

ANCHOVY 27.9.a STOCK

STOCK STRUCTURE

27.9.A ANCHOVY

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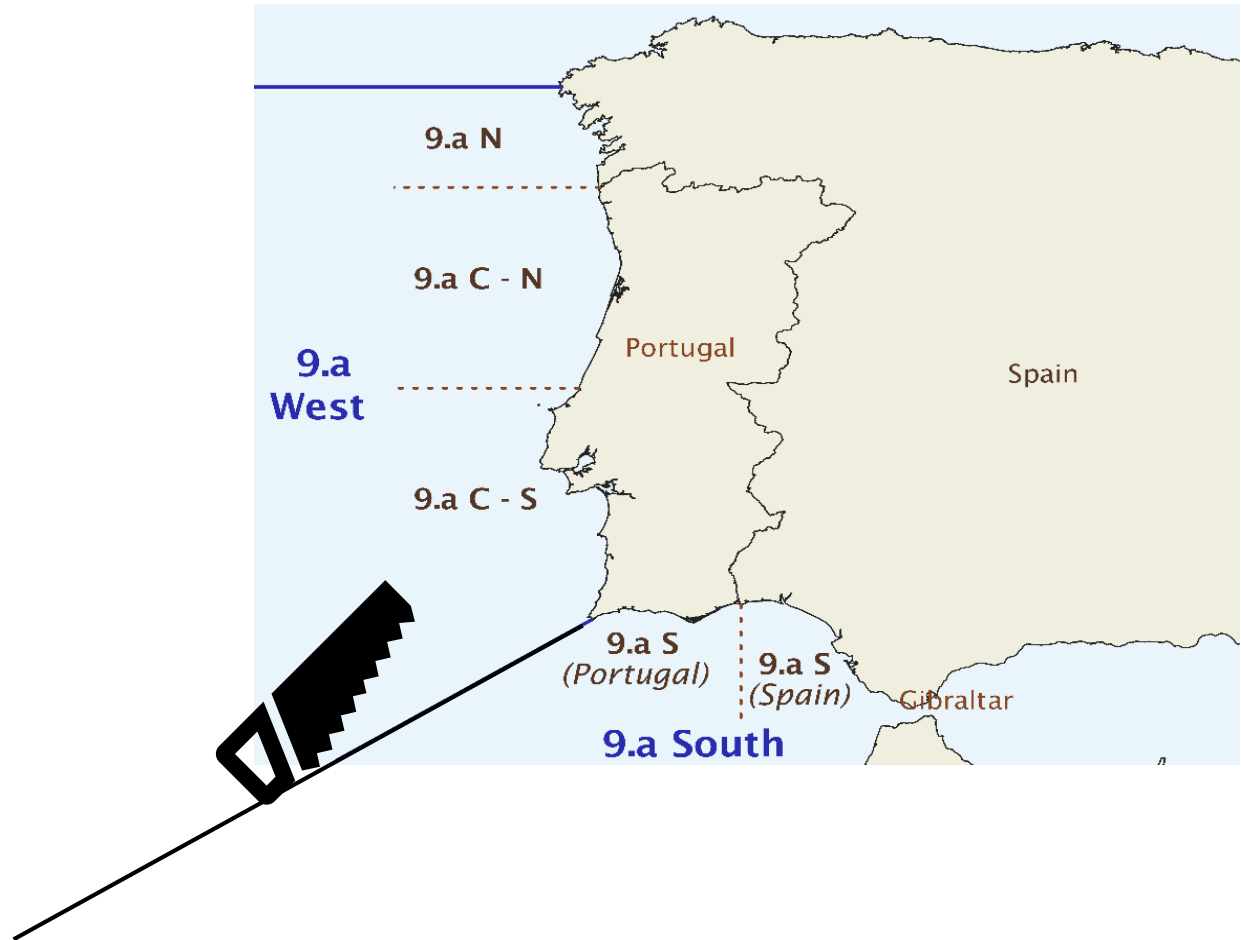


OBJECTIVE

WD to provide state-of-the art and new information on the stock structure of anchovy in the Sub-division 27.9.a.

To submit to ICES SIMWG (Stock Identification Methods WG)

To consider potential separation of the western and southern components of the anchovy 27.9.a into two stock units .



SPRING ACOUSTIC SURVEYS

Adult anchovy core distribution areas in springtime (by decreasing order of importance):

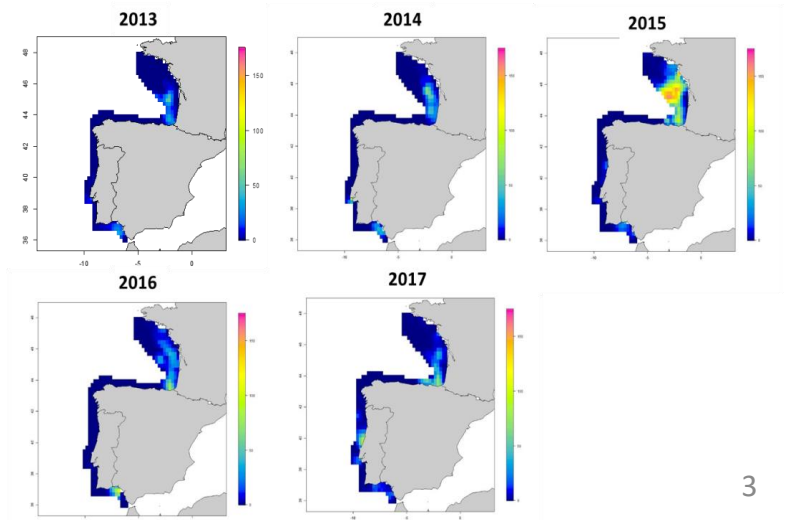
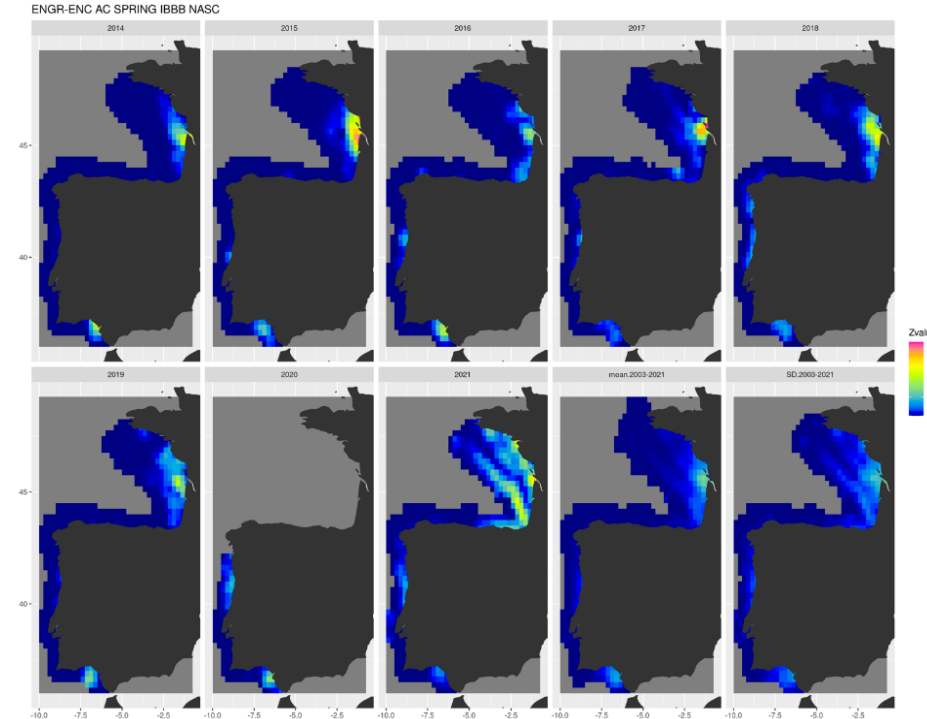
Southern Bay of Biscay (Gironde and Landes coast, $\sim 46^\circ\text{N}$)

