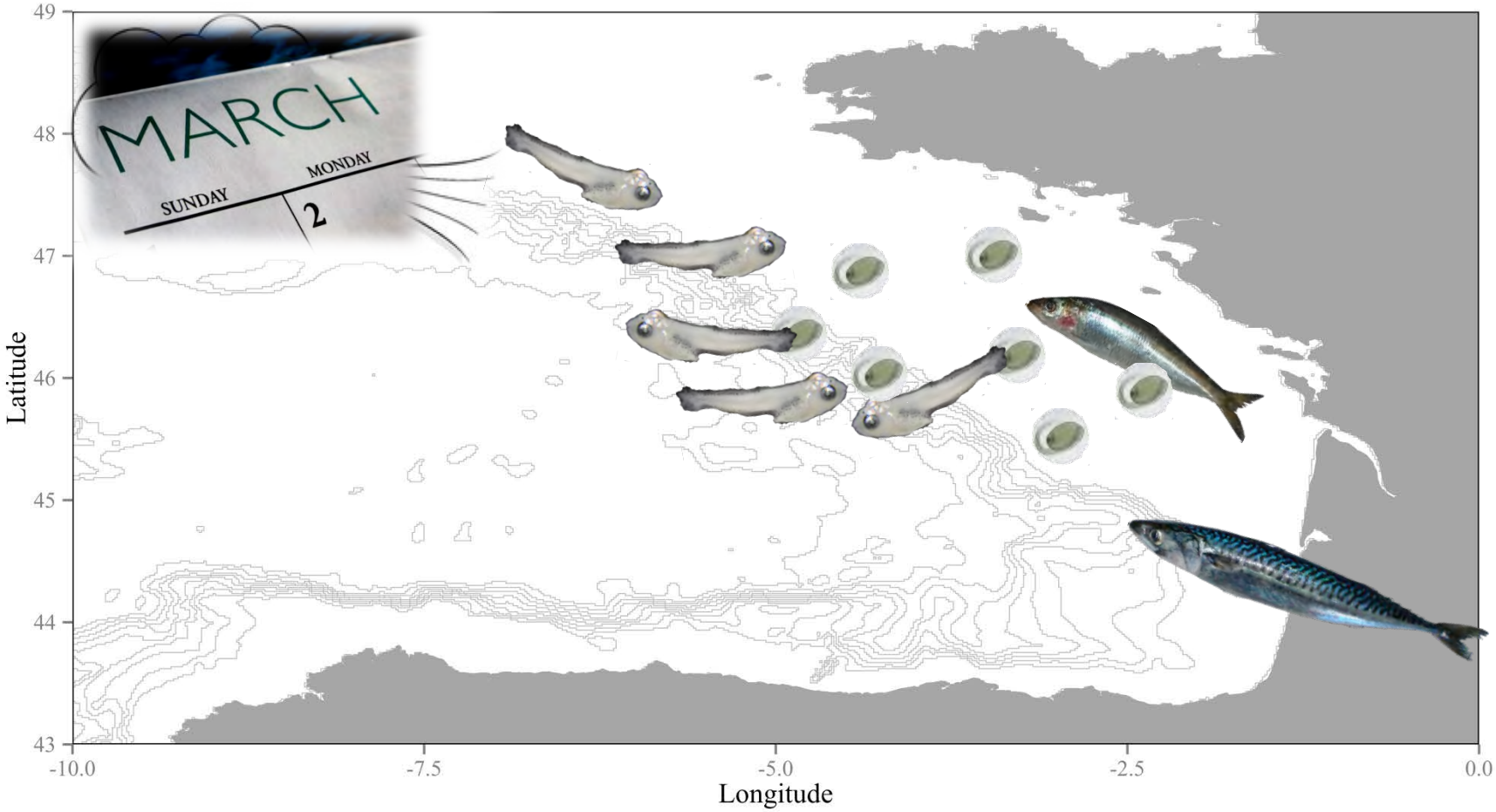
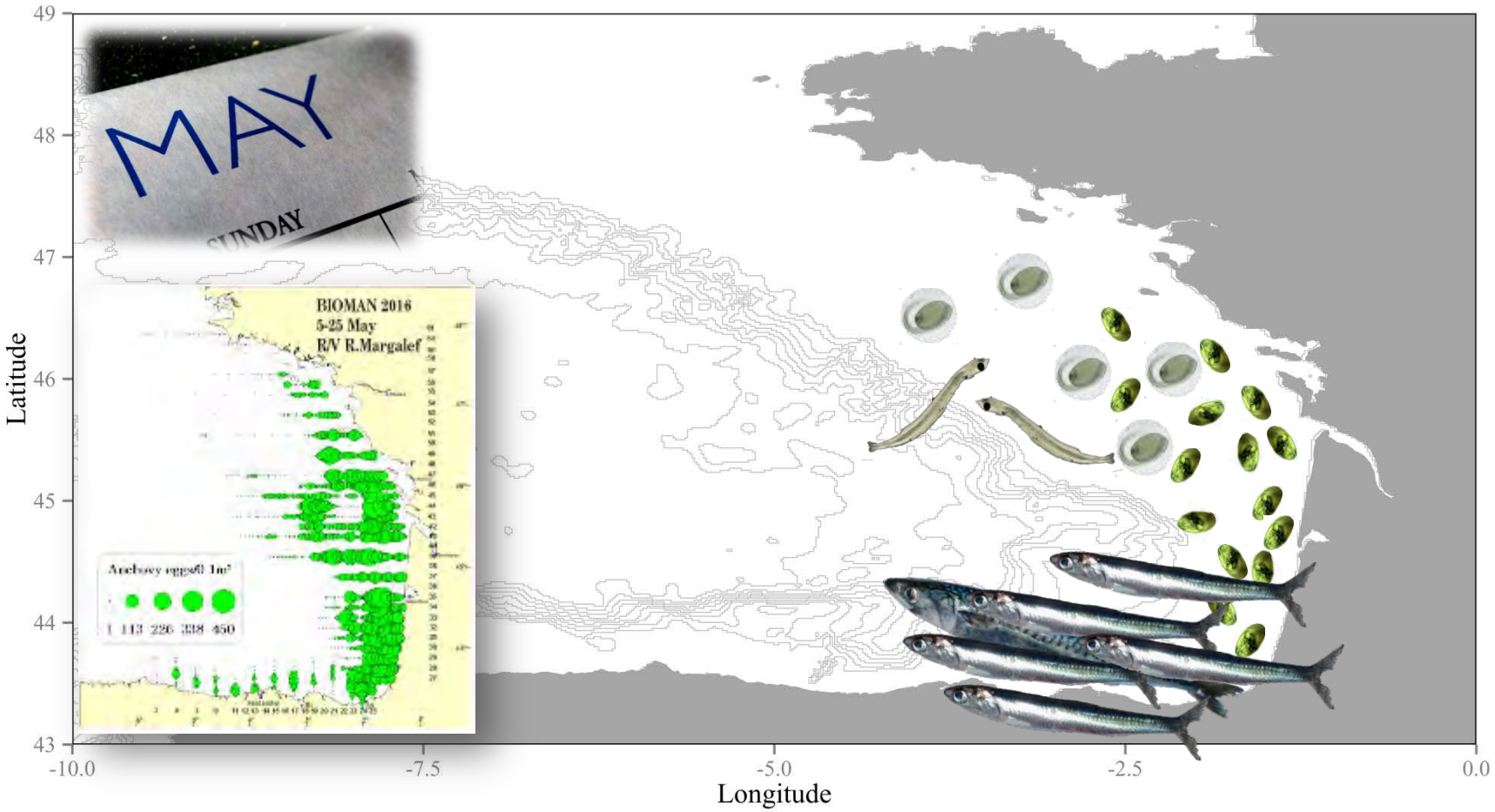
IGP effects on ELS of anchovy and sardine?

