

GROWTH VARIABILITY AND DEMOGRAPHIC STRUCTURE OF NORTHEAST ATLANTIC CHUB MACKEREL (*SCOMBER COLIAS*) IN SOUTHERN EUROPEAN ATLANTIC WATERS

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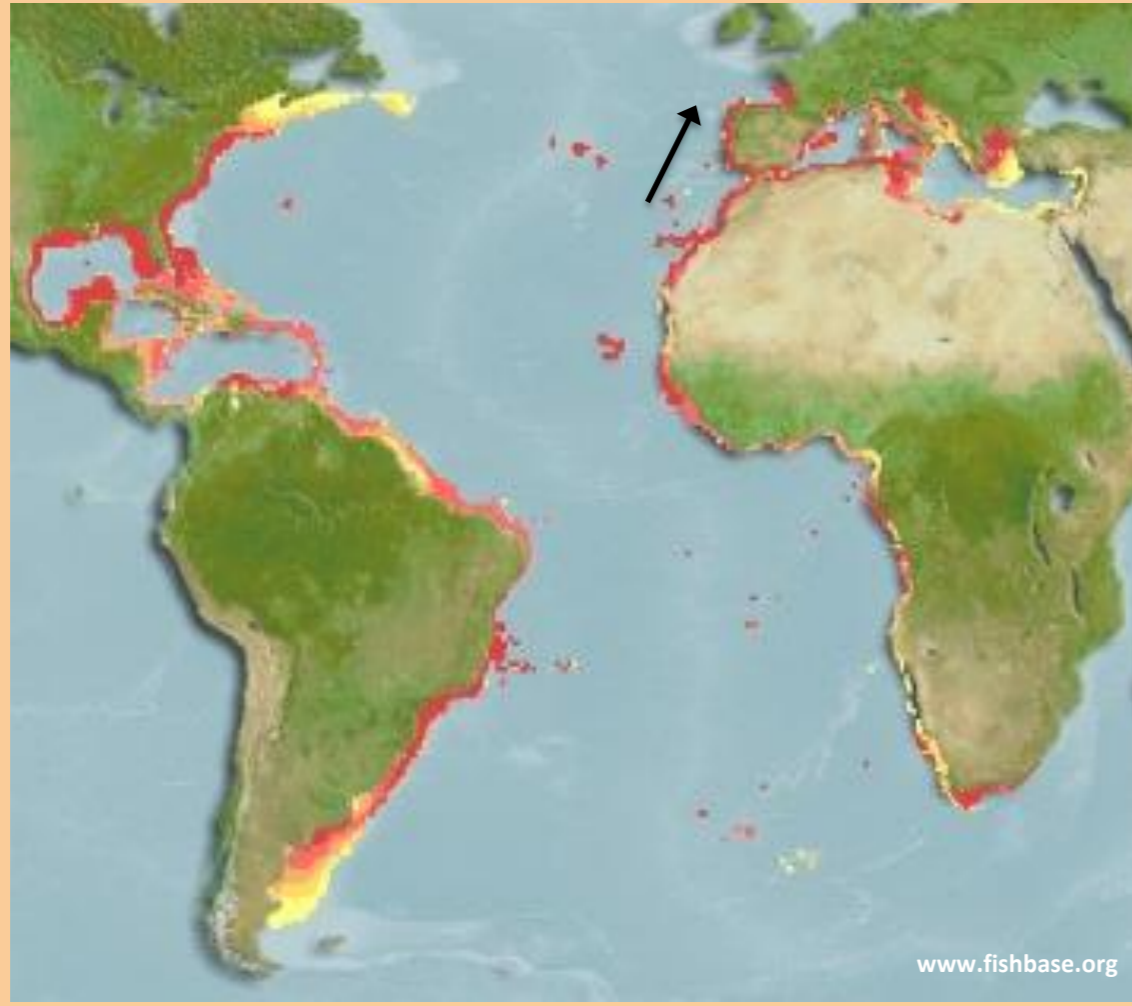
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IMPORTANCE OF THE STUDY



The Atlantic chub mackerel (*Scomber colias*) is one of the main fishing resources for the fisheries targeting small pelagics in NW African waters.

