

# Anchovy in Division 9a Southern Component Input data WGHANSA-1 2021

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# Gaps of information in 2020

## Gaps of information in 2020: problems with the IEO's sampling programs.

- IEO's on-shore and at-sea sampling programs were suspended in most of 2020 because administrative problems and to a lesser extent to the Covid-19 disruption (affecting sampling of LFDs of catches, discards sampling/estimates...).
- (Budgetary) Problems in purchasing commercial samples for biological sampling (affecting estimation of maturity, age, ALKs...).
- Abnormal/absence of activity in IEO's labs (3 month closure because Covid-19 disruption: 15 March-21 June).



# Gaps of information in 2020: problems with the IEO's sampling programs.

9aN	Q1	Q2	Q3	Q4	TOTAL
CATCH (t)	14,492	7,029	261,462	26,455	309,438
%CATCH	4,7	2,3	84,5	8,5	100
LFD_samp	0	0	0	0	0
LFD_indiv	0	0	0	0	0
Biol_samp	0	0	0	0	0
Biol_indiv	0	0	0	0	0
Biol_age	0	0	0	0	0

9aS	Q1	Q2	Q3	Q4	TOTAL
CATCH (t)	1284,888	2247,32	2529,799	1100,798	7162,805
%CATCH	17,9	31,4	35,3	15,4	100
LFD_samp	0	0	8	7	15
LFD_indiv	0	0	1824	2390	4214
Biol_samp	0	0	22(1)	16	38(1)
Biol_indiv	0	0	1726(98)	779	2505(98)
Biol_age	0	0	1763	779	2542

Commercial samples and their sampled individuals between parenthesis.

# Gaps of information in 2020: approaches/assumptions to fill the gaps.

- 9a N:

- Discards: Average discards (in t) for the available time-series (2014-2019) show that quarterly discards could be considered, for the time being, as negligible, almost null, in subdivision 9a N. Therefore, discards in Q1 and Q2 in 2020 (not sampled) will be considered = 0. Landings = Catches.

- LFDs & ALKs: quarterly catches raised to the adjacent 9a CN quarterly LFDs, ALKs (& LWRs).

- 9a S\_ES:

- Discards: discards in Q1 (80 t) and Q2 (41 t) estimated by applying the average discard/catch ratio throughout the time-series. Notwithstanding the above, discards will also be considered as negligible in Q1 and Q2 in 9a S in 2020 and = 0.

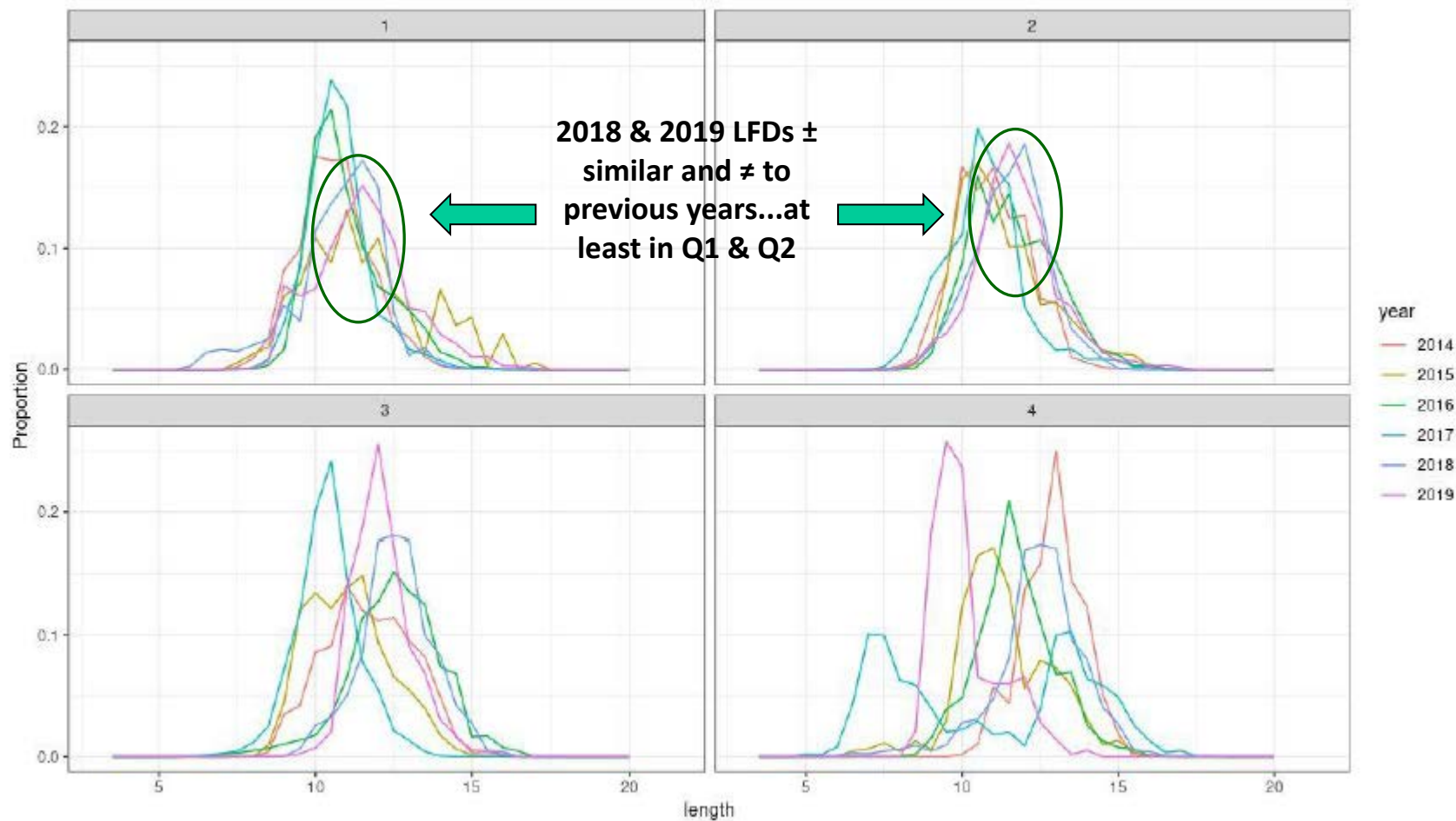
- LFDs & ALKs: No LFDs & ALKs from 9a S\_PT. 2 alternatives to raise Q1 & Q2 9a S total catches:

- to apply Q1<sub>2019</sub> and Q2<sub>2019</sub> LFDs & ALKs (&LWRs).

- to apply Q1<sub>2018+2019</sub> and Q2<sub>2018+2019</sub> LFDs & ALKs (&LWRs). No significant inter-annual differences (K-S test, Fisher test), at least in Q1 and Q2 LFDs.

# Gaps of information in 2020: approaches/assumptions to fill the gaps.

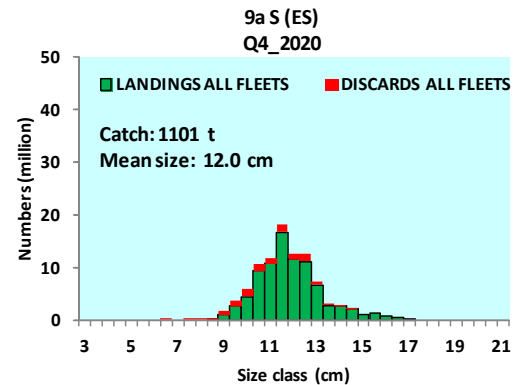
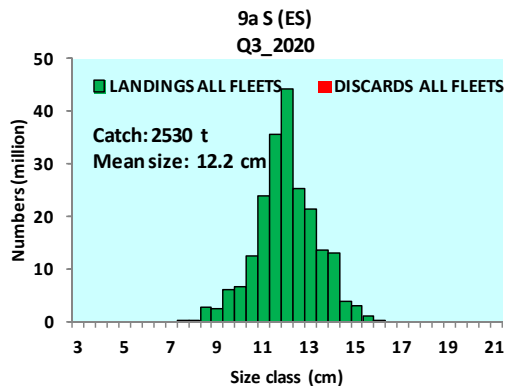
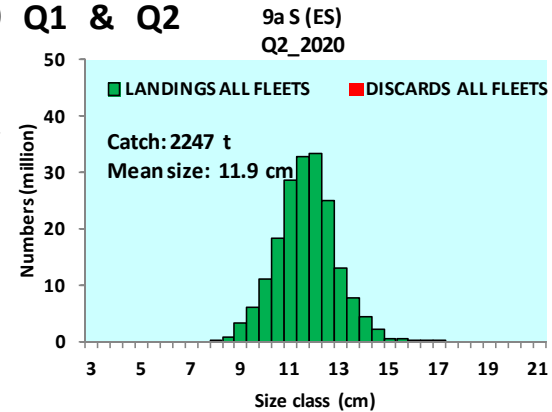
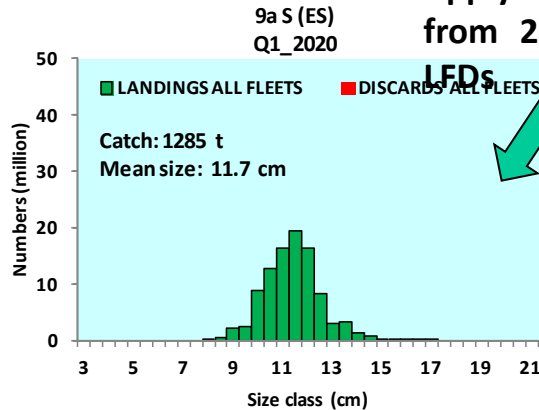
Quarterly LFDs of catches (all fleets) in 9a S Spanish fishery (2014-2019)



