Review on

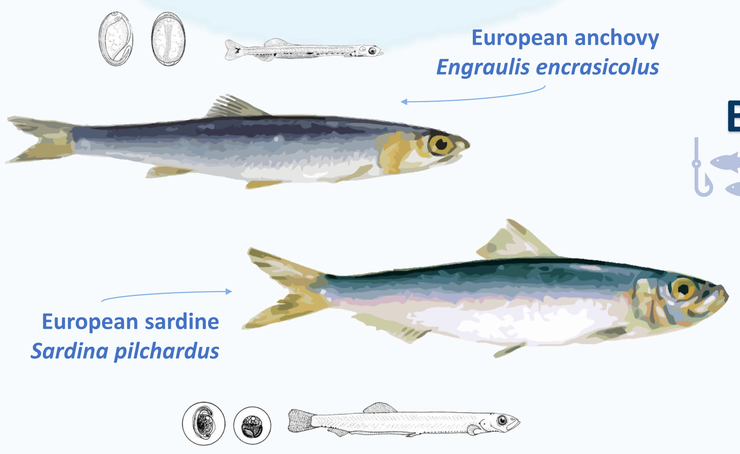
The influence of environmental factors on different life stages of anchovy and sardine in the Mediterranean Sea

Elena Fernández-Corredor[1], Marta Albo-Puigserver[2], Maria Grazia Pennino[2], Jose Mª Bellido[2], Marta Coll[1]

[1]Institut de Ciències del Mar, Spain; [2] Instituto Español de Oceanografía, Spain

@elenafcorr

elenafc@icm.csic.es



Background

European anchovy and European sardine populations are clearly influenced by **changes in the environment** by:

- controlling food availability
- influencing recruitment, growth and condition[2]

Low position in the food web + relatively short life-span

↳ strongly dependent on the environment

↳ excellent **bio-indicators of climate-driven changes[3]**

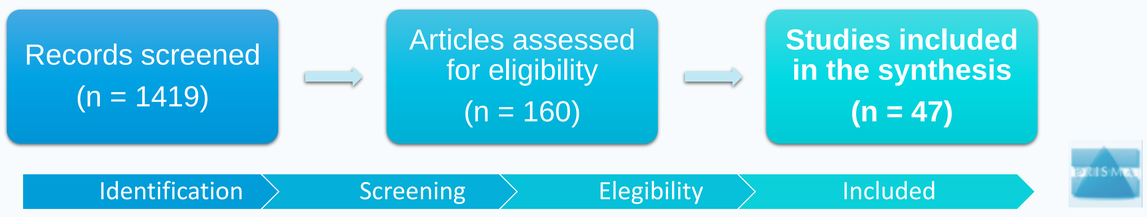
OBJECTIVES

Review and map the **environmental factors** influencing anchovy and sardine in the Mediterranean

Materials & Methods

Bibliographic search following the PRISMA approach

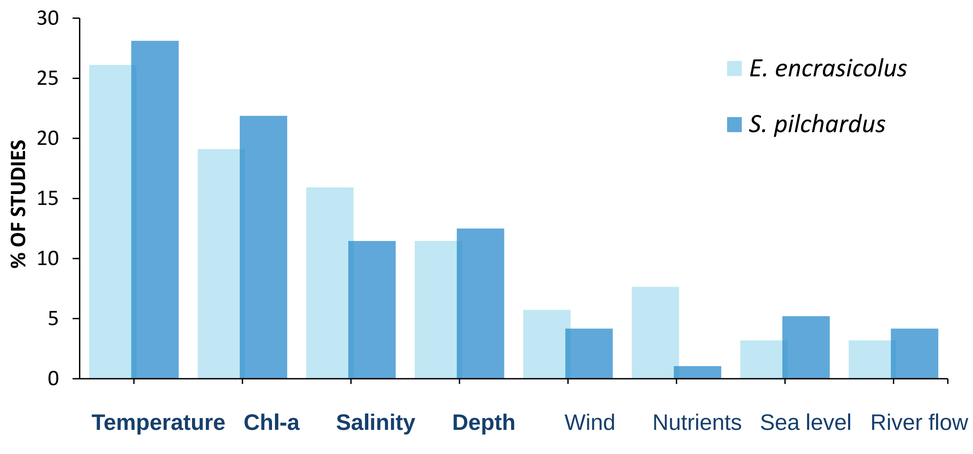
Graphic **representation** of the effect of the selected variables per area