Gulf of Cadiz ($\sim 37^\circ\text{N}$)

Northwestern Portuguese coast ($\sim 40^\circ\text{N}$).

Gap in the distribution of adult anchovy in the western side of the Cantabrian Sea and in the southwestern Portuguese coast.

Egg distribution similar to that of the adults



PELAGO SURVEY SERIES

Adult anchovy core distribution areas in springtime in 9a:

Gulf of Cadiz (~37°N)

Northwestern Portuguese coast (~40°N).

Gap in the distribution of adult anchovy in the southwestern Portuguese coast.

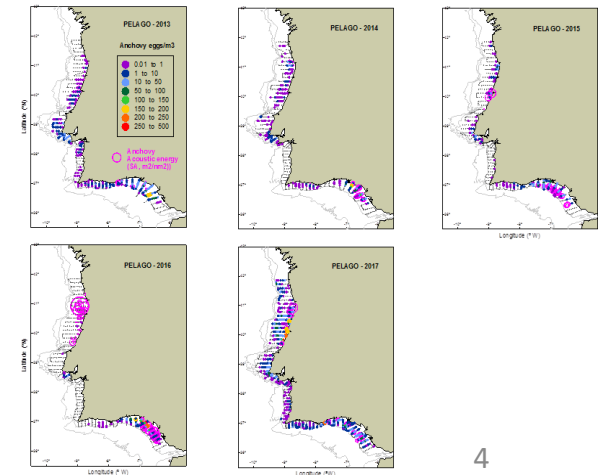
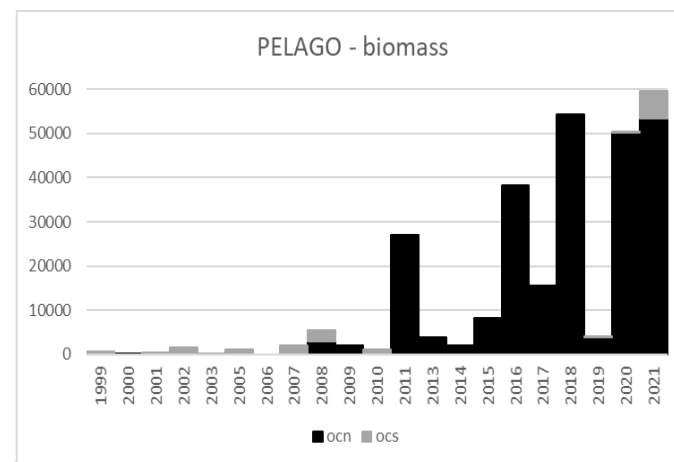
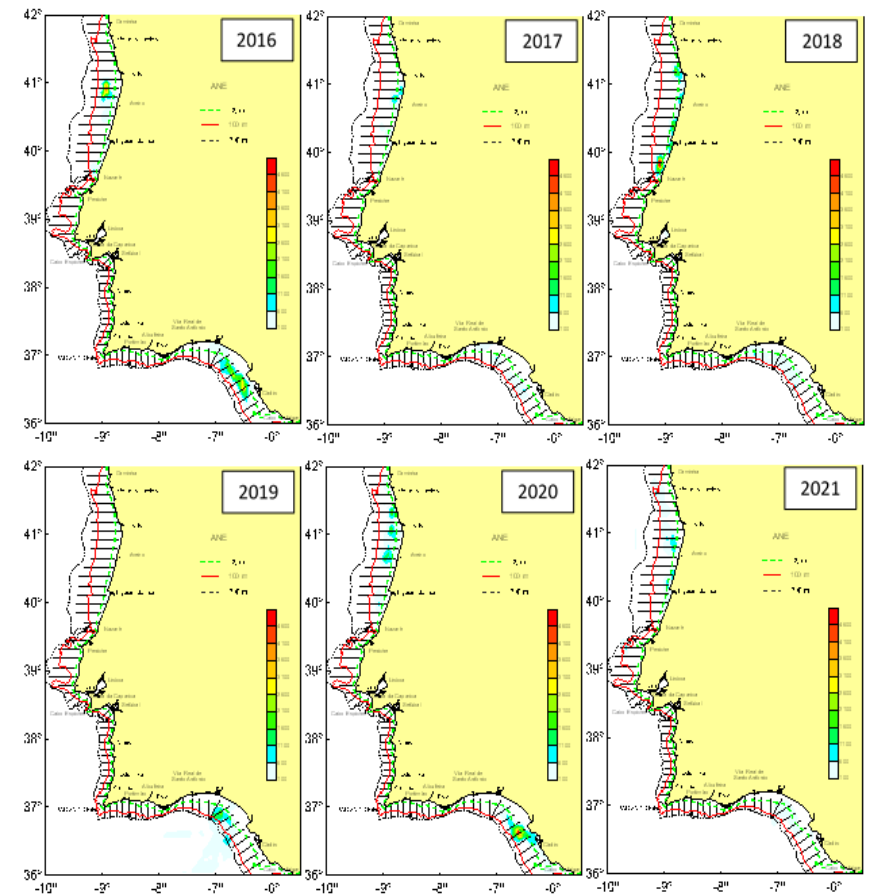
Most fish in 9aCN.