# Gaps of information in 2020: approaches/assumptions to fill the gaps.

Quarterly LFDs of catches (all fleets) in 9a S Spanish fishery in 2020 after raising procedures to fill the gaps.

Applying % by size class  
from 2018+2019 Q1 & Q2

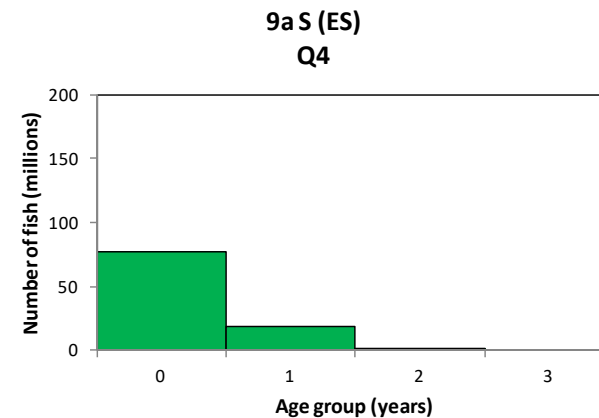
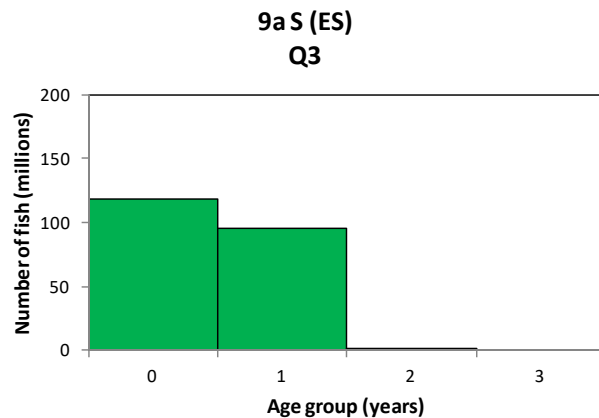
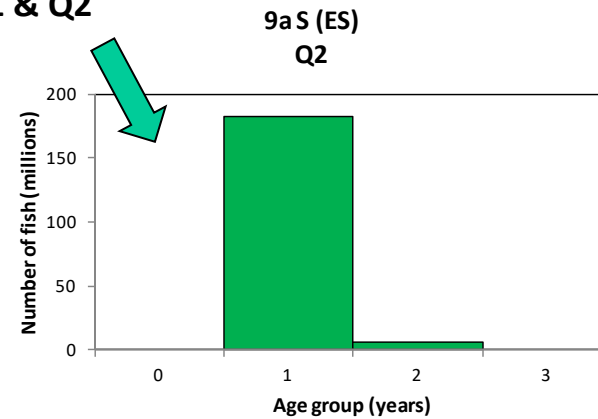
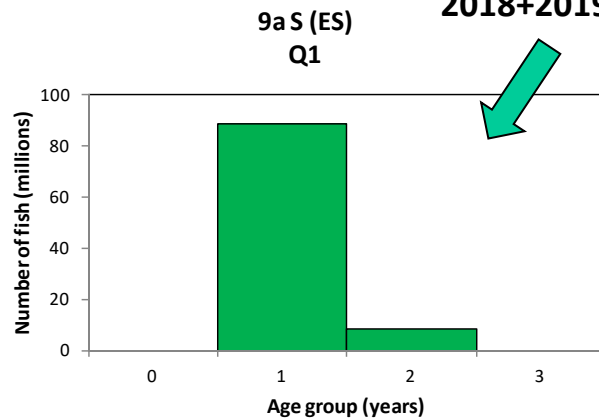




# Gaps of information in 2020: approaches/assumptions to fill the gaps.

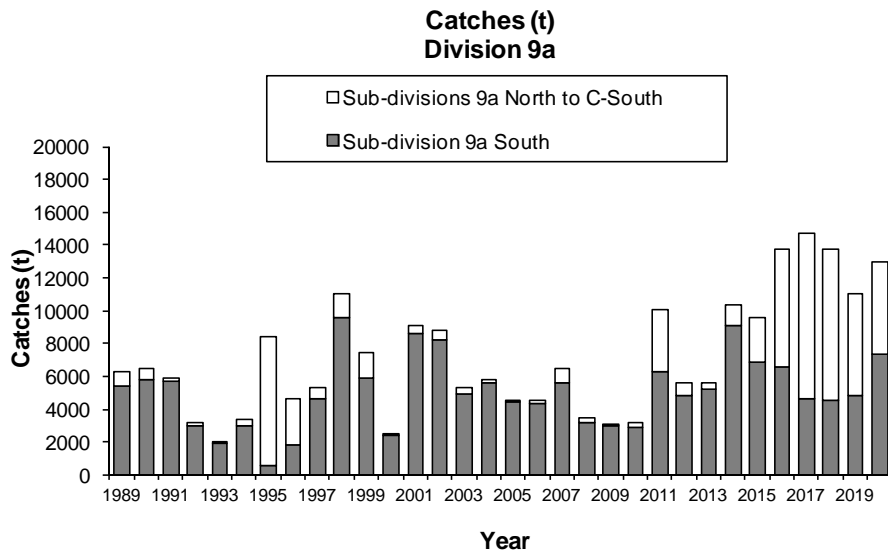
Quarterly Catch-at-Age (all fleets) in 9a S Spanish fishery in 2020 after raising procedures to fill the gaps.

Applying ALKs & LWRs from 2018+2019 Q1 & Q2



# The fishery in 2020: Catches

# The Anchovy fishery in the Southern component in 2020:



- **↑** Division 9a: **12 956 t**, a 18% increase in relation to 2019 (11 014 t). Consecutive historical maxima in the recent historical series (since 2016).
- **↓** Western Component: **5639 t** (6200 t in 2019). 9% decrease. 44% of catches in the Division. Well above the historical mean (1983 t). 2016-2020 recent period of high catches.

## Last catch advice (July 2020-June 2021):

Total stock: **15 669 t**.

Western comp.: **4347 t**; Southern comp.: **11 322 t**.

## Agreed TAC (July 2020-June 2021):

Total stock: **15 669 t**.

PT: **8175 t**.