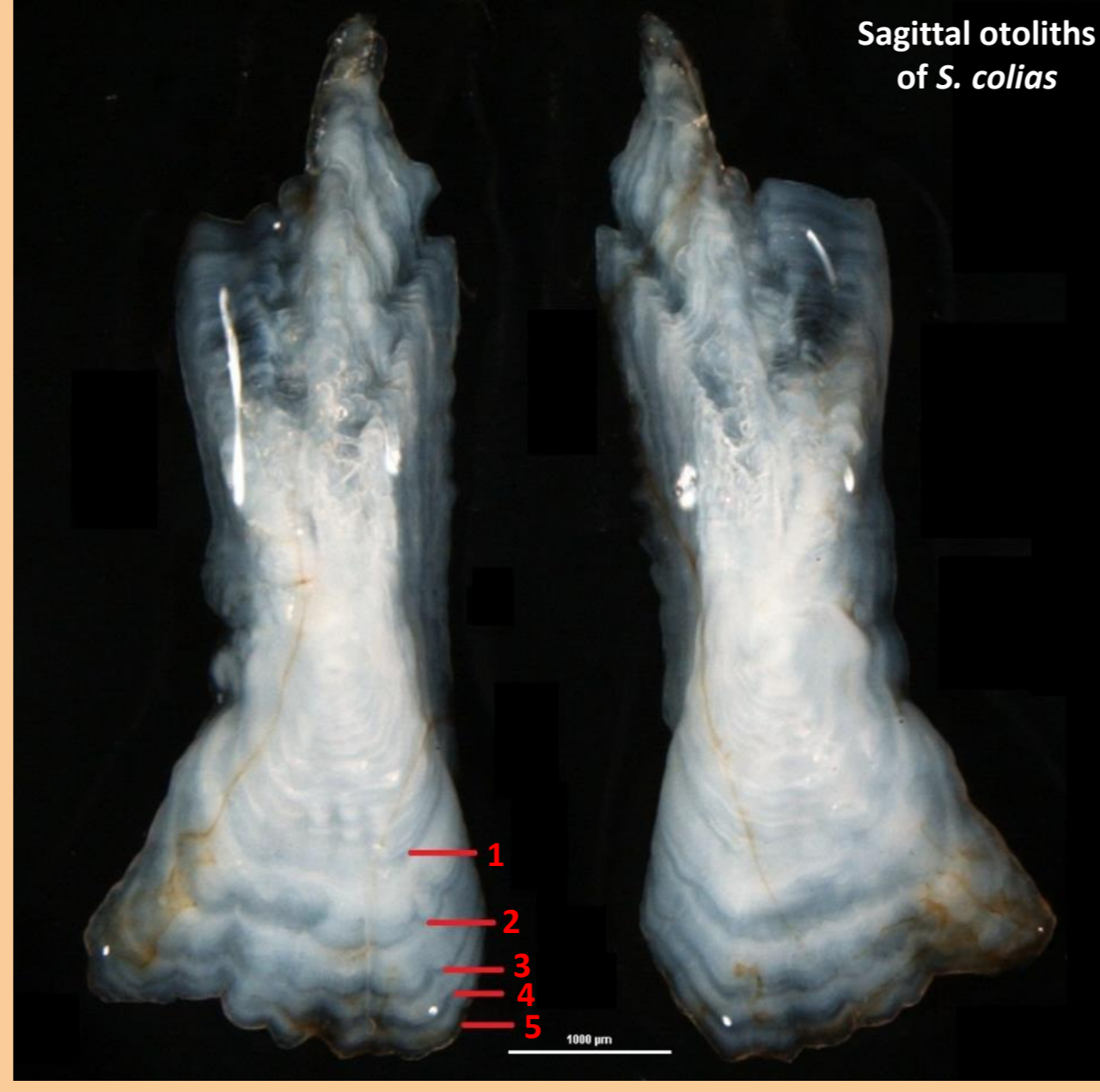
This species is expanding its geographical distribution through higher latitudes in southern European Atlantic waters, and it has become an important fishing resource in Iberian Atlantic waters during the last decades.



AIM

To analyse the growth variability and the demographic structure of the catches of *S. colias* in the Atlantic Iberian waters.