9aCS: 2011-2018: absent

2019: 3%

2020: 0.02%

2021: 10% of total biomass West PT



AUTUMN ACOUSTIC SURVEYS

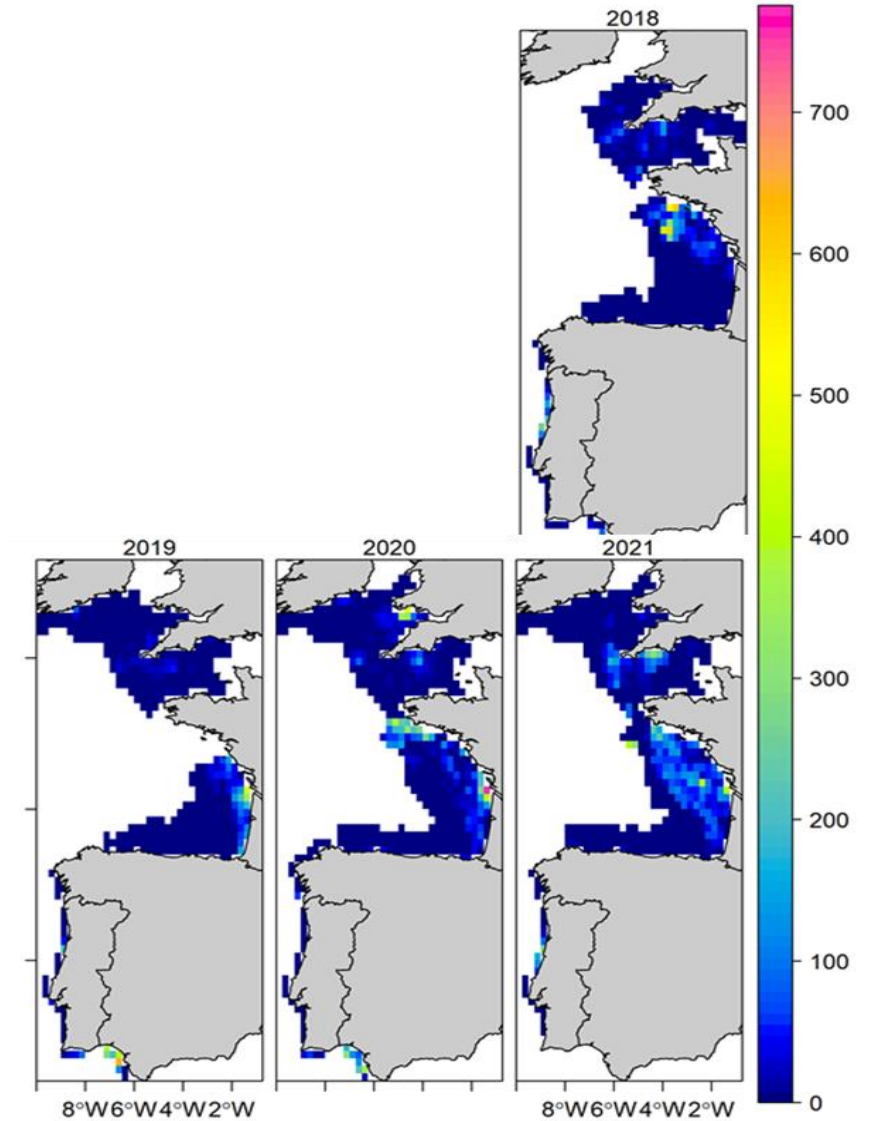
Adult anchovy core distribution areas similar to spring time:

Southern Bay of Biscay (Gironde and Landes coast, $\sim 46^\circ\text{N}$)

Gulf of Cadiz ($\sim 37^\circ\text{N}$)

Northwestern Portuguese coast ($\sim 40^\circ\text{N}$).

Gap in the distribution of adult anchovy in the western side of the Cantabrian Sea and in the southwestern Portuguese coast.



IBERAS ACOUSTIC SURVEYS

9aCN:

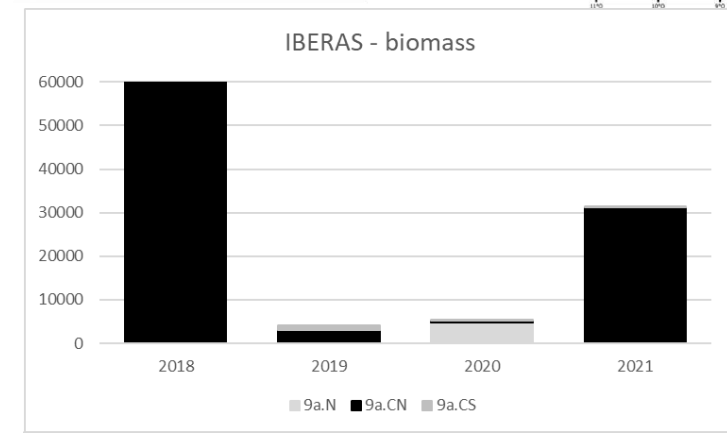
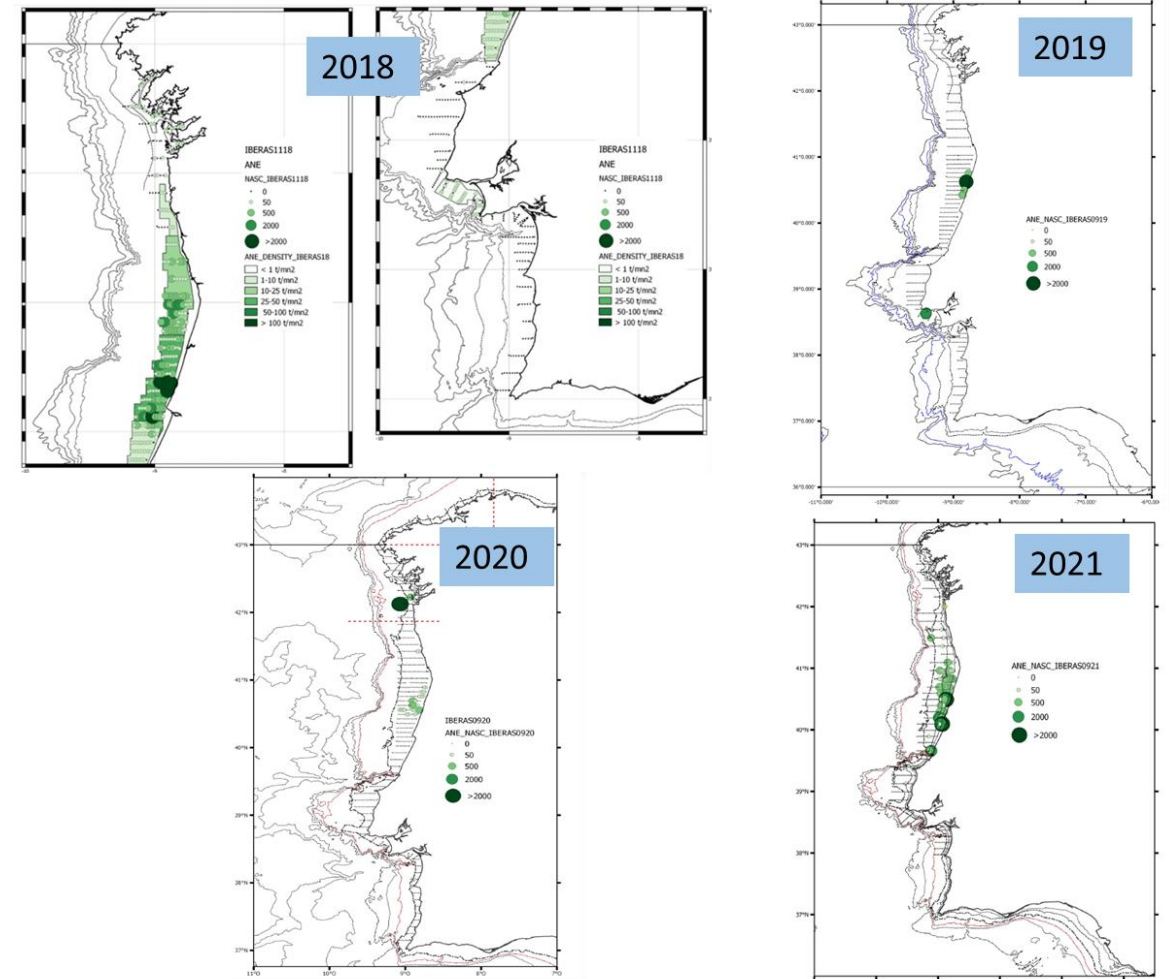
- peak abundance years (>99.9% of total west biomass, 2018 and 2021)
- low abundance year (70%, 2019)
- 2020: Most anchovy was found in the 9a.N area (94%).