ES: **7494 t** (9a N: 85 t; **9a S: 7409**) + **734 t** (9a N: 114 t; **9a S: 621 t**)

By Interannual flexibility  
↓

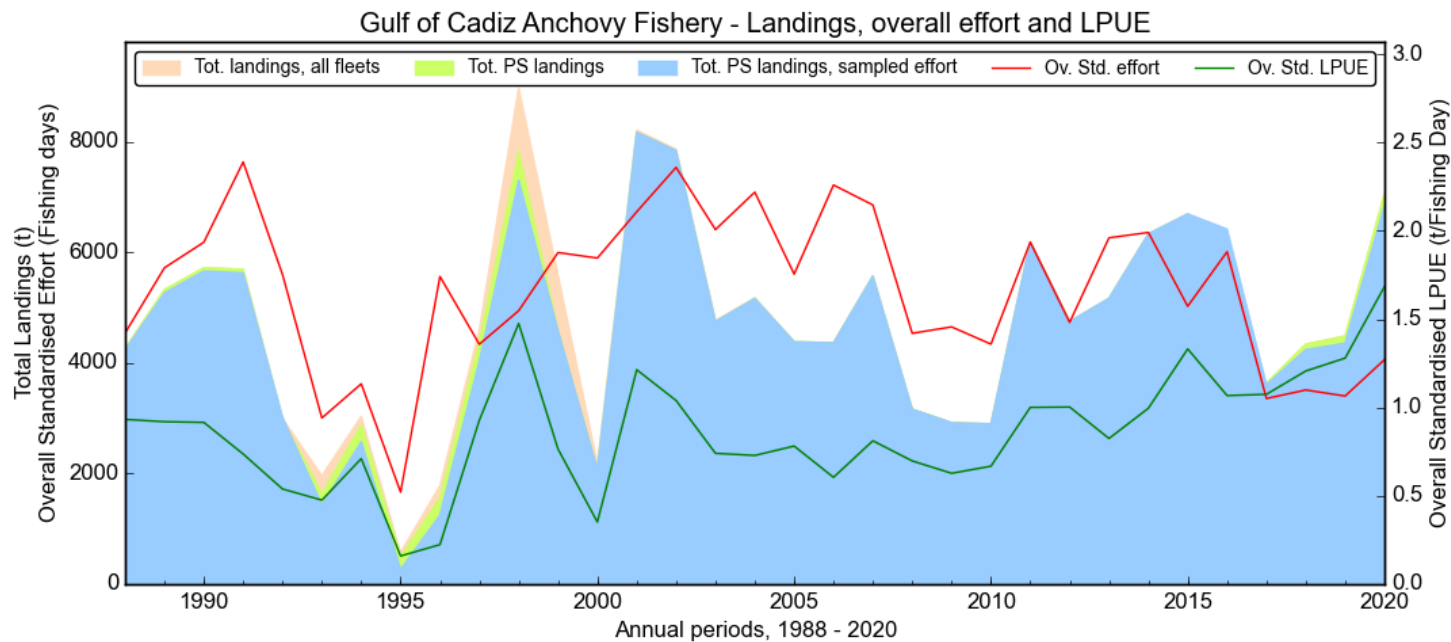
## Provis. Estimated catches (July 2020-June 2021):

Western comp.: **5421 t**.

Southern comp.: **5700 t**.

- **↑↑** Southern Component (9a S): **7317 t** (4814 t in 2019). 52% increase. 56% of catches in the Division.
  - PT: **155 t** (113 t in 2019).
  - ES: **7163 t** (4701 t in 2019):
    - Official: **7058 t**.
    - Unallocated: **0 t**.
    - Discards: **105 t**. (0 t PS; 105 t OTB) (1.5% of total catch).
- Purse-seiners: 98.5% of total catches in the Southern Component.

## Southern Component: the Gulf of Cadiz Anchovy Spanish PS fishery. Anchovy specific standardised effort and CPUE.



- Strong decrease in effort and landings in 2017.
- 2018-2020: relatively stable trend in effort (some increase in 2020) coupled with steeply increasing catches resulted in a increasing trend in lpue (from less than 1 t to at around 1.2-1.7 t/fishing day).
- But, warning !!:
  - LPUE= total landings/total positive fishing trips (=daily sales per vessel).
  - LPUE probably overestimated? The fleet probably invests more searching time than expected.

Southern Component: Starting catch for  $C_{y-1}$  for the advice this year (July 2021).

$$C_y = C_{y-1} \frac{I_y}{\sum_{y-2}^{y-1} I_i / 2}$$

$C_{y-1}$ : Catch advice for the previous management period, i.e. the period July 2020 to June 2021, for a management year lasting from July in the year  $y$  to June in the year  $y+1$ .

$$C_{y-1} = \mathbf{11\ 322\ t}$$

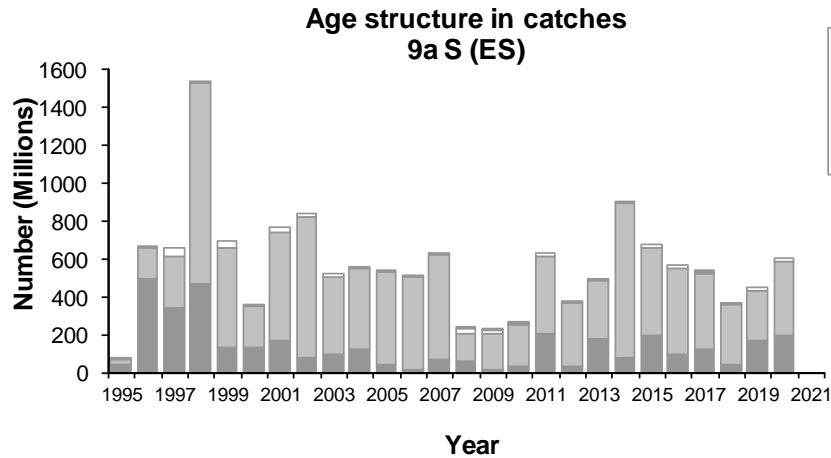
$I_y$  and  $I_i$  are Gadget outputs (Biomass estimates)

# The fishery in 2020: Sizes and Ages in catches

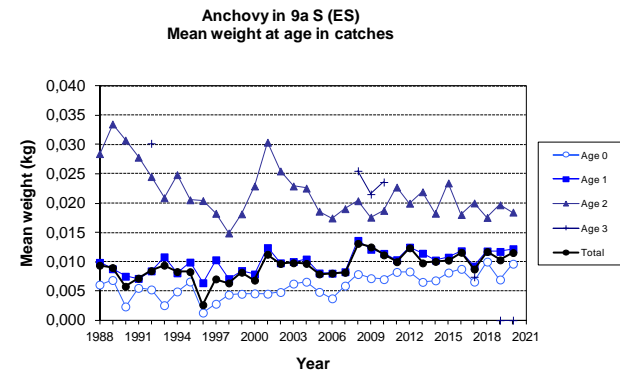
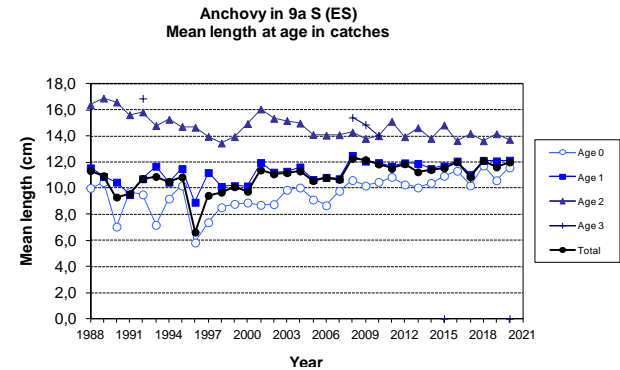
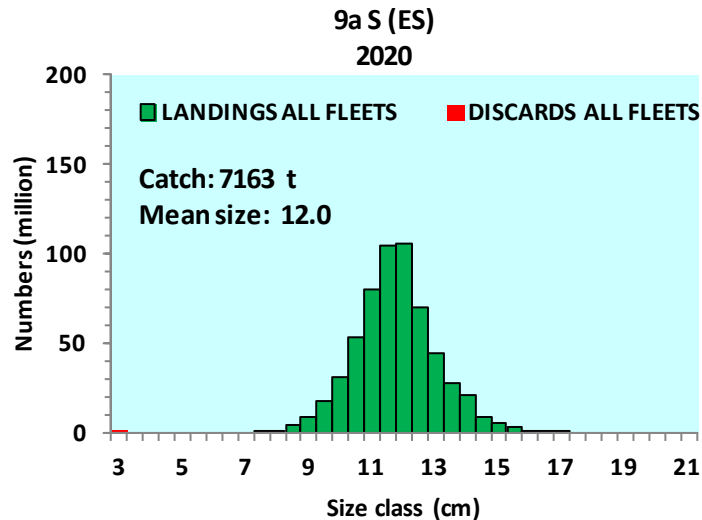
Southern component: the Portuguese fishery. CANUM, LFD, Mean size & Weight in catches.

- Total catches in 2020:
  - ✓ 9a S (PT): **155 t**:
    - PS= 153 t.
    - MIS\_MIS= 1 t.
    - OTB\_DEF= 0.1 t.
- Mainly in Q2 & Q3.
- No discards. Landings=Catches.
- Neither LFD nor age structure available for 2020 catches. Raised to the adjacent 9a S\_ES LFDs & ALKs.

# Southern component: the Spanish fishery. CANUM, LFD, Mean size & Weight in catches.



- Total catches in 2020: **7163 t** (7058 t L + 105 t D)
  - 599 million fish (35% increase in numbers with respect to 2019= 446 millions). 20% increase in age 0 anchovies. 46% increase in age group 1. 2% decrease in age 2. Age 1 dominated the catches (64%). No age 3 fish. Incidental occurrence of age group 3 in the catch time-series.
  - Total mean length and weight: 12.0 cm and 11.5 g. Similar values than in precedent years.