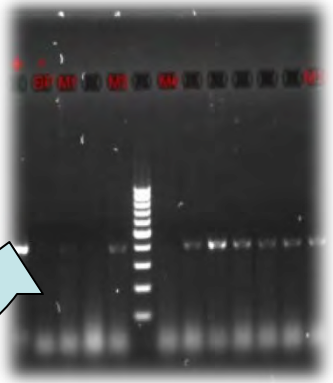


IGP effects on ELS of anchovy and sardine?

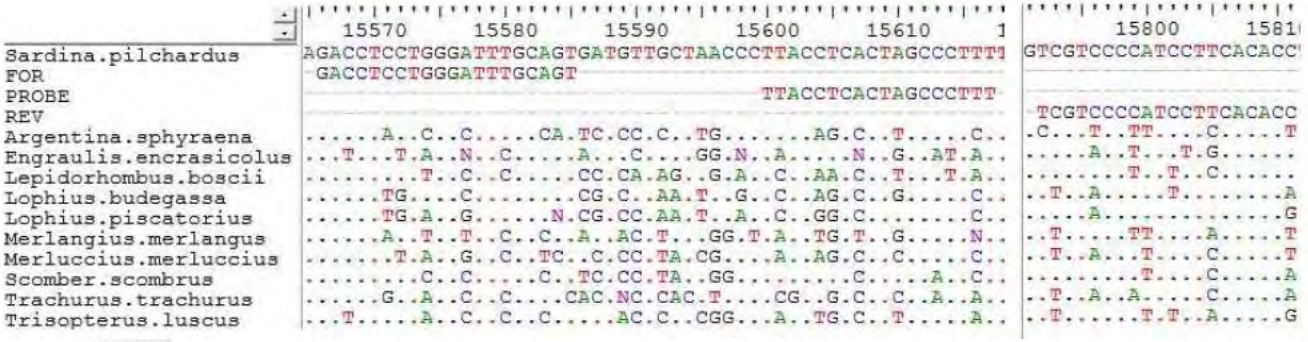


- High digestion rate
- High regurgitation
- Time consuming…

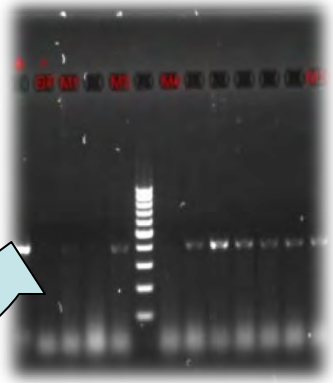
New methods, new insights



qPCR



Preliminary results…



qPCR

- 6 out of 238 mackerel larvae contained DNA of sardine in stomach contents.
  - ➢ *NO spatial overlap found in samples!*
    But wind regime could change…
- None showed DNA of anchovy.

✓ Useful method for prey detection (validation ok)

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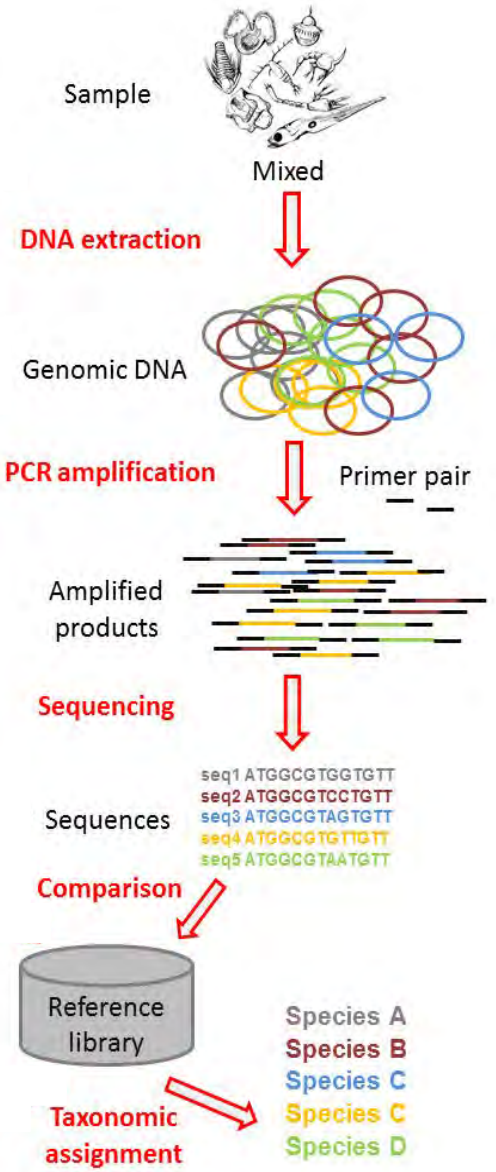
New methods, new insights