MATERIAL & METHODS



Age was estimated from counts of annual increments in 21,491 sagittal otoliths from 2010 to 2020, following the international *S. colias* standardized age estimation criteria (ICES, 2016).

The specimens were collected from commercial fleet and research surveys by IEO-CSIC (Spain) and IPMA (Portugal), within the EU-Data Collection Framework.

The study area covered the Atlantic Iberian waters, from the southern Bay of Biscay up to Gulf of Cadiz.

Growth Parameters of the von Bertalanffy growth function (VBGF) (Von Bertalanffy, 1938) were estimated by applying a nonlinear regression using sequential quadratic programming:

$$L_t = L_{\infty} (1 - \exp(-k(t-t_0)))$$

where L_t = Length at time t , L_{∞} = theoretical asymptotic length, k = growth rate parameter, t_0 = the age of the fish at zero length, t = age in years.

The growth performance index (Φ') was calculated using the equation devised by Pauly and Munro (1984) and was calculated to compare the growth patterns:

$$\Phi' = \log_{10} k + 2 \log_{10} L_{\infty}$$

where L_{∞} and k are parameters of von Bertalanffy growth equation.

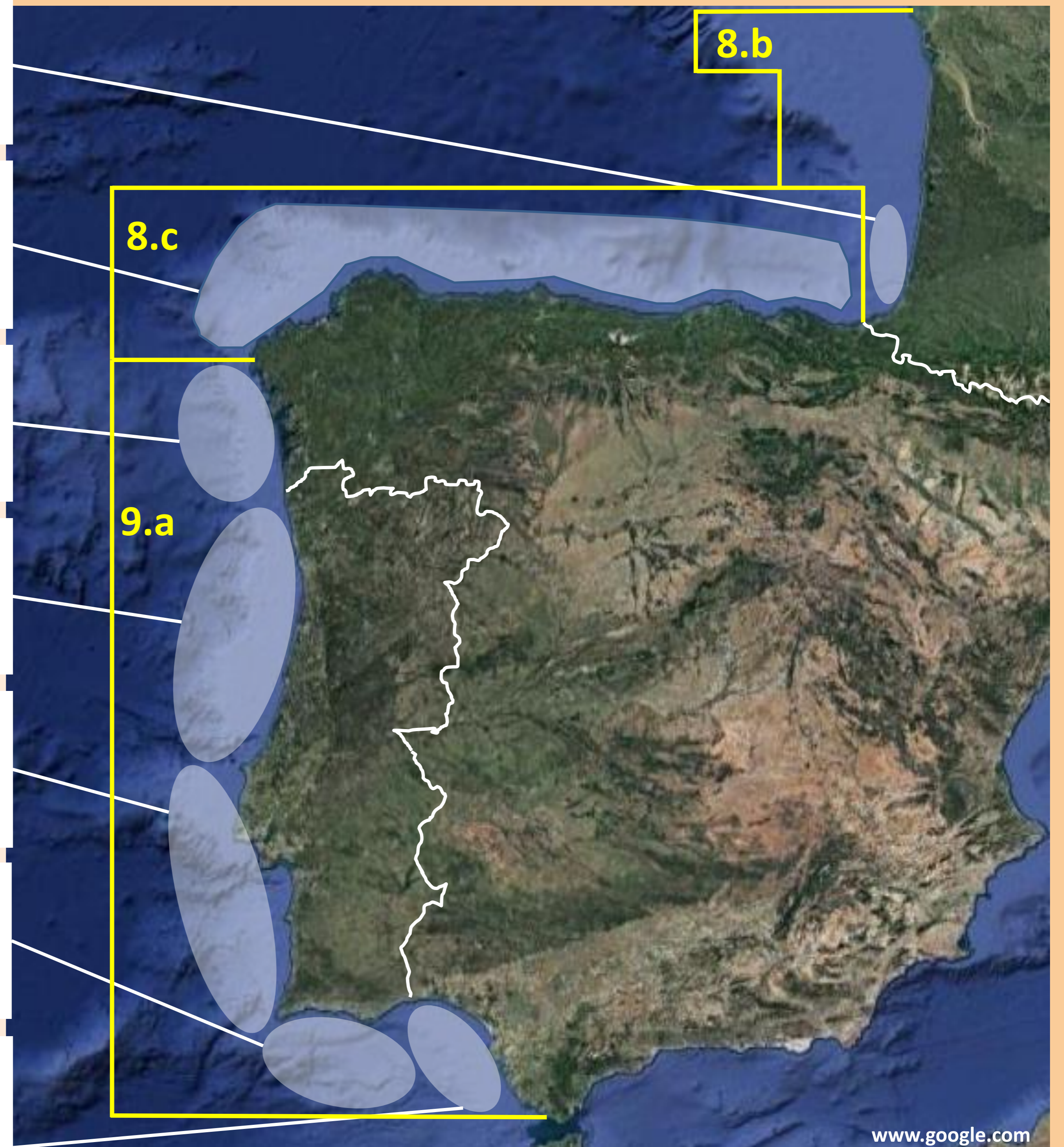
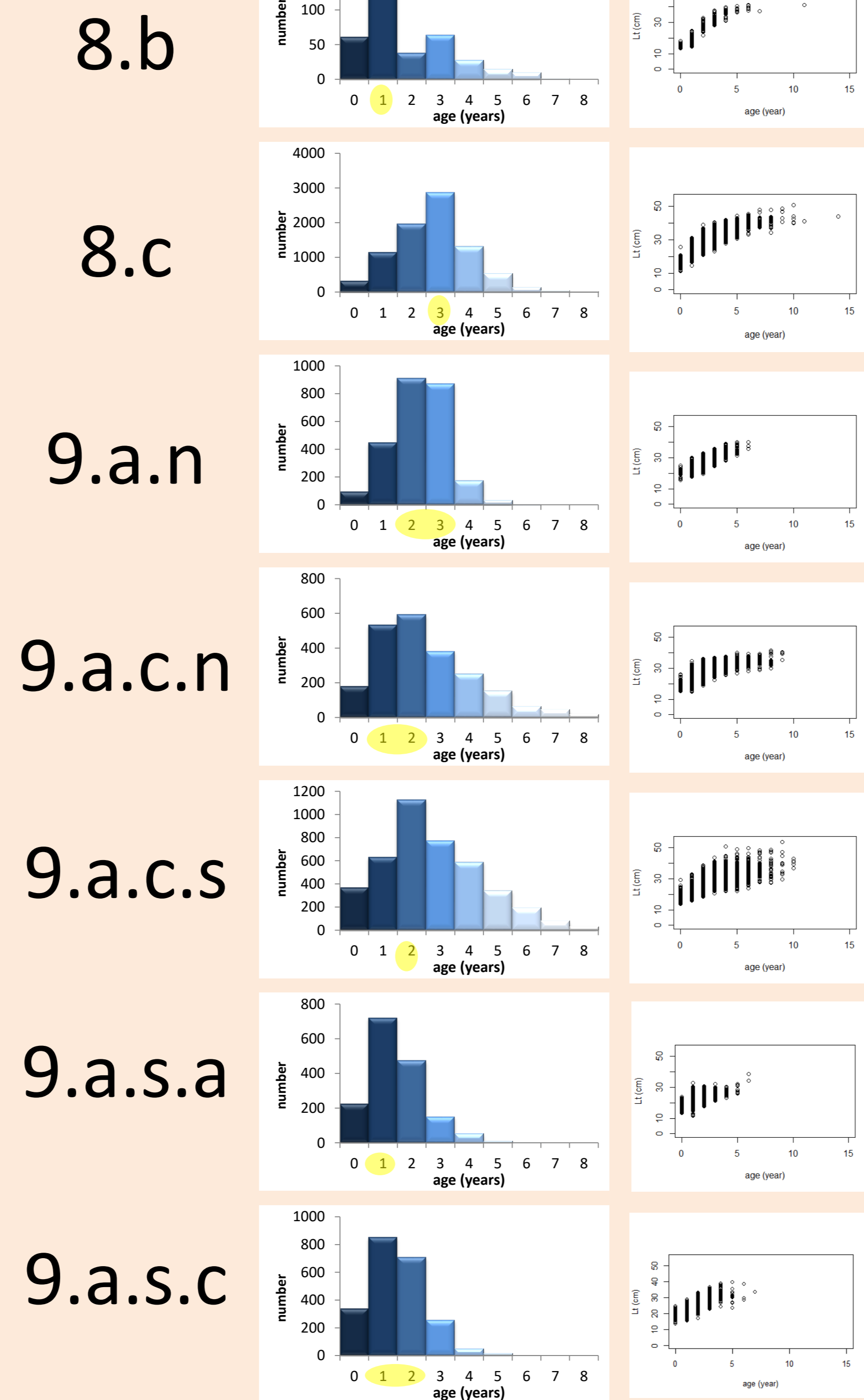
RESULTS & DISCUSSION