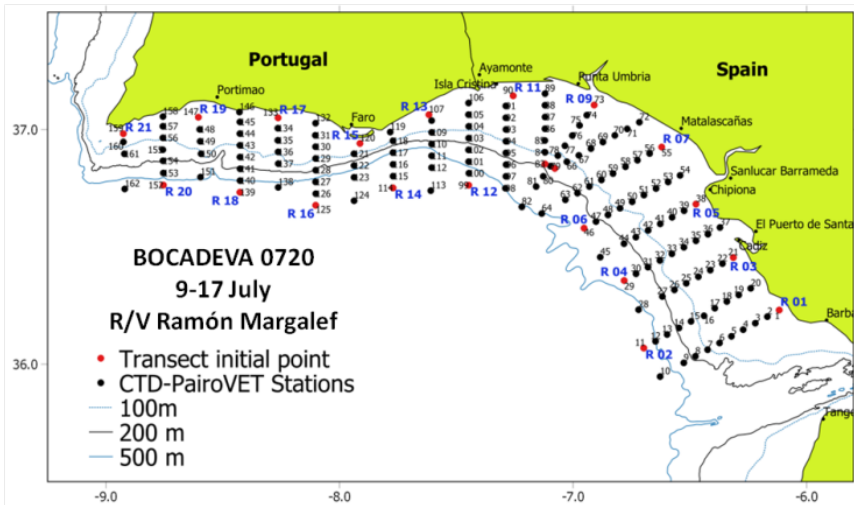


# Surveys' direct information

# Fishery-independent information: Surveys in 2020 (postWG)-2021

Sub-division	Summer 2020	Autumn 2020	Spring 2021
9a N		IBERAS 0920 (PT & ES)	PELACUS 0321 (ES)
9a CN			
9a CS			PELAGO 21 (PT)
9a S	BOCADEVA 0720 (ES) ECOCADIZ 2020-07 (ES)	ECOCADIZ-RECLUTAS 2020-10 (ES)	

# Fishery-independent information: DEPM in 2020 (post-WG). Summer survey. *BOCADEVA 0720*: 09-17/07/2020. 9a South. (I)



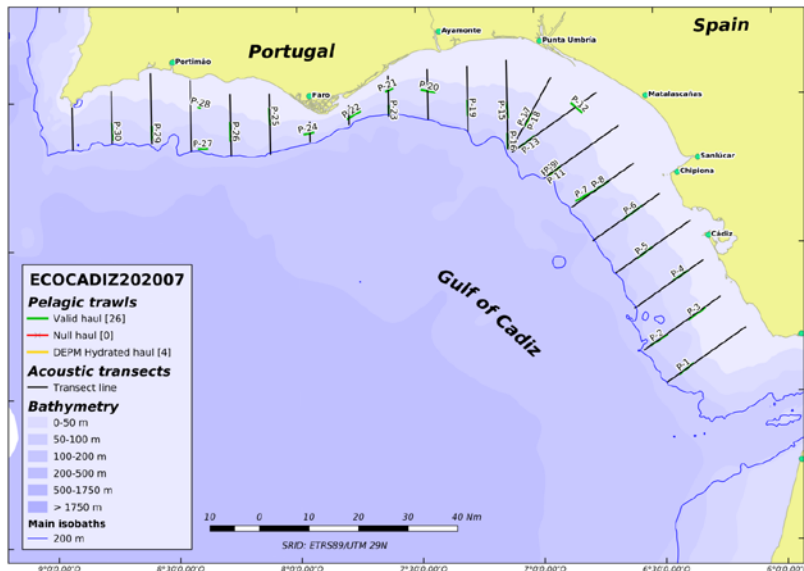
## Eggs sampling:

**BOCADEVA 0720** survey: GoC Anchovy DEPM survey (20-200 m depth). R/V *Ramón Margalef* (IEO). Summer.

## Coupled sampling:

Ichthyoplankton/hydrographic

- 21 transects (= *ECOCADIZ*).
- 162 PairoVET (150  $\mu$ m mesh size)+CTD stations.
- 152 CUFES (335  $\mu$ m mesh size)+TSG-F stations.



## Adult sampling:

*ECOCADIZ 2020-07* (01-14/08/2020). Acoustic-trawl survey. R/V *Miguel Oliver* (Spanish Fisheries Secretariat). Summer.

- 21 positive hauls + 4 night hauls (searching hydrated females).
- 1726 sampled indiv. (1677 aged).
- 686 ovaries.
- 180 hydrated females.

# Fishery-independent information: DEPM in 2020 (post-WG). Summer survey. *BOCADEVA 0720*: 09-17/07/2020. 9a South. (II)

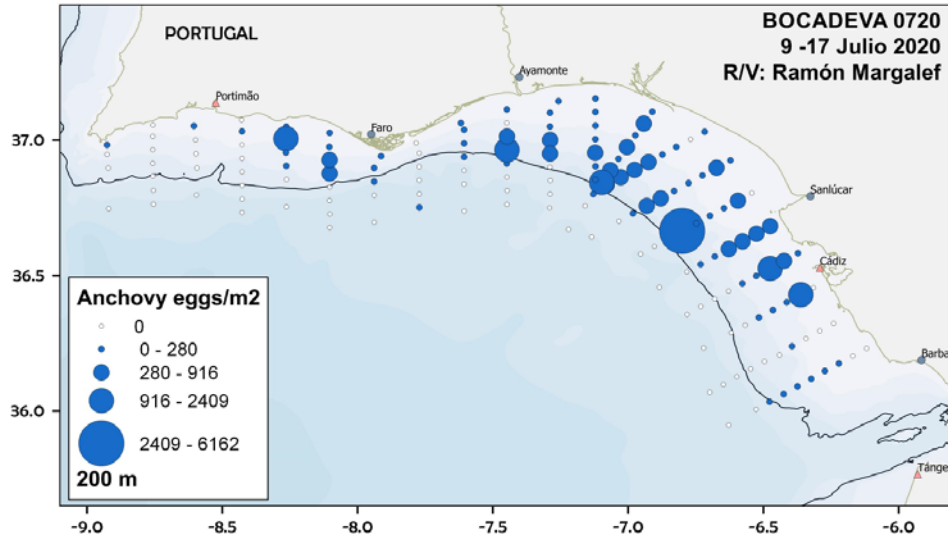
## PairoVET

Total surveyed area: **16 223 km<sup>2</sup>**.  
Positive area: **10 058 km<sup>2</sup> (62%)**.

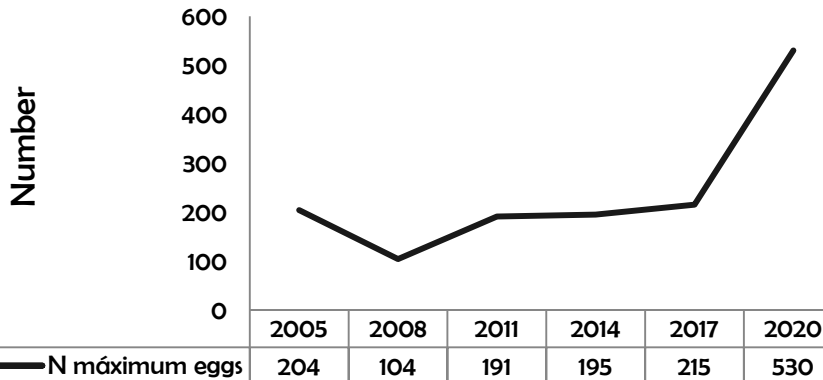
Total stations: **162**.  
Positive stations: **86 (53%)**.

Total Anchovy eggs: **2916**.  
Max. number: **530**.