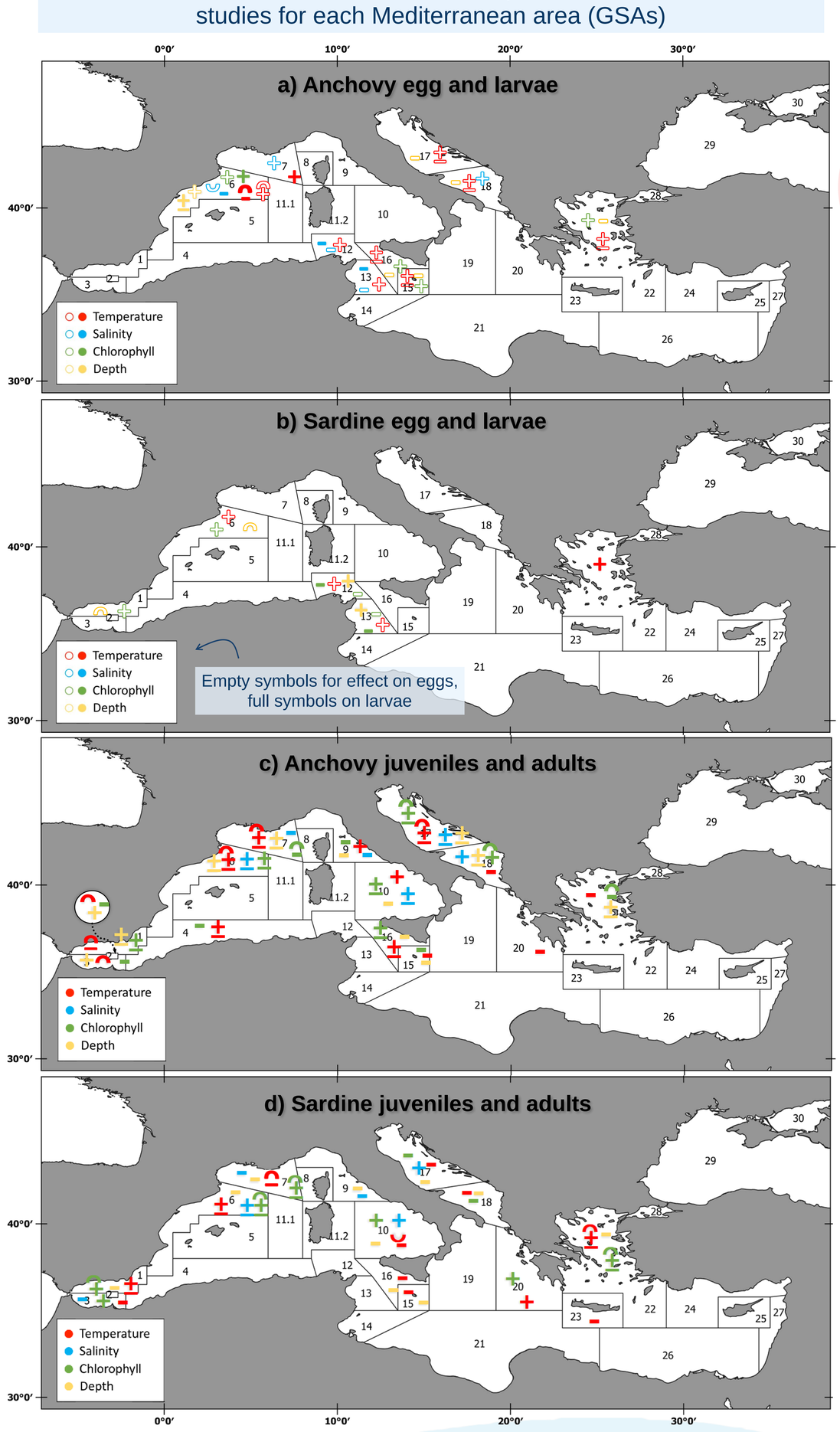
RESULTS

- Scientific knowledge was more extensive for **anchovy** (83% of the reports)
- **Adults** were the most studied life stage (62%)
- Data was **heterogeneously distributed**
  - ↳ Most studied areas were the Spanish coast, the Northern Adriatic and the Aegean Sea
- Preferred methods → **Generalized Additive Models** (49%)
- Main dependent variables studied → **abundance and biomass** (32%)
- The dependent and explanatory variables chosen were not independent from the species studied

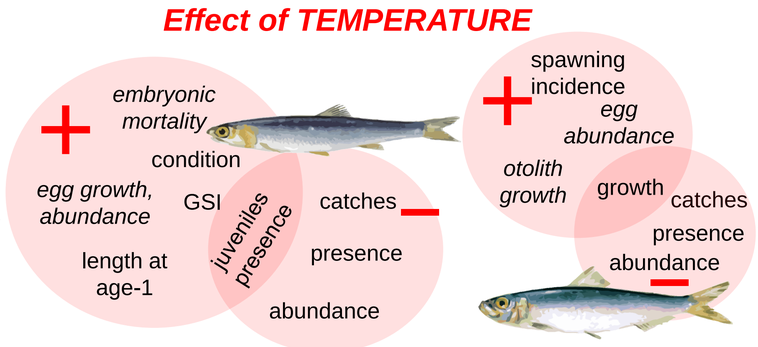
Explanatory variables significantly related to sardine and anchovy