Demographic structure by area

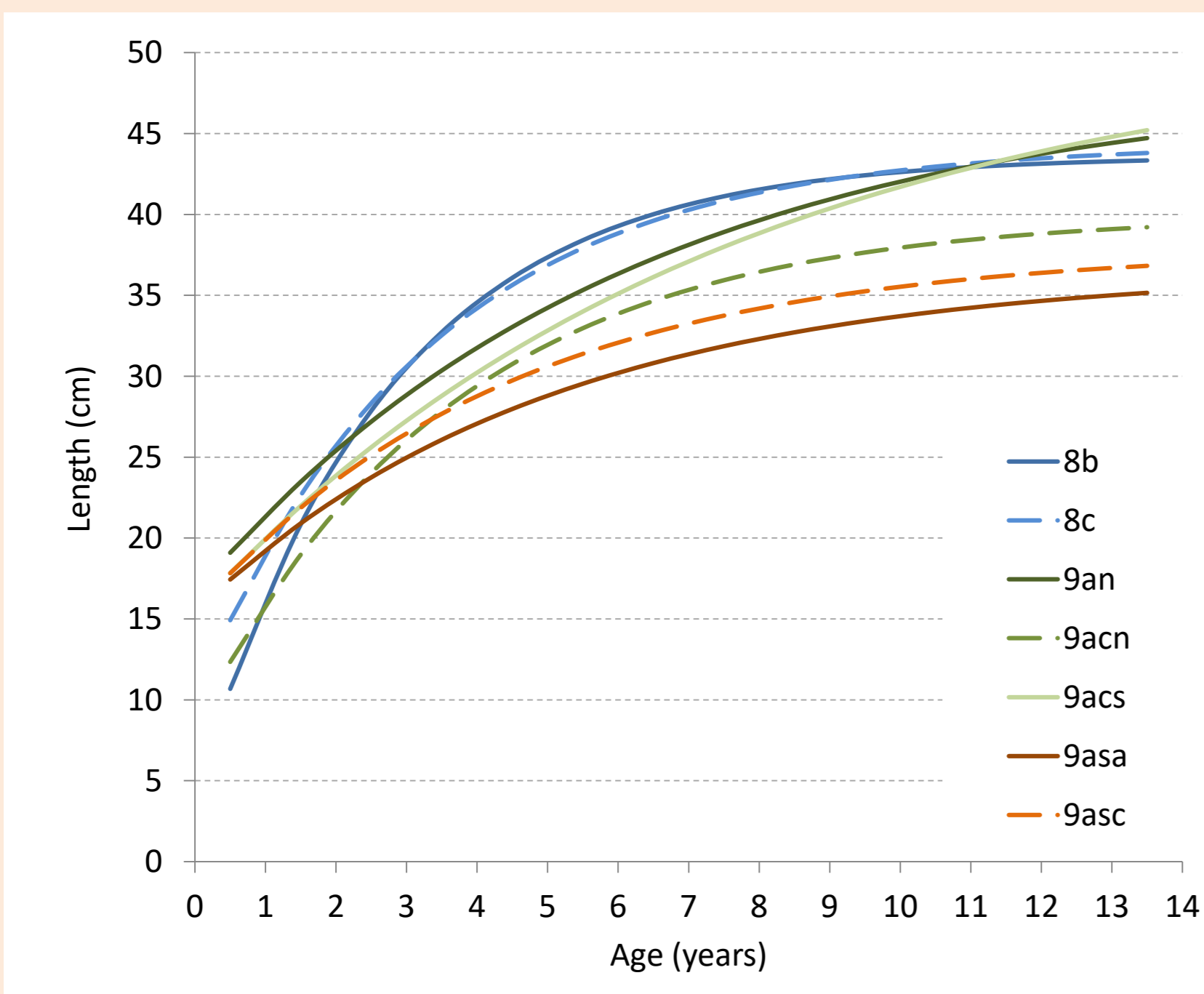
Variation in the demographic structure of *S. colias* among areas is observed, with the highest age range in central Portuguese waters (9.a.c.n-9.a.c.s) and in the Cantabrian Sea (8.c).