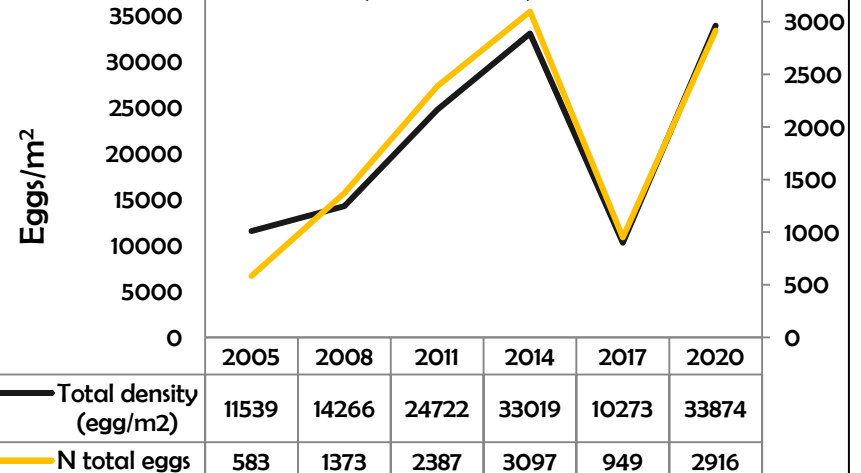
Total density: **33 873.9 eggs/m<sup>2</sup>**.  
Max. density: **6161.6 eggs/m<sup>2</sup>**.



Maximum number of Anchovy eggs by PairoVET station (Gulf of Cadiz)



Anchovy eggs by PairoVET (Gulf of Cadiz)



Fishery-independent information: DEPM in 2020 (post-WG). Summer survey.  
*BOCADEVA 0720*: 09-17/07/2020. 9a South. (III)

## EGG PARAMETERS

$$P_0 \text{ (eggs/m}^2\text{/day)} = \mathbf{523.4 (0.44)}.$$

$$Z \text{ (day}^{-1}\text{)} = \mathbf{-1.1124}.$$

$$P_{\text{total}} \text{ (eggs/day)} = \mathbf{5.264431e+12 (0.38)}.$$

## ADULT PARAMETERS

$$W = \mathbf{16.630 (0.13)}.$$

$$F = \mathbf{8212 (0.14)}.$$

$$R = \mathbf{0.543 (0.009)}.$$

S: in process

## PRELIMINARY GOC ANCHOVY SSB 2020

$S = 0.241$  (time-series mean value, used provisionally)

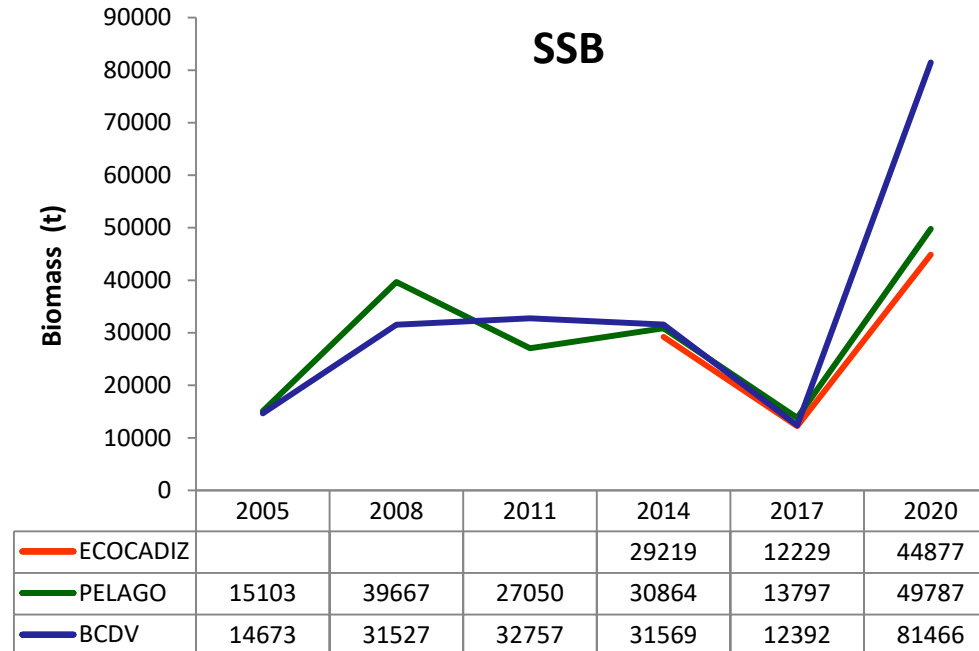
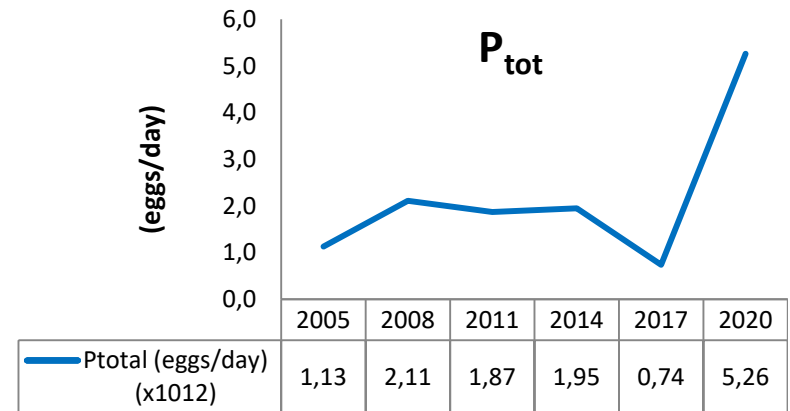
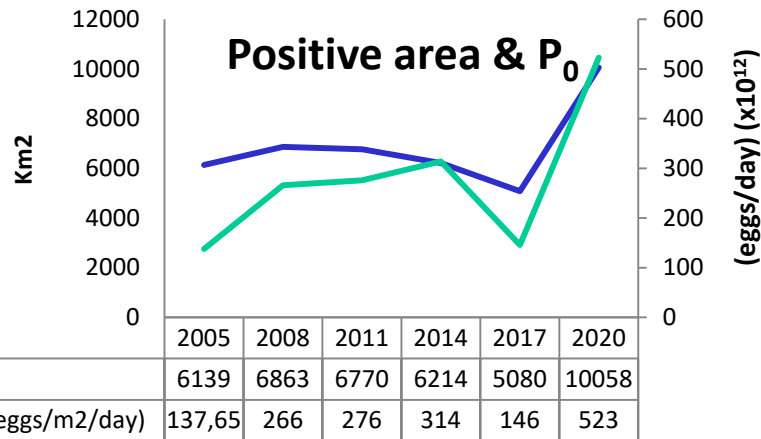
$$\text{SSB} = \mathbf{81\ 466 (0.43)}.$$

Fishery-independent information: DEPM in 2020 (post-WG). Summer survey.  
*BOCADEVA 0720: 09-17/07/2020. 9a South. (IV)*

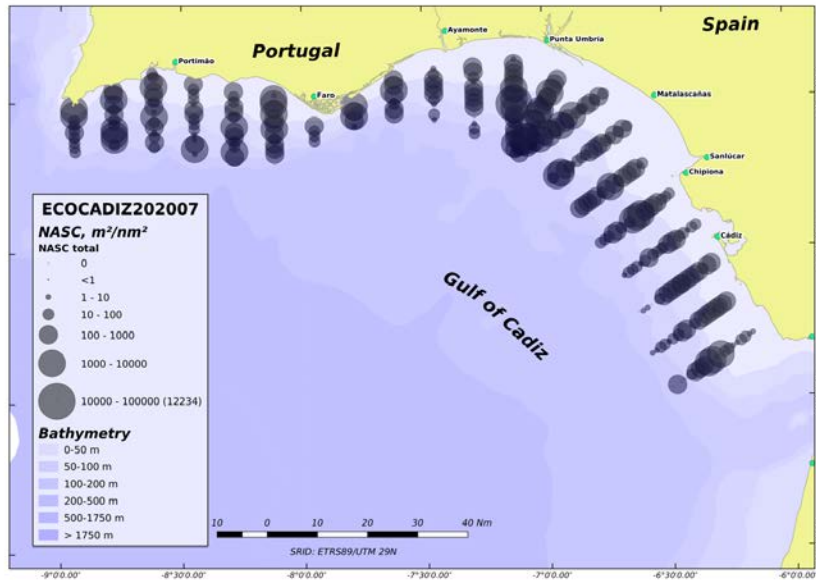
Year	2005	2008	2011	2014	2017	2020
<b>Eggs</b>						
$P_0$ (eggs/m <sup>2</sup> /day)	138	266	276	314	146	<b>523</b>
Z (day <sup>-1</sup> ) (CV)	-0.039	-1,43	-0.29	-0.33	-0,16	<b>-1.11</b>
$P_{total}$ (eggs/day) (x10 <sup>12</sup> )	1,13	2,11	1,87	1,95	0,74	<b>5,26</b>
Surveyed area (km <sup>2</sup> )	11982	13029	13107	14595	15556	<b>16223</b>
Positive area (km <sup>2</sup> )	6139	6863	6770	6214	5080	<b>10058</b>
<b>Adults</b>						
Female Weight (g)	25.2 / 16.7	23,7	15,2	18,2	16,2	<b>16,6</b>
Batch Fecundity	13820/ 11160	13778	7486	7502	7507	<b>8212</b>
Sex Ratio	0.53 / 0.54	0,528	0,531	0,54	0,53	<b>0,54</b>
Spawning Fraction	0.26 / 0.21	0,218	0,276	0.276	0,243	<b>0,241 (1)</b>
<b>SSB</b>						
SSB (t)	14673	31527	32757	31569	12422	<b>81466</b>

