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


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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
Northeast Atlantic mackerel

Maturity:
age 2-3yr

Summer
Feeding
Migration

Maps showing distribution and spawning areas from 2007 to 2014.
NEA mackerel: trophic studies

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

ICES Journal of Marine Science

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

Eneko Bachiller* and Xabier Iglesias

Allazo Saizola (AzTec Foundation), Research Unit Biogeography, Vizcaya (Biscay), Spain.


MARINE ECOLOGY PROGRESS SERIES

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

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Published 24 March 2013, Volume 441, Issue 1, Pages 102742

PLOS ONE

RESEARCH ARTICLE

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

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

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Fish egg & larvae predation by adult NEA mackerel

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

$P_c (\text{ane}) = 36\%$

$P_c (\text{ane}) \text{ due to MAC} = 7\%$

$O_{\text{mac-ane}} \downarrow$

In 45% of guts
23% of total prey W
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
Preliminary results...

- 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)
New methods, new insights

DNA METABARCODING

Sample → Mixed
DNA extraction
Genomic DNA
PCR amplification
Primer pair
Amplified products
Sequencing
Sequences
Comparison
Reference library
Species A
Species B
Species C
Species C
Species D

Taxonomic assignment
Preliminary results...

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

N = 40 indiv.
Preliminary results...

- 19 species (groups)
- Fish eggs in 22 indiv. (44%)
  - >10 eggs in 9 stomachs
  - 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

N = 40 indiv.
Preliminary results...

N = 40 indiv.

+ 24 indiv. (commercial fishing vessels)

• 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

Sardine present in >50% mackerel!
Preliminary results...

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

N = 47 indiv.
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.

- Unidentifiable (highly digested) prey can be detected
- **Cost-effective**

- **Quantification**?
- **Cannibalism**?
- ‘Prey of preys’?
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...
Thanks for your attention