The predominant age group in the Cantabrian Sea is that of 3 years old. The predominant age becomes progressively younger towards the south: age 1 is the most abundant in the southernmost area studied (Gulf of Cadiz, 9.a.s.a), as well as in 8.b. This age structure in 8.b should be taken with caution as it comes from a limited sampled area and based on a smaller sample size than for the other areas studied.

Differences in the demographic structure of *S. colias* among areas are determined by factors intrinsic to the population of each area (i.e., growth, recruitment, mortality), but also by the diverse data on the population that is available in each area for this study. Thus, the variation in the commercial importance of *S. colias* as target species in each area that determines the size of their commercial catches, and the possibility of capturing *S. colias* in the research surveys conducted in each area, also influence the resulting age structure by area.



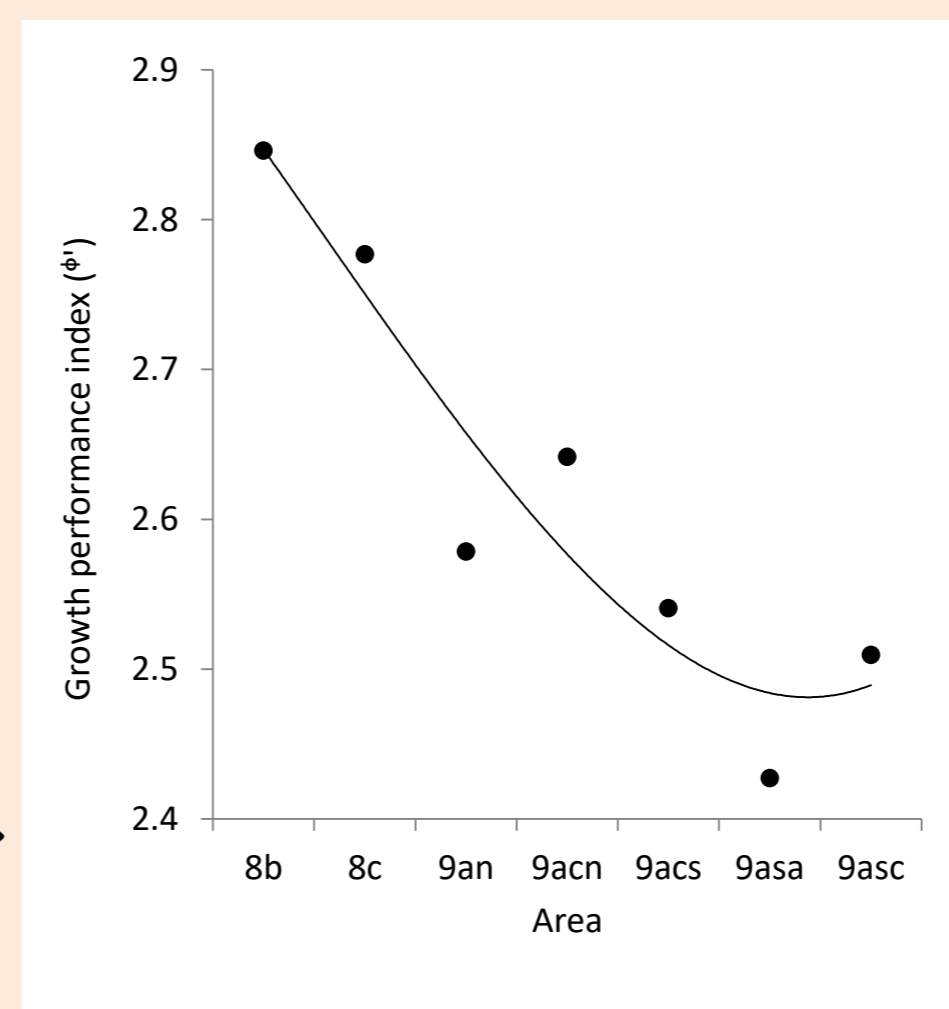
Growth by area



The mean length at the first age group is smaller in the northernmost areas (8.b and 8.c), what could be related to a later spawning process (Dominguez-Petit et al., 2021) and a shorter growth period during their first year of life.