(1) Time-series mean value

# Fishery-independent information: DEPM in 2020 (post-WG). Summer survey. *BOCADEVA 0720: 09-17/07/2020. 9a South. (V)*



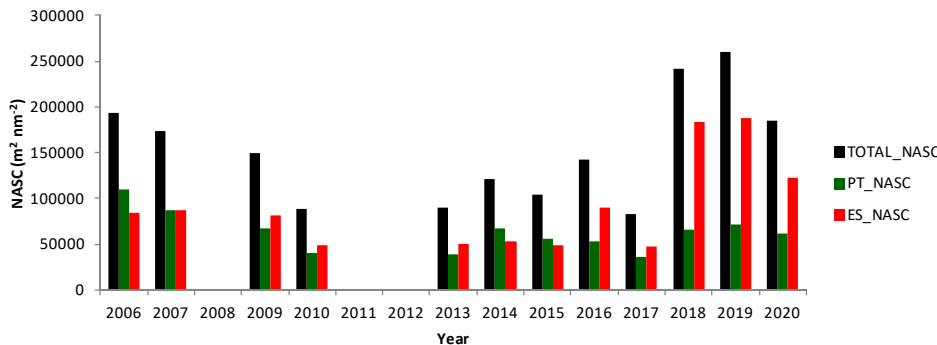
# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Summer survey. *ECOCADIZ 2020-07*: 01-14/08/2020. 9a South. (I)



***ECOCADIZ 2020-07*** survey: Gulf of Cadiz pelagic ecosystem survey (20-200 m depth). RV *Miguel Oliver* (SGP). Summer.

21 transects. 26 valid hauls. 4 extra night hauls to collect hydrated females (DEPM). No CUFES (in *BOCADEVA*). 158 CTD-LADCP st. TSG-F. Top predator census.

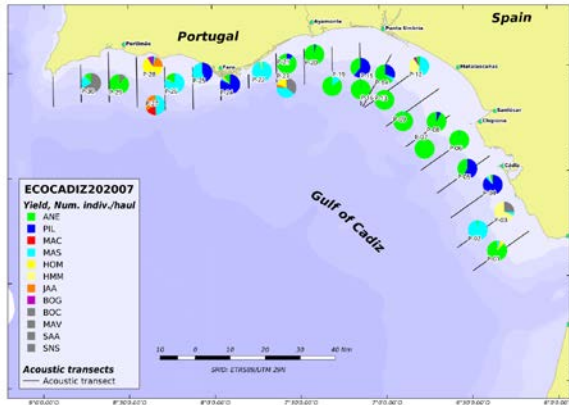
The total NASC allocated to the “pelagic fish species assemblage” showed a slight decrease in relation to the time-series maxima for TOTAL-NASC and ES\_NASC recorded in 2018 and 2019. Even so, above the historical mean.



Anchovy (35%), chub mackerel (24%) and sardine (23%) the main contributors to the total NASC.

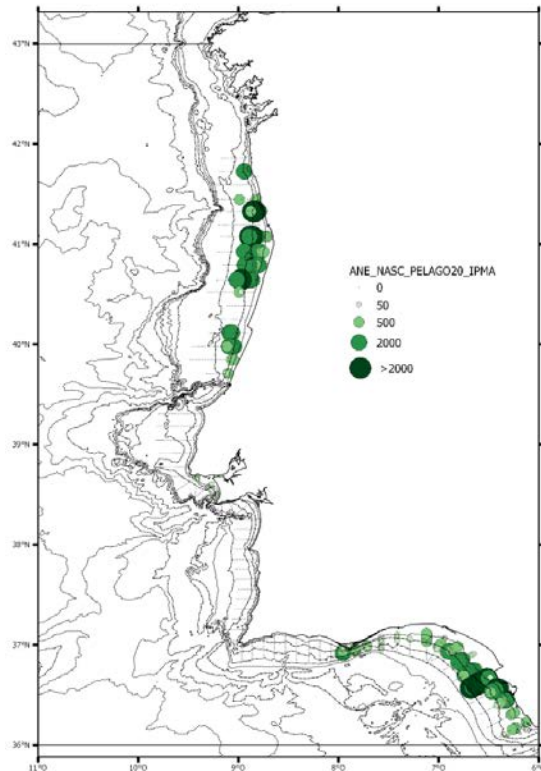


# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Summer survey. *ECOCADIZ 2020-07*: 01-14/08/2020. 9a South. (II)

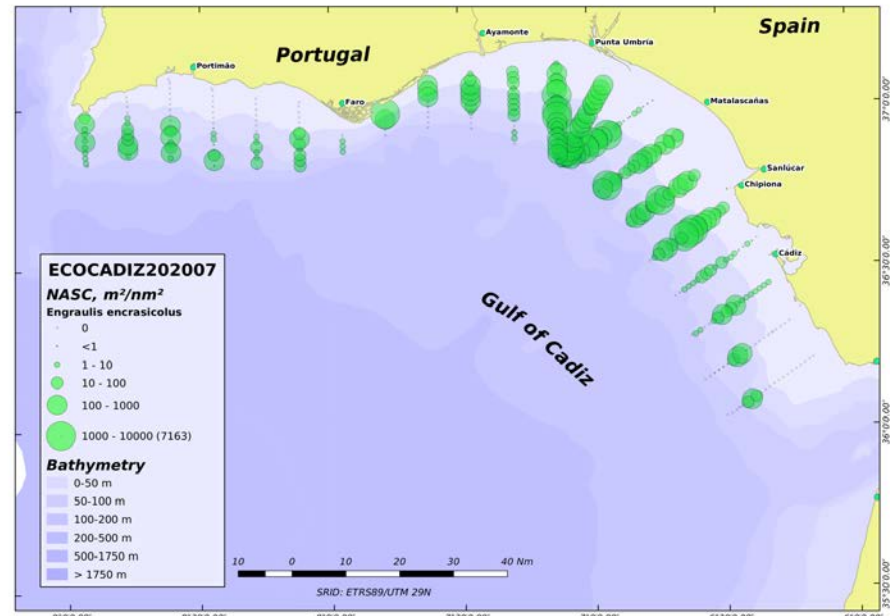


Anchovy showed a high frequency of occurrence (81%) in the 26 valid hauls.

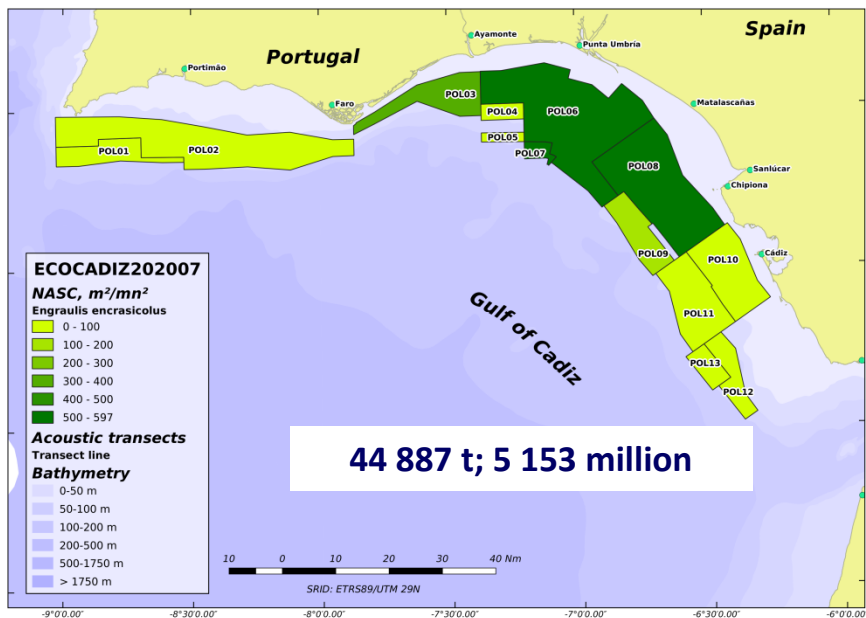
Widely distributed. Mainly concentrated between Cape Santa Maria and Guadalquivir River. Higher densities in Algarve waters than those recorded ones in the *PELAGO 20* spring survey (no anchovy in western Algarve).