+

DNA METABARCODING



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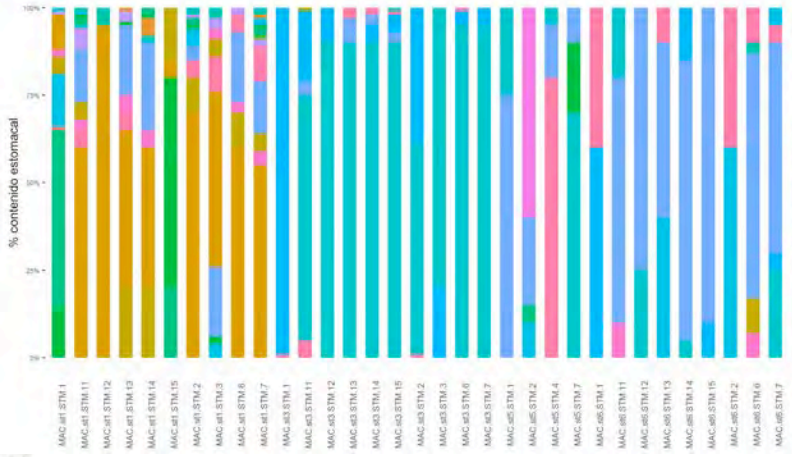
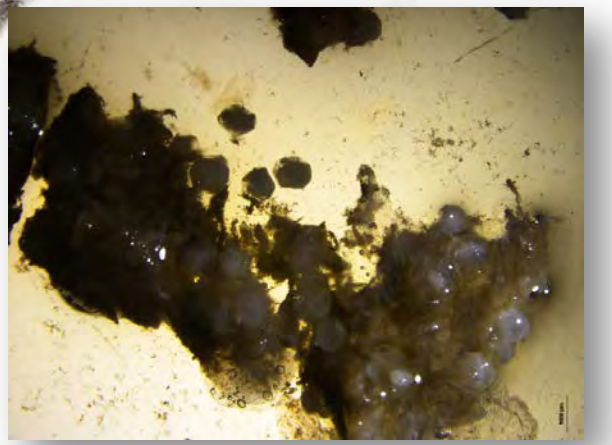
Preliminary results…

N = 40 indiv.





- 19 species (groups)
- Fish eggs present in 22 indiv. (44%)
  - >10 eggs in 9 stomachs
  - Max = 152 eggs
- No recognizable sardine eggs/larvae

Preliminary results…

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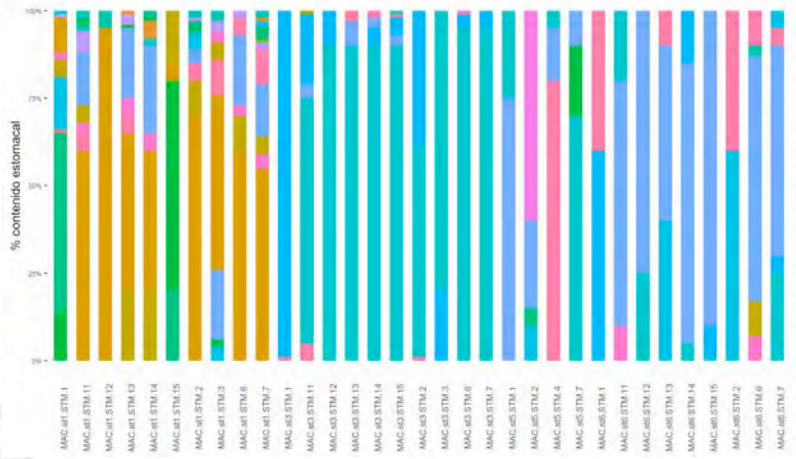