Von Bertalanffy growth parameters for combined sexes by area

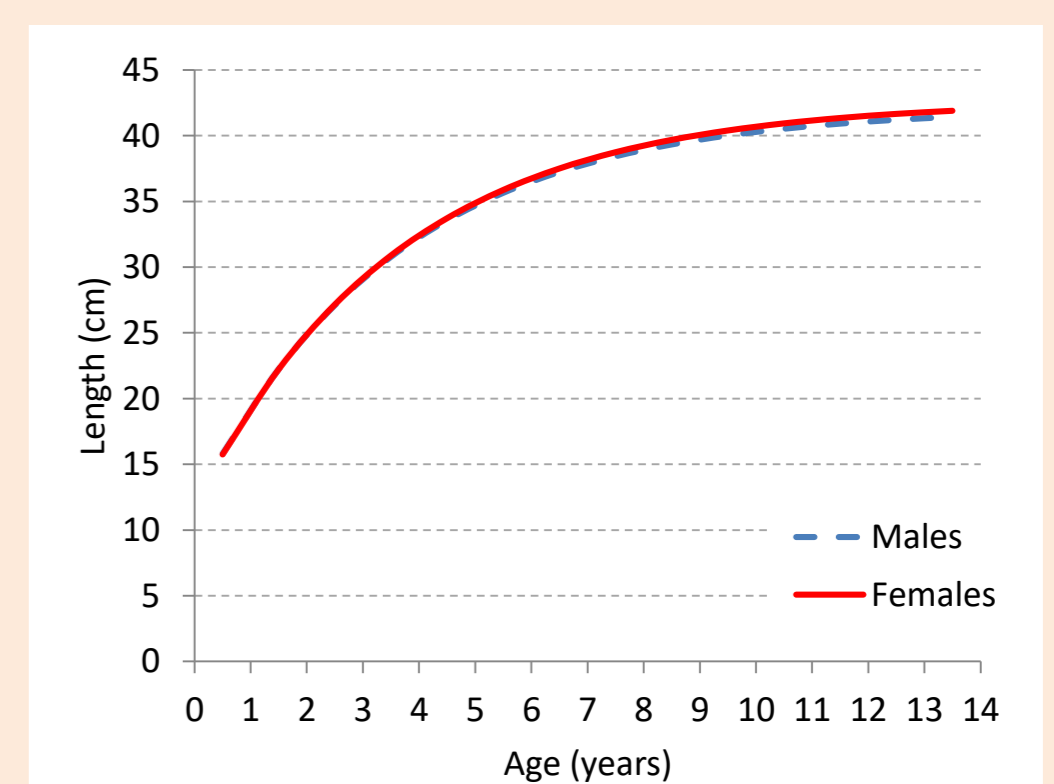
ICES Subdiv.	L_{∞}	k	t_0	Φ'	n
8b	43.61	0.37	-0.26	2.85	367
8c	44.36	0.30	-0.85	2.78	8364
9an	48.21	0.16	-2.59	2.58	2536
9acn	40.00	0.27	-0.85	2.64	2225
9acs	51.11	0.13	-2.73	2.54	4144
9asa	36.58	0.20	-2.74	2.43	1632
9asc	37.91	0.23	-2.32	2.51	2223