The smallest anchovies in the surroundings of the Guadalquivir river mouth and Bay of Cadiz. Larger/older anchovies in the westernmost and easternmost waters.



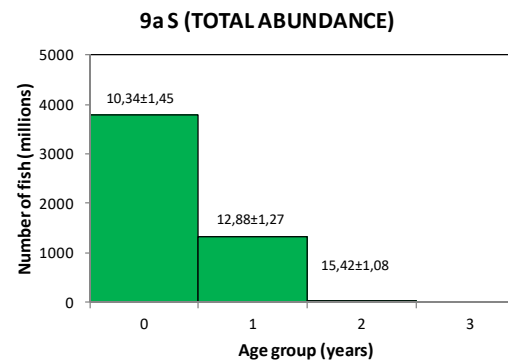
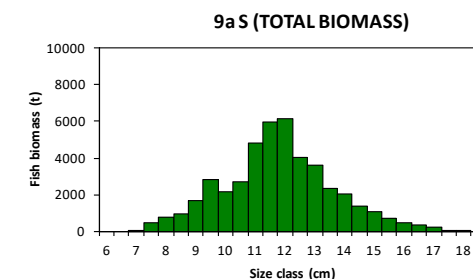
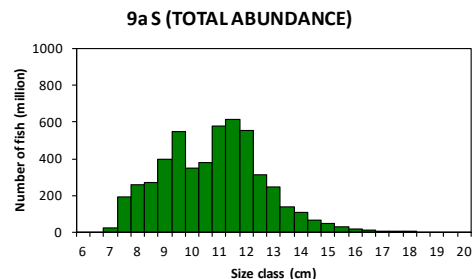
# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Summer survey. *ECOCADIZ 2020-07*: 01-14/08/2020. 9a South. (III)



A total of **44 887 t** and **5 153 million** fish were estimated for this species for the whole surveyed area. (PT: 7 773 t; 439 million. ES: 37 114 t; 4 714 million).

**PELAGO 20** previously estimated in Spring for this area: 49 787 t and 5 639 million (PT: 1 789 t; 89 million. ES: 47 998 t; 5 550 million).

(*ECOCADIZ 2019-07*: 57 700 t; 5 485 million; historical maximum in the time-series).



Modes at 11.5 and 9.5 cm size classes.

0-2 age groups present. Age-0 accounted 75% and 57% of the total N and B.

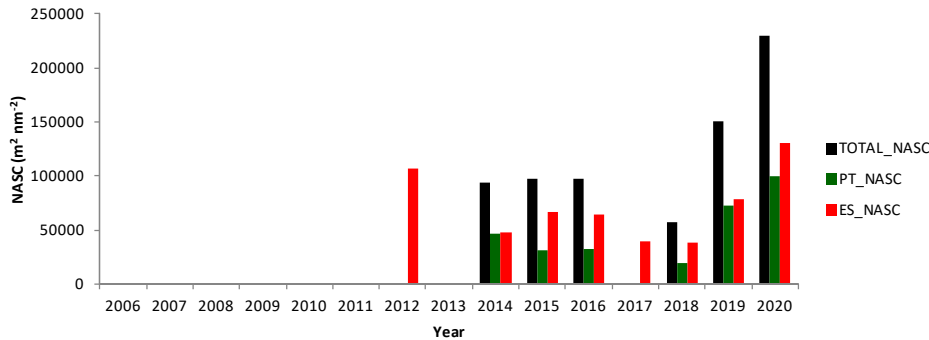
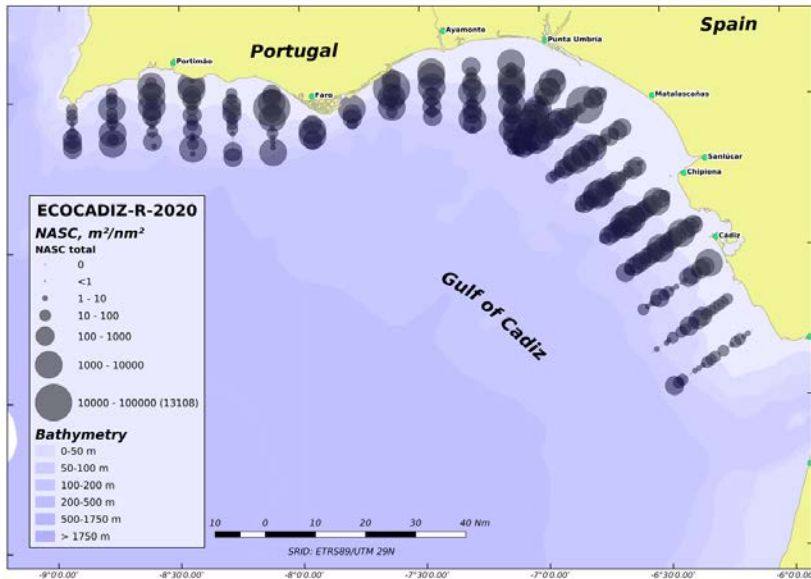
# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Autumn surveys. *ECOCADIZ-RECLUTAS 2020-10*: 02-21/10/2020. 9a South. (I)

***ECOCADIZ-RECLUTAS 2020-10*** survey: acoustic assessment of the abundance of anchovy and sardine juveniles in their main recruitment areas off the Gulf of Cadiz (20 -200 m depth), (surveys in 2012, 2014-2019). RV *Ramón Margalef* (IEO). Autumn.

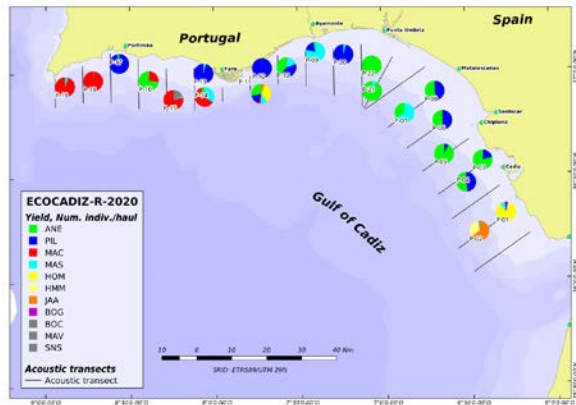
21 transects. 22 valid hauls. No CUFES. 179 CTD-LADCP st. No TSG-F. No Top predator census.

Historical maxima for total and regional NASC allocated to the “pelagic fish species assemblage” as a consequence of high PIL\_NASC (PT & ES), ANE\_NASC (ES) and VMA\_NASC (PT).

Sardine (57%), anchovy (20%) and chub mackerel (14%) the main contributors to the total NASC.

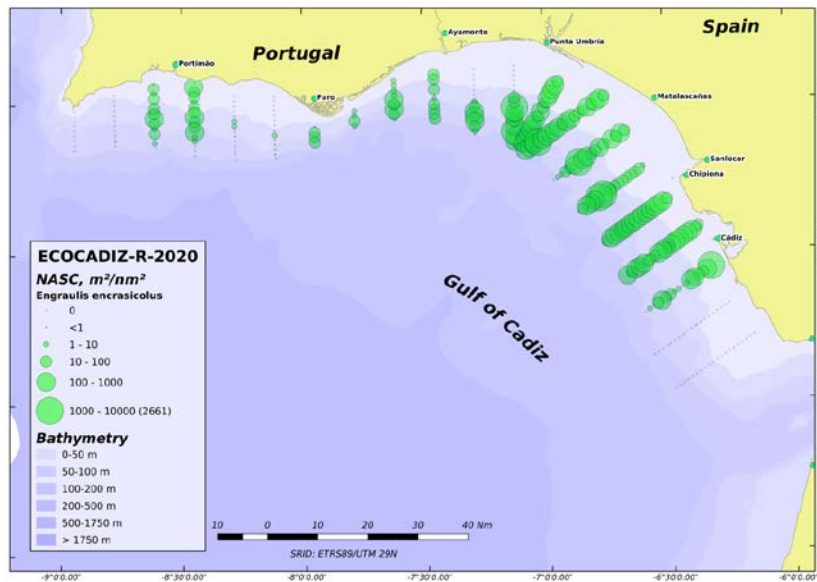


# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Autumn surveys. *ECOCADIZ-RECLUTAS 2020-10*: 02-21/10/2020. 9a South. (I)