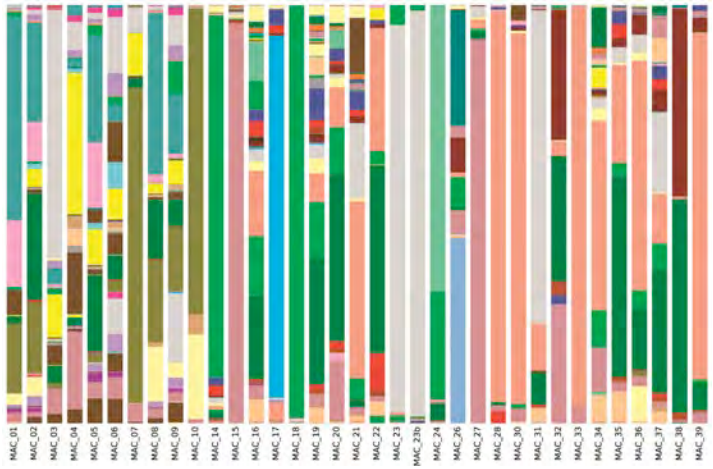

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- **Fish eggs** in 22 indiv. (44%)
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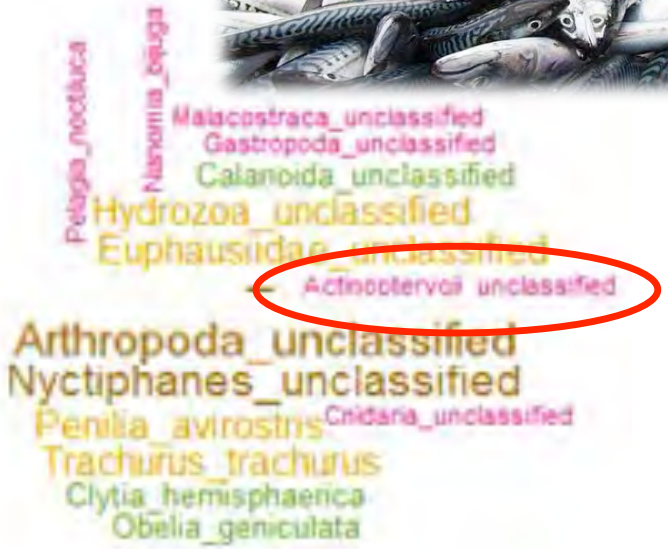
  - Max = 152 eggs
- No sardine eggs/larvae

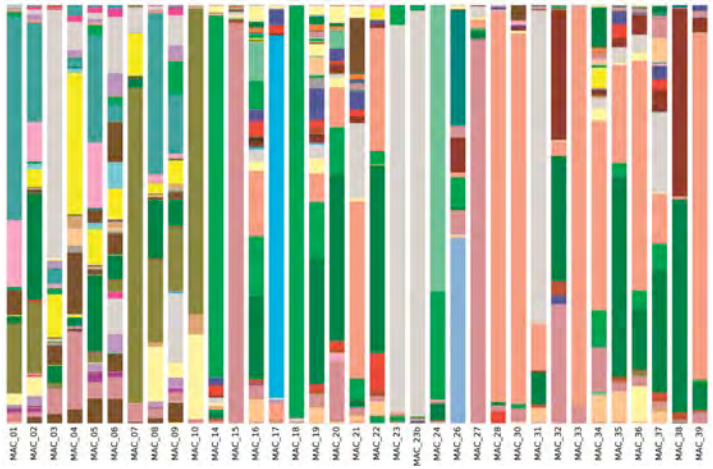
- 176 species (groups)
- **14 fish species** present in 97%
  - Hake present in 71% of samples
  - Horse mackerel (26%), flat fish (17%)...
- No sardine eggs/larvae

Preliminary results…

N = 40 indiv.