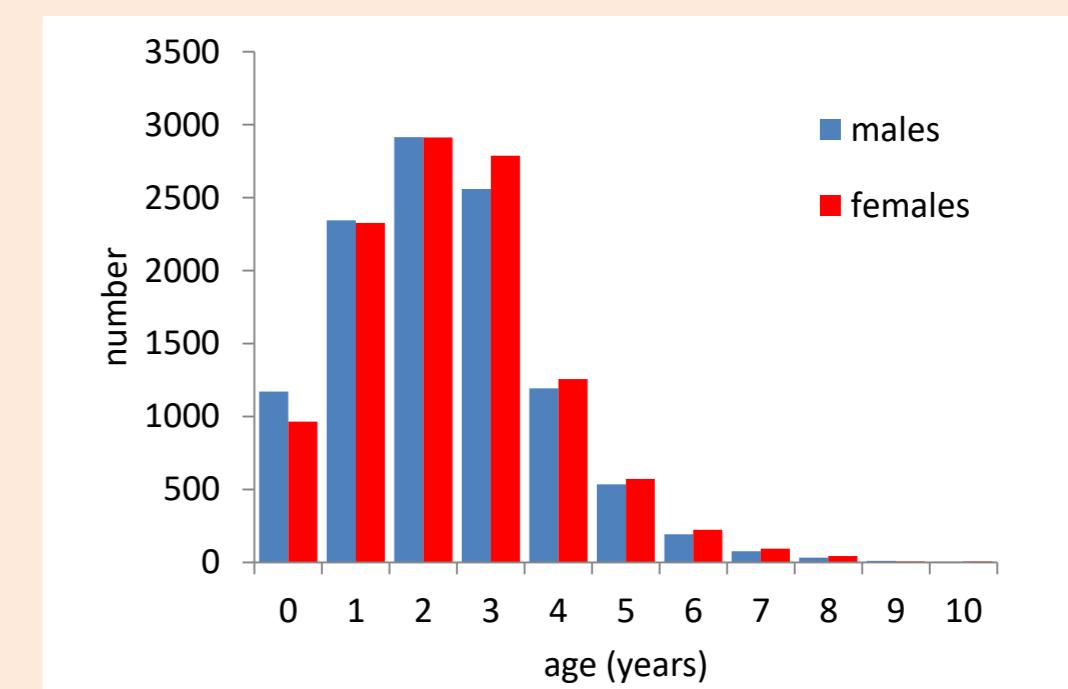
The growth performance index (Φ') shows a clear downward north-south trend, confirming preliminary observations from few previous studies (Navarro et al., 2021).

The use of samples from several years in the present study allows to include the inter-annual growth variability in the parameters estimation, and thus obtaining more representative parameters of the mean growth of *S. colias* in the studied areas.

Growth by sex



Similar growth between sexes of *S. colias* is observed, but with slightly greater abundance of females from age group 3 onwards.



ACKNOWLEDGEMENTS

This work is supported by the EU through the European Maritime and Fisheries Fund (EMFF) within the National Program of collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy, by the Instituto Español de Oceanografía (BIOPEL, PELASSES, PELCOSAT and ERDEM projects) and by the Instituto Português do Mar e da Atmosfera (PNAB and SARDINHA2020 projects).

REFERENCES

- Dominguez-Petit, R., Landa, J., Navarro, M.R., Nunes, C., Jurado-Ruzafa, A., Ramos, F., Silva, A., Tornero, J., Hernández, C. 2021. Variación espacial de los parámetros de historia vital del estornino (*Scomber colias*) y sus implicaciones en el potencial reproductivo. V Simposio Iberoamericano de Ecología Reproductiva, Reclutamiento y Pesquerías (SIBECORP), Santa Marta (Colombia), 11-15 Octubre 2021
- ICES, 2016. Report of the Workshop on Age Reading of chub mackerel (*Scomber colias*) (WKARCM). 2-6 November 2015, Lisbon, Portugal. ICES CM 2015/SSGEIOM:11, p. 81.
- Navarro, M.R., Landa, J., Villamor, B. and Dominguez-Petit, R. 2021. First approach to the growth and age corroboration of northeast atlantic chub mackerel (*Scomber colias*) in northern Iberian waters. Estuarine, Coastal and Shelf Science, 259: 107433.
- Pauly, D., Munro, J.L., 1984. Once more on growth comparison in fish and invertebrates. ICLARM Fishbyte., 2(1), 21.
- von Bertalanffy, L., 1938. A quantitative theory of organic growth (inquiries on growth laws II). Hum. Biol. 10, 181-213.