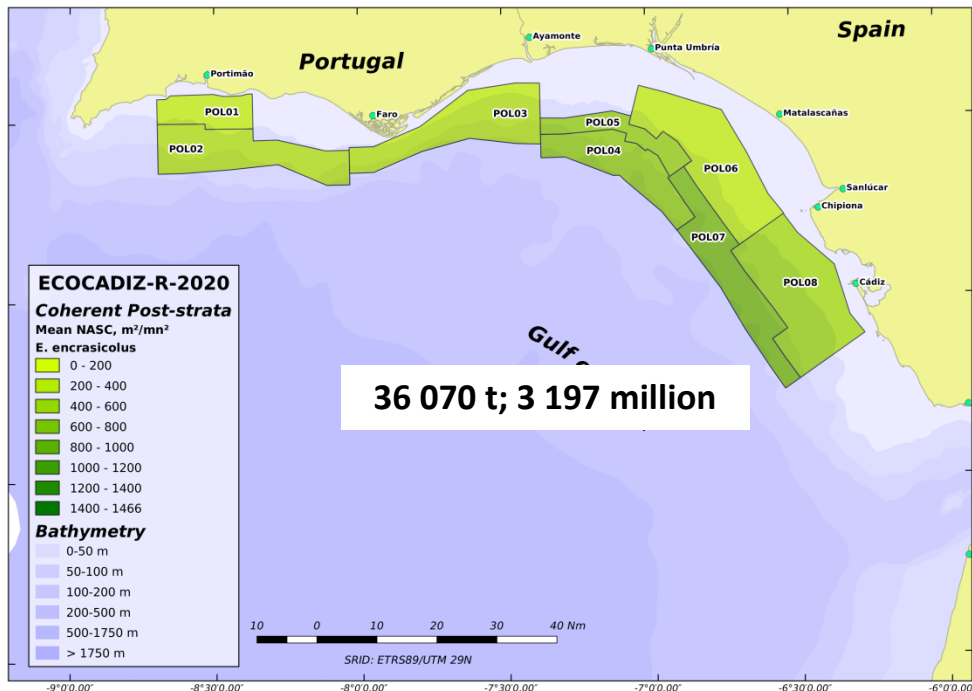
Anchovy showed a high frequency of occurrence (73%) in the 22 valid hauls.

Widely distributed. Mainly concentrated between east of Cape Santa Maria and Bay of Cadiz.



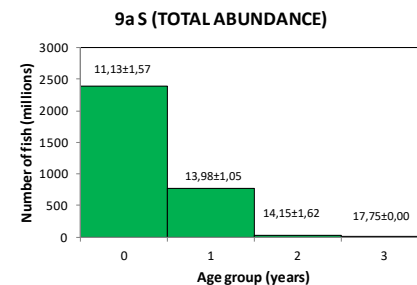
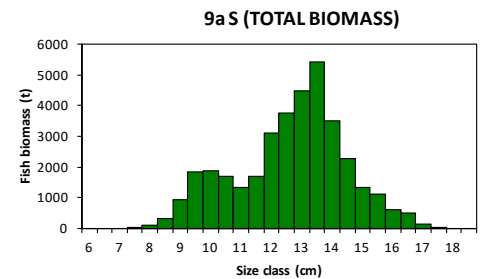
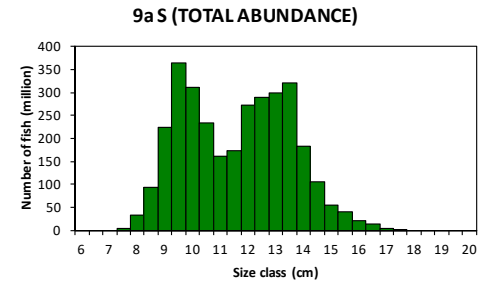
The smallest anchovies in the surroundings of the Guadalquivir river mouth and adjacent coastal waters. Larger/older anchovies in the westernmost waters.

# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Autumn surveys. *ECOCADIZ-RECLUTAS 2020-10: 02-21/10/2020. 9a South. (II).*



A total of **36 070 t** and **3 197 million** fish were estimated for this species for the whole surveyed area. (PT: 3 290 t; 145 million. ES: 32 780 t; 3 051 million).

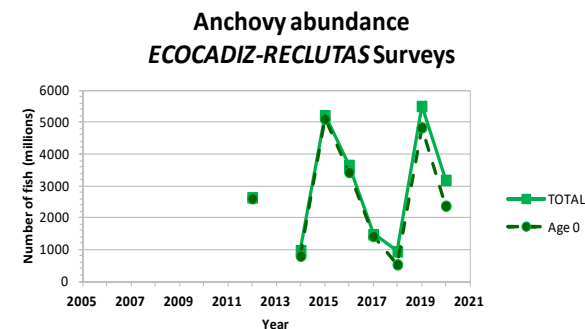
(25% and 42% decreases in B and N in relation to *ECOCADIZ-RECLUTAS 2019-10: 48 398 t; 5 518 million*).



2 modes (9.5 and 13.5 cm). Ages 0, 1, 2 and 3. **Age-0** anchovies in the surveyed area were estimated at **2385 million** fish and **21 060 t**, respectively, *i.e.* **75%** and **58%** of the total estimated anchovy abundance and biomass.

# Fishery-independent information: Acoustic surveys in 2020 (post-WG). Autumn surveys. *ECOCADIZ-RECLUTAS 2020-10*: 02-21/10/2020. 9a South. (III).

Estimate/Year	Total Population (Recruits at age 0)							
	2012	2014	2015	2016	2017	2018	2019	2020
<b>Biomass (t)</b>	13680 (13354)	8113 (5131)	30827 (29219)	19861 (15969)	7642 (7290)	10493 (3834)	48357 (36405)	36070 (21060)
<b>Abundance (millions)</b>	2469 (2619)	986 (814)	5227 (5117)	3667 (3445)	1492 (1433)	953 (543)	5505 (4845)	3197 (2385)



The 2020 estimates of age-0 fish experienced a similar decreasing trend than the one showed by the whole population in relation to the historical peak recorded the year before, but with values close to the time-series average.

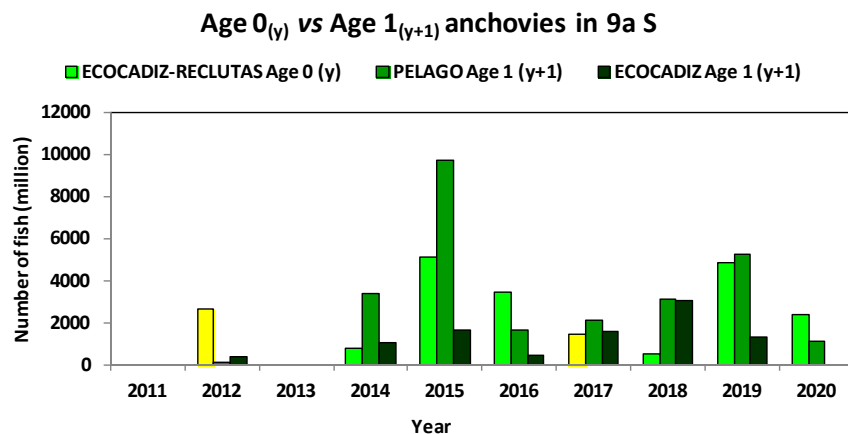
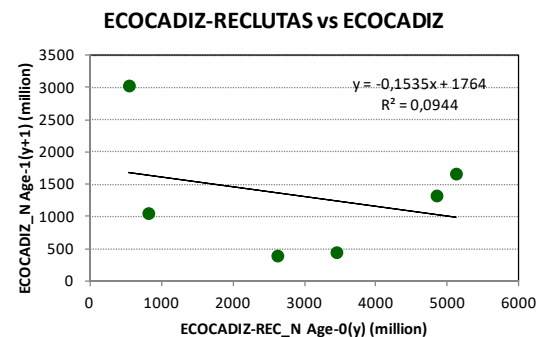
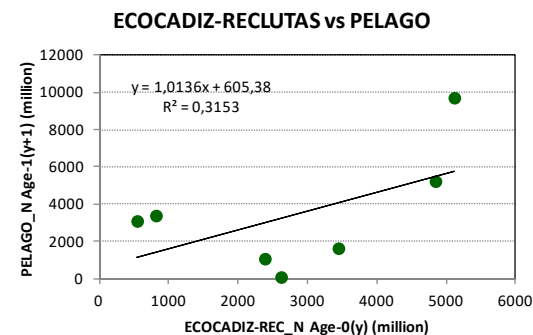