9aN:

- Very low abundance except 2020

9aCS:

- very low (<0.2% of west, 2018, 2020 and 2021)
- 29% in the low abundance year (2019): northern part of the SW Iberia, near Lisboa

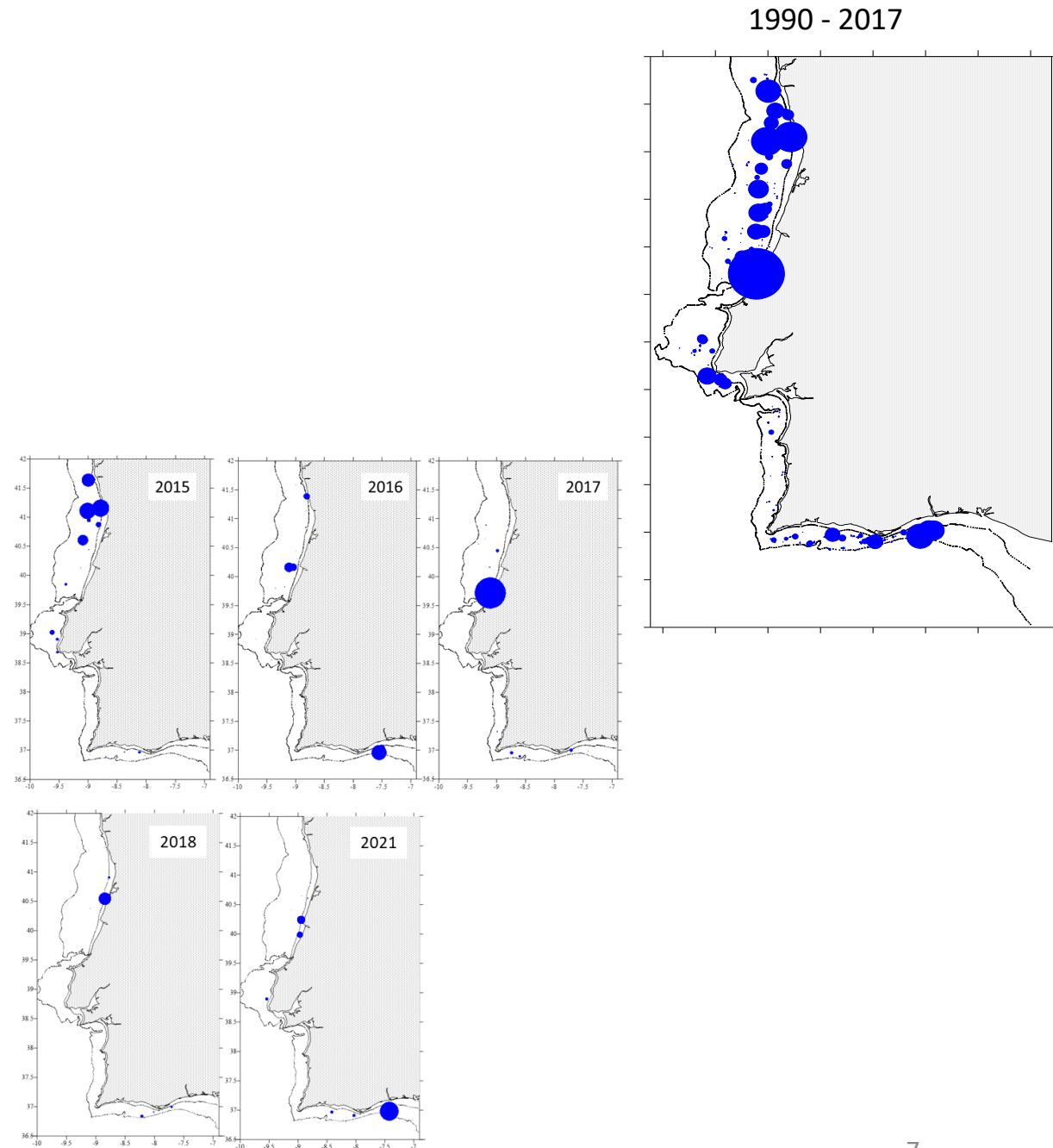


TRAWL SURVEY SERIES

Most fish distributed in 9aCN, particularly near Aveiro - Figueira da Foz and in the southern coast (Algarve).

In sub-area 9aCS: almost limited to the region around Lisbon (similar to spring acoustic surveys).

A persistent gap SW Iberian all years, including the recent peak biomass.