+ 24 indiv. (commercial fishing vessels)





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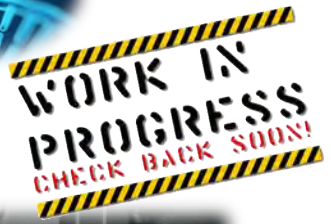
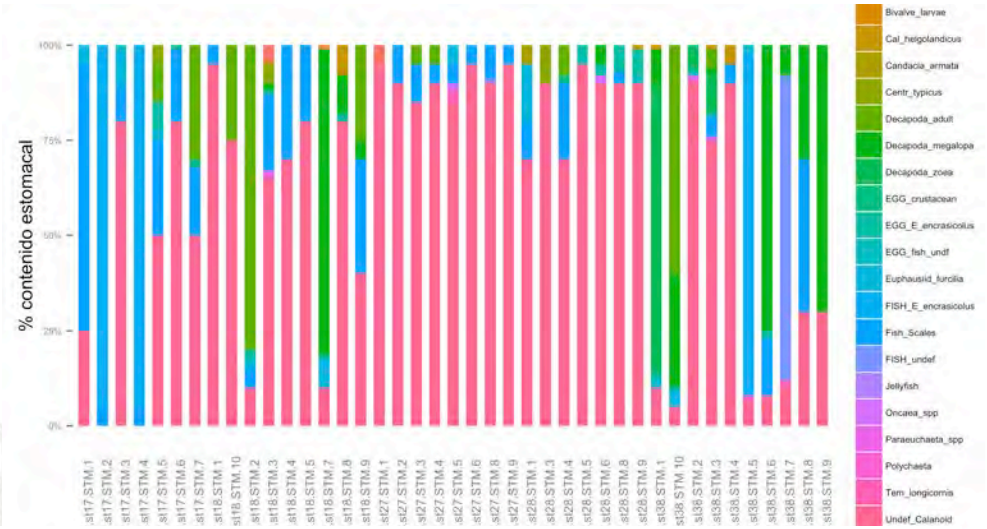
  - Horse mackerel (26%), flat fish (17%)...
- No sardine eggs/larvae

Sardine present in >50% mackerel!

Preliminary results…

N = 47 indiv.





- 22 species (groups)
- Fish eggs in 17 indiv. (36%)
  - **Anchovy eggs** in 11 stomachs (24%)
- Anchovy juveniles in 4 indiv. (8.5%)

Preliminary conclusions

- The **ELS survival** (& **recruitment**) **of clupeoids** can be **negatively affected by mackerel** (larvae & adult) **predation**.
- **IGP effects** are mostly dependent on **spatio-temporal overlap** (opportunistic predation by mackerel).
- **Combination** of visual analysis and metabarcoding on stomach contents provide new information which could be essential to better **understand trophic interactions**.

- Unidentifyable (highly digested) prey can be detected
- Cost-effective

- Quantification?
- Cannibalism?
- 'Prey of preys'?

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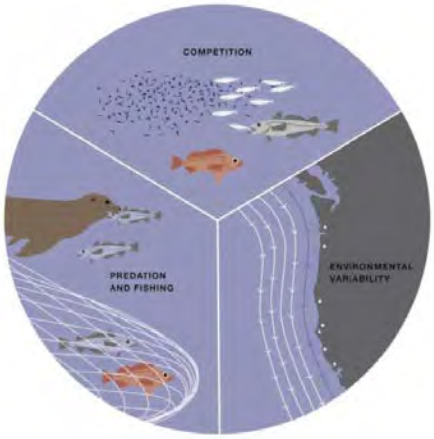
Food for thought…

- Intensive sampling (spatio-temporal overlap)
- IGP (visus + genetic tools) vs. $O_{mac - pil\&ane}$ (wind regime…)

  sardine & anchovy ELS survival

  mackerel recruitment

➢ Incorporate such information to multispecies/ ecosystem modeling tools…



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Thanks for your attention

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