Environmental variables effect reported in the different studies for each Mediterranean area (GSAs)

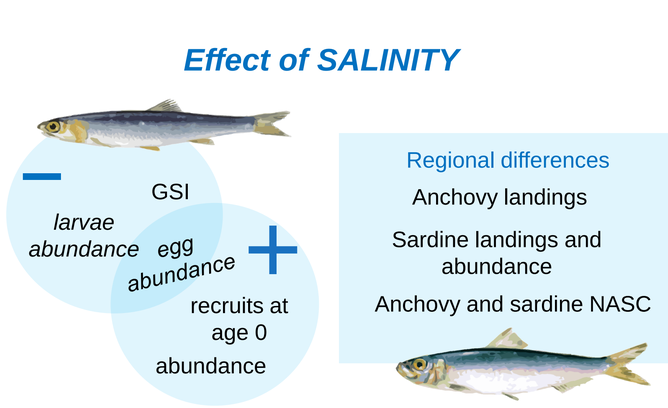


Effect of TEMPERATURE

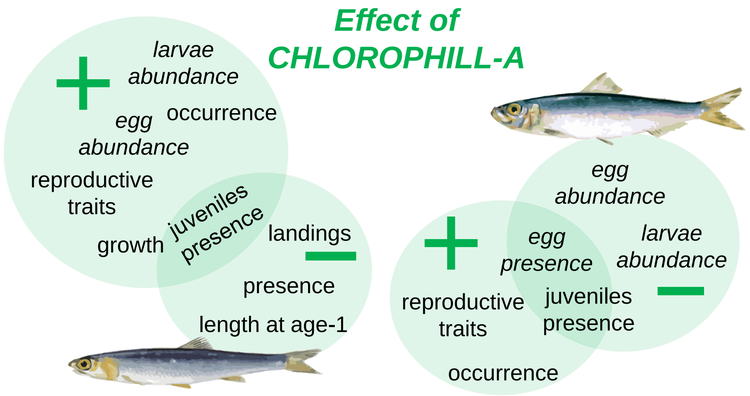


Regional differences
Anchovy larval growth and abundance

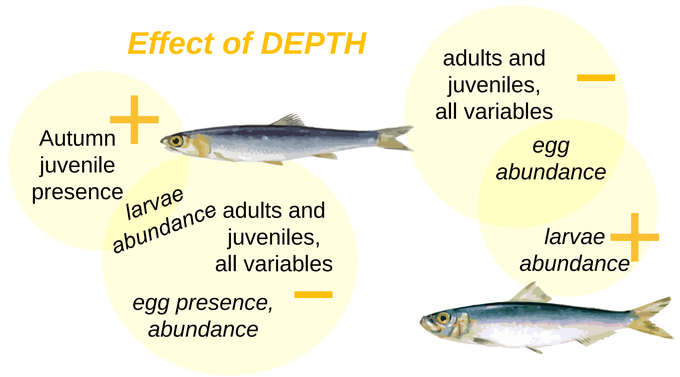
Effect of SALINITY



Effect of CHLOROPHILL-A



Effect of DEPTH



CONCLUSIONS

FUTURE CONCERNS

- Rising temperatures could lead to **extended spawning season** for anchovy
- Warmer waters at winter could enhance sardine larvae and juvenile growth, but if the optimum temperature is exceeded the effect could be negative
- Higher SSS could benefit sardine distribution
- Ocean warming + overfishing may represent an **"allied attack"** on their populations

Gaps of knowledge

- **Lack of information** at the Eastern Mediterranean.
- More studies on the environment effect on **larvae and eggs** are needed, with particular attention to **sardine**.
- The effects of **sea level, wind, river flow, nutrients** and **climatic indexes** have been described to influence fish dynamics, still few studies included them.
- Further efforts needed to make studies intercomparable within areas.

Anchovy and sardine share ecological niche but have different environmental requirements.

Climate alterations and scarce resources could increase **competition** and **overlapping** of their populations.

Complete study and supplementary materials

REFERENCES: (1) **Palomera et al. (2007).** Small pelagic fish in the NW Mediterranean Sea: An ecological review. *Prog. Ocenogr.* 74:377-396 (2) **Lloret et al. (2004).** Impact of freshwater input and wind on landings of anchovy (*E. encrasicolus*) and sardine (*S. pilchardus*) in shelf waters surrounding the Ebre River delta (north-wester Mediterranean). *Fish. Oceanogr.* 13(2), 102-110 (3) **Peck et al. (2013).** Life cycle ecophysiology of small pelagic fish and climate-driven changes in populations. *Prog. Ocenogr.* 116, 220-245.