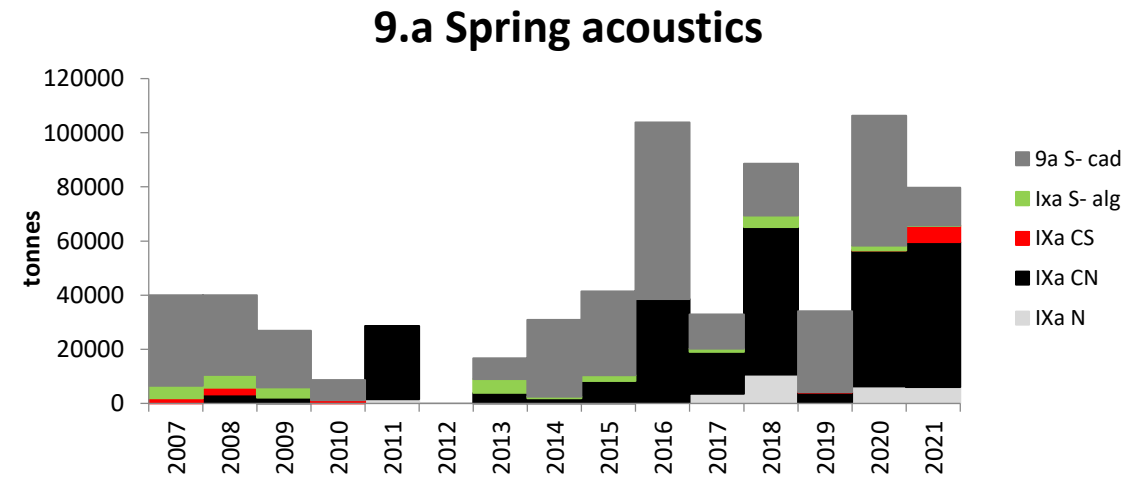
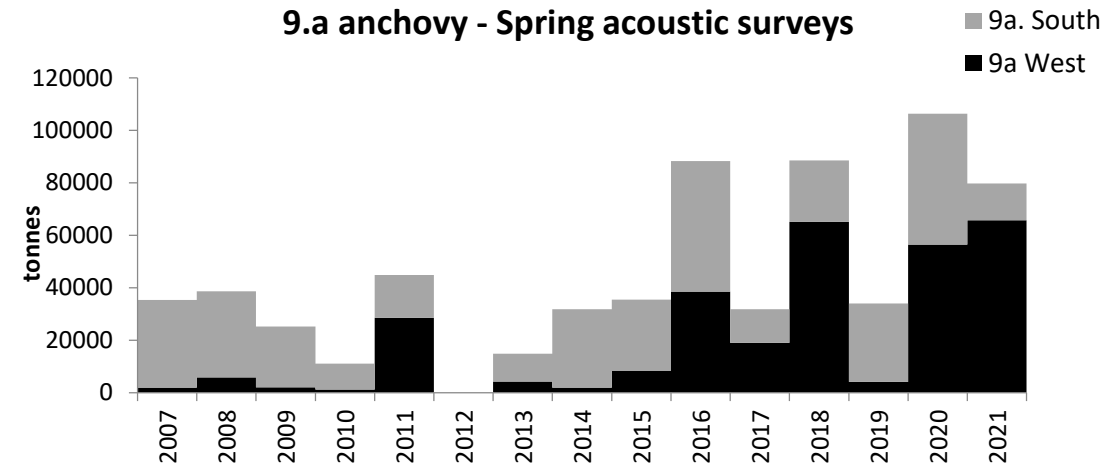
HISTORIC DYNAMICS OF STOCK BIOMASS SIZE INDICATORS

Beginning of the time series (2007 to 2015): most anchovy S Iberia (>70%), exception 2011.

Since 2016: biomass west increased sharply significantly higher in the west in 2018 and 2021, biomass peaked (> 70%).

West Iberia: most 9aCN, followed 9aN, absent or residual 9aCS most years.

South Iberia, Most anchovy 9a South Cadiz, 9a South Algarve residual.



OTHER INDEPENDENT DATA OF ANCHOVY DISTRIBUTION: PORTUGUESE ESTUARIES

Small anchovy (<10 cm) is frequently detected in estuaries (Lima, Douro, Mondego, Tejo, Sado, Mira, Arade and Guadiana)



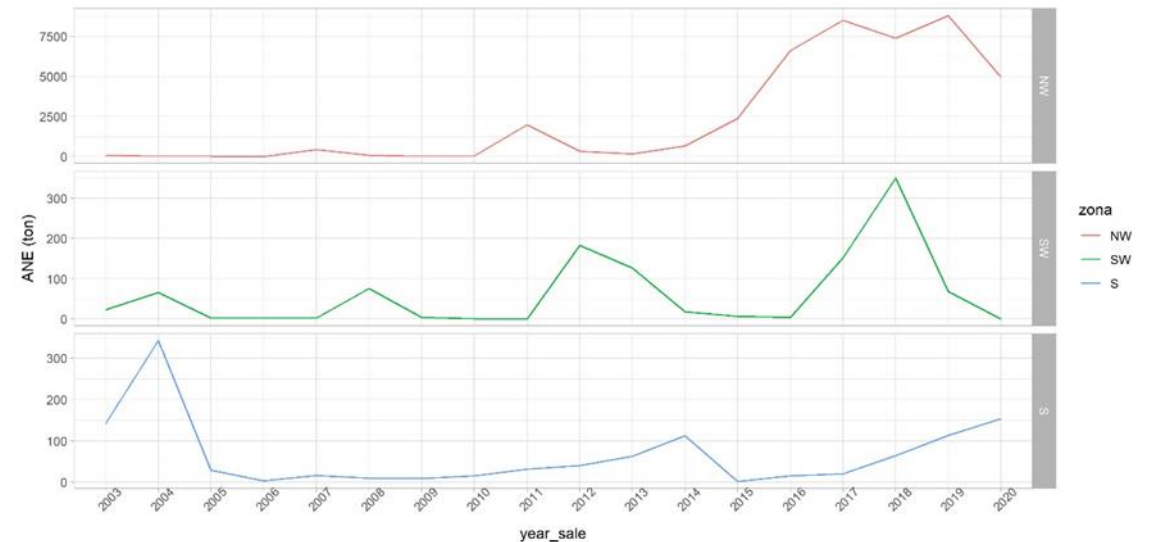
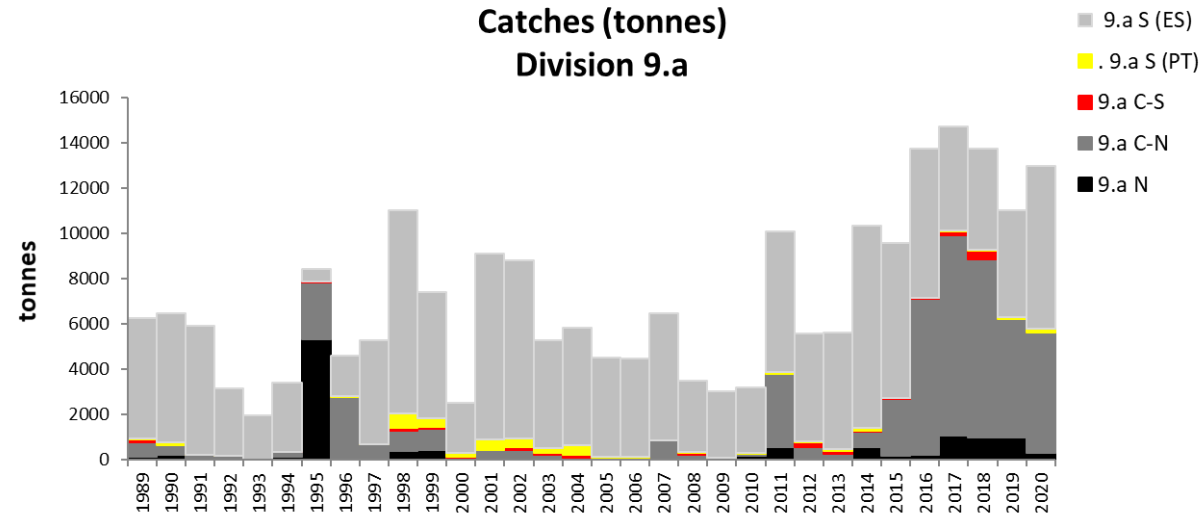
TABLE II. Fish species, grouped by families, that have occurred in the Ria de Aveiro.

Family	Species	1912	1915	1981	1988	1997	1999	2000
Ammodytidae	<i>Ammodytes tobianus</i>	x	x	x	x		x	
Ammodytidae	<i>Gymnammodytes cicerelus</i>							
Ammodytidae	<i>Hyperophus lanceolatus</i>	x		x	x		x	
Anguillidae	<i>Anguilla anguilla</i>	x	x	x	x	x	x	x
Atherinidae	<i>Atherina boyeri</i>				x	x	x	x
Atherinidae	<i>Atherina presbyter</i>	x	x	x	x	x	x	x
Balistidae	<i>Balistes carolinensis</i>						x	
Belontiidae	<i>Belone belone</i>	x	x	x	x	x		
Blenniidae	<i>Lipophrys pholis</i>	x	x					
Blenniidae	<i>Parablennius gattorugine</i>	x	x	x	x		x	x
Blenniidae	<i>Parablennius sanguinolentus</i>	x			x		x	
Callionymidae	<i>Callionymus lyra</i>		x	x	x	x	x	x
Carangidae	<i>Trachurus trachurus</i>	x		x		x	x	x
Centrarchidae	<i>Micropterus salmoides</i>			x				
Clupeidae	<i>Alosa alosa</i>	x	x			x	x	x
Clupeidae	<i>Alosa fallax</i>	x	x	x	x	x	x	x
Clupeidae	<i>Sardina pilchardus</i>	x	x	x	x	x	x	x
Clupeidae	<i>Sprattus sprattus</i>	x	x	x				
Cobitidae	<i>Cobitis taenia</i>			x	x			
Congridae	<i>Conger conger</i>	x	x	x			x	
Cottidae	<i>Taurulus bubalis</i>	x			x			
Cyprinidae	<i>Barbus bocagei</i>		x	x				
Cyprinidae	<i>Carassius auratus</i>	x						
Cyprinidae	<i>Carassius carassius</i>	x	x	x	x	x		x
Cyprinidae	<i>Rutilus macrolepidotus</i>	x	x	x				
Engraulidae	<i>Engraulis encrasicolus</i>	x	x	x	x	x	x	x
Gadidae	<i>Ciliata mustela</i>	x	x	x	x		x	x
Gadidae	<i>Gaidropsarus mediterraneus</i>	x	x		x			

HISTORIC DYNAMICS OF LANDINGS

Most time series landings dominated by 9a South
 – Cadiz, beginning >80% of catches most years.
 West: only in years when abundant.

Since 2016: most catches in the west (9aCN,
 >90% 9aCN

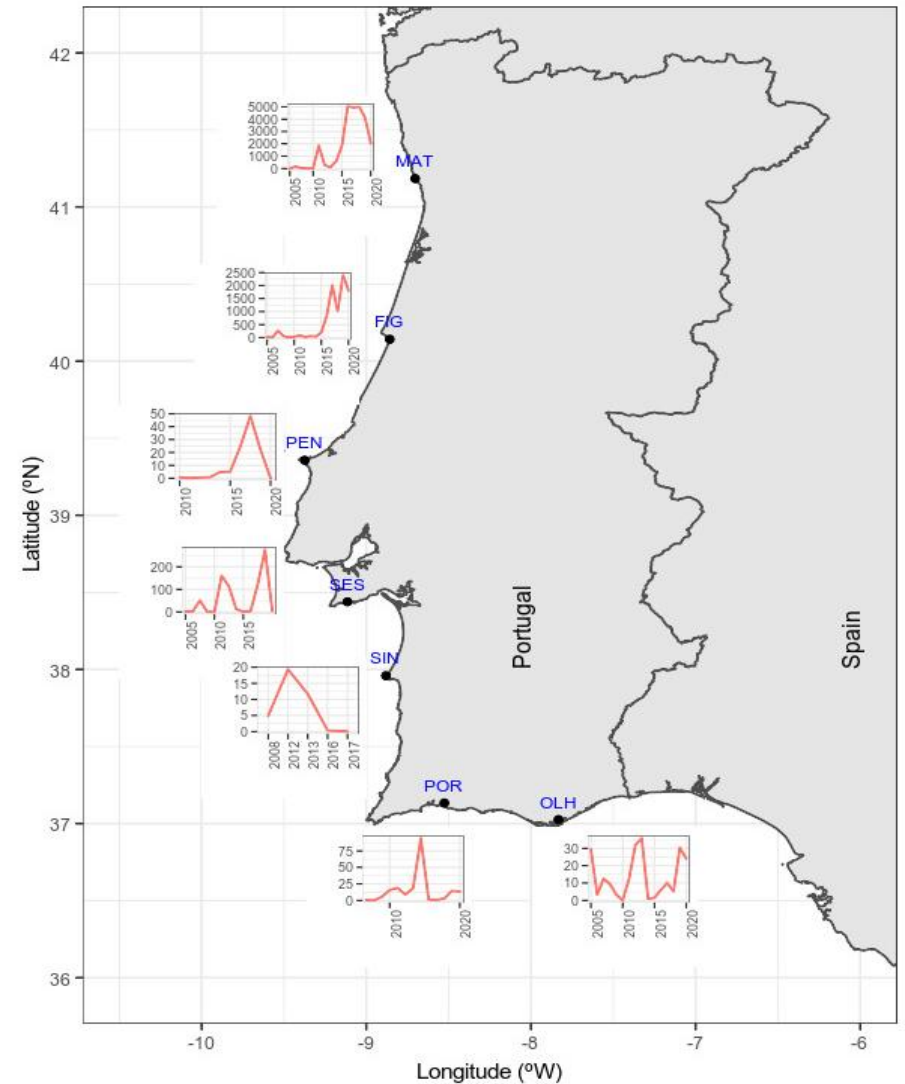


HISTORIC DYNAMICS OF LANDINGS

Distribution of catches by main fishing ports in Portugal:

Great majority north of 9aCN area, followed by the area around Lisbon (port of Sesimbra) with catches 1 order of magnitude lower.

Catches in remaining 9aCS & 9aS-Alg significantly lower

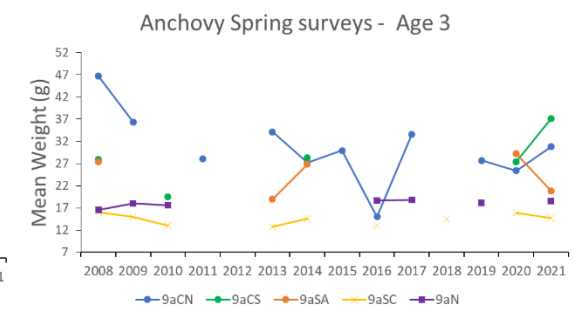
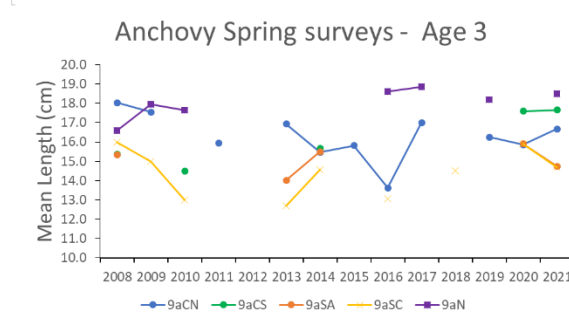
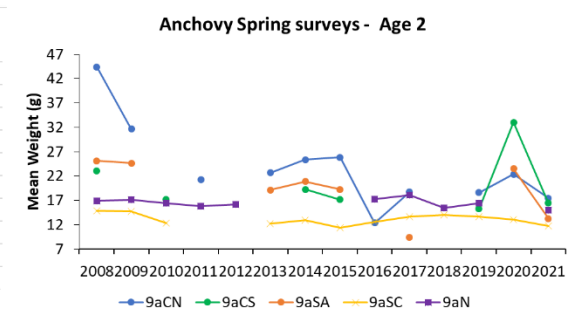
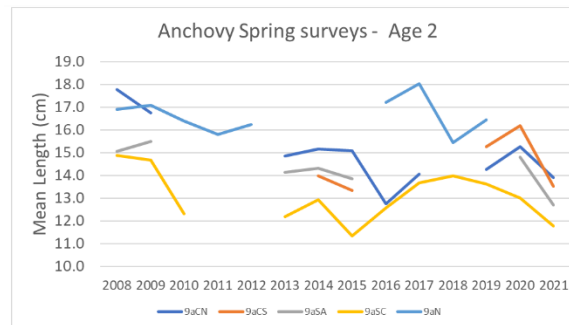
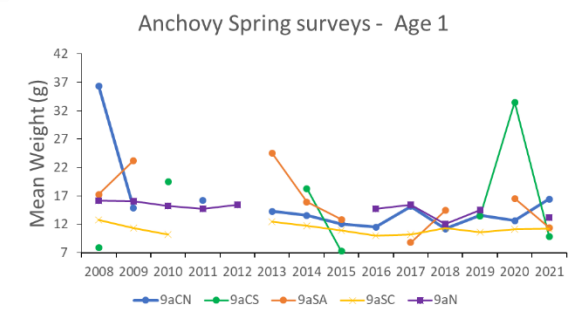
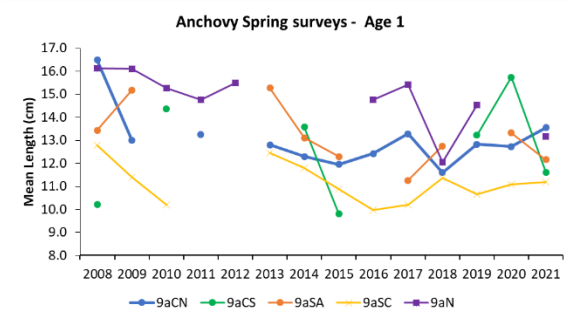


POPULATION DIFFERENCES IN ANCHOVY LIFE HISTORY TRAITS IN DIVISION 9A

Mean length and mean weight of anchovy in spring acoustic surveys is generally lower in the 9aS-Cad, followed by 9aCN: two different recruitment areas.

Mean length/weight in 9a-S-Alg and 9aN generally higher.

Few data 9aCS, similar to 9aCN

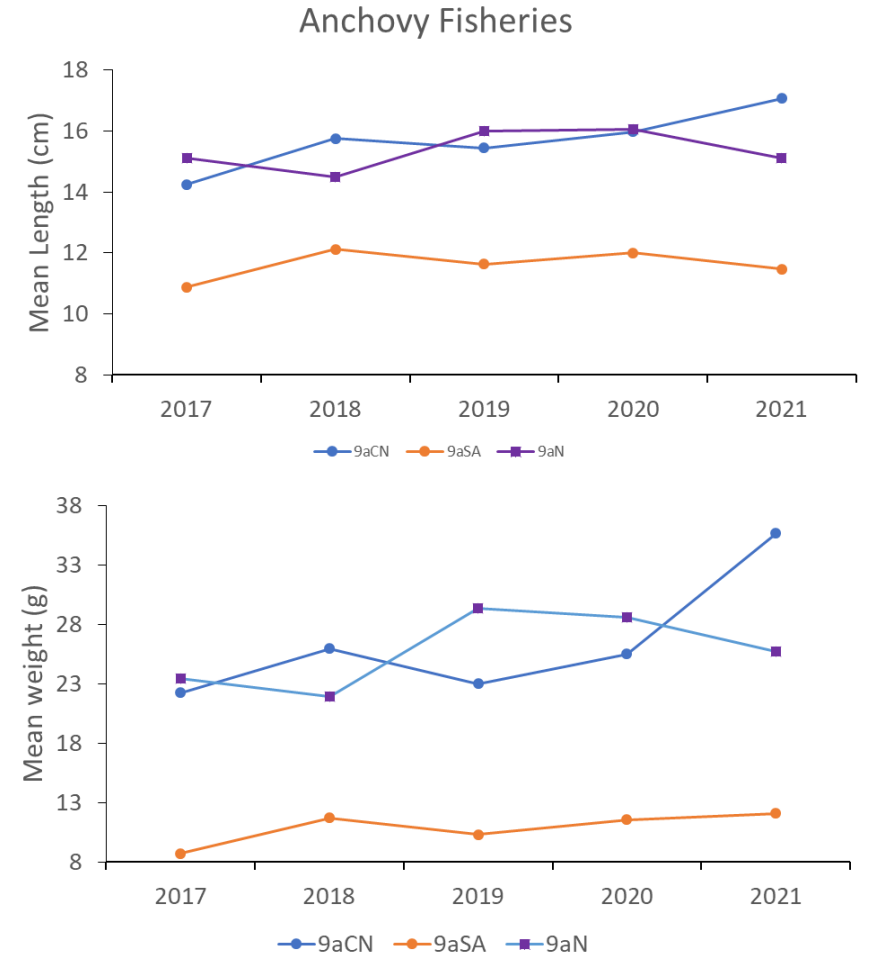


POPULATION DIFFERENCES IN ANCHOVY LIFE HISTORY TRAITS IN DIVISION 9A

Similarly to spring acoustic surveys, mean length and weight at age in the catches is smaller in the 9a South Cadiz area

9aN & 9aCN similar

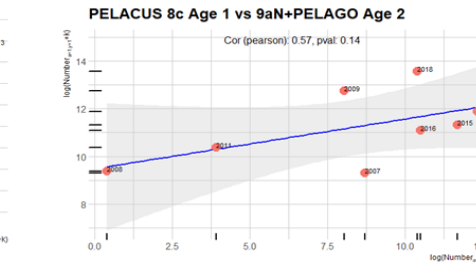
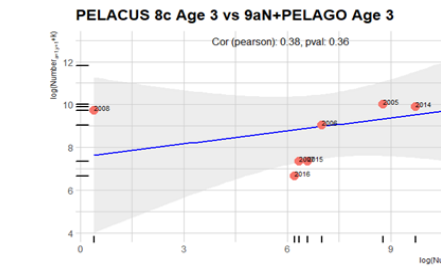
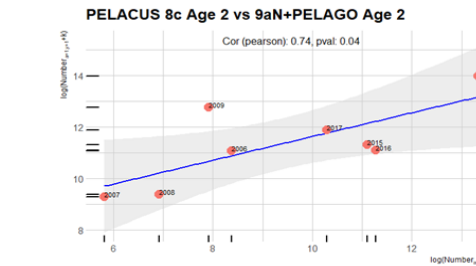
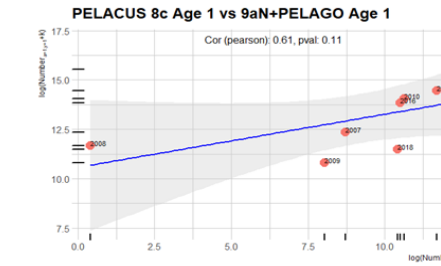
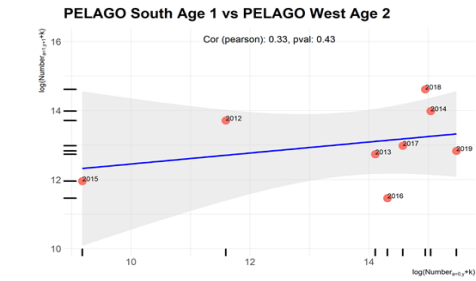
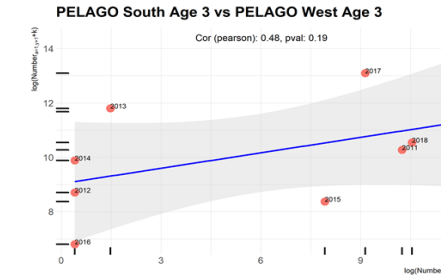
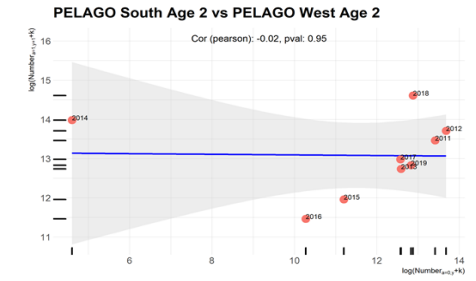
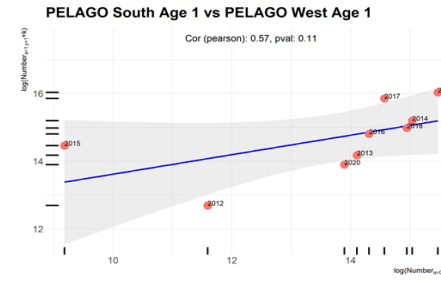
No data 9aCS (very low fisheries)



POPULATION DIFFERENCES IN ANCHOVY LIFE HISTORY TRAITS IN DIVISION 9A

No significant correlation abundance of fish of the same age between the areas (west with south, west with B Biscay).

No correlation was found between age 1 individuals in the South/Biscay with age 2 individuals Western in the following year.



SYNOPSIS OF PUBLISHED WORKS ON POPULATION STRUCTURE

MORPHOMETRICS

Junquera and Pérez-Gándaras (1993): Separation 9aN with Bay of Biscay; in the Cantabrian Sea, intermediate population (west 8c)

Caneco et al. (2004): Separation 9a from Bay of Biscay; north-south cline along the 9a (fish Gulf of Cadiz being mostly different from 9aN). Doubts Algarve (mostly attributed West)

OTOLITH SHAPE ANALYSES

Bacha (2014): Alborán Sea distinct NE Atlantic, including Gulf of Cadiz.

Seven locations in SW Mediterranean & Atlantic until Morocco: 3 stocks: Algero-Provençal Basin, the southern Alborán Sea, and the Atlantic Ocean (Morocco and Gulf of Cadiz).

SYNOPSIS OF PUBLISHED WORKS ON POPULATION STRUCTURE

GENETICS

Borsa, 2004: two ecotypes (oceanic, coastal) that differ genetically and morphologically - Mediterranean Sea

LeMoan et al. 2016, Montes et al. 2016: Same ecotypes Atlantic;

LeMoan et al. 2016; Catanese et al. 2017: ecotypes more different than Med and Atlantic populations. Hybridize.

Magoulas et al. 2006; Borrell et al. 2012, Viñas et al. 2013, Silva et al. 2014a, Silva et al. 2014b: two lineages with different proportions in each area (not ecotypes).

Zarraonaindia et al. (2012): Other two ecotypes (unrelated to the coastal/oceanic ones), associated with narrow or wide oceanic platforms

Petitgas et al. 2012; Montes et al. 2016, Huret et al. 2020: differentiation between North Sea+English Channel and Bay of Biscay. Not consensual (Zarraonaindia et al. 2012, Silva et al 2014a).

Silva et al. 2014a, Zarraonaindia et al. 2012: Differentiation suggested between West Galicia+North of PT with Gulf of Cadiz. (small number of markers, different proportions of ecotype)

Suggest studying proportions between ecotypes.

CONCLUSIONS

Spatial distribution of anchovy in division 9a: discontinuity of the western and south components in several life stages (eggs, juveniles and adults) and seasons of the year.

No correlation of ages between catches or surveys between the two areas, suggesting independent dynamics.

Morphometric and genetic studies are not conclusive as they might be confounded by the presence of the coastal and marine ecotypes. Some genetic and morphometric evidences for the separation of the Gulf of Cadiz anchovy population from that in the western Iberia (although results from the Algarve are generally absent) exists, this need to be confirmed with additional studies considering the complex evolutionary history of this species.

From the evidences presented in the working document, WGHANSA supports the separation of the western and southern components of the anchovy 279a into two stock units: the population in Subdivision 9a South and the populations from sub-divisions in the western coast (9a North, Central-North and Central-South), and therefore submits it to the ICES Stock Identification Methods Working Group (SIMWG) for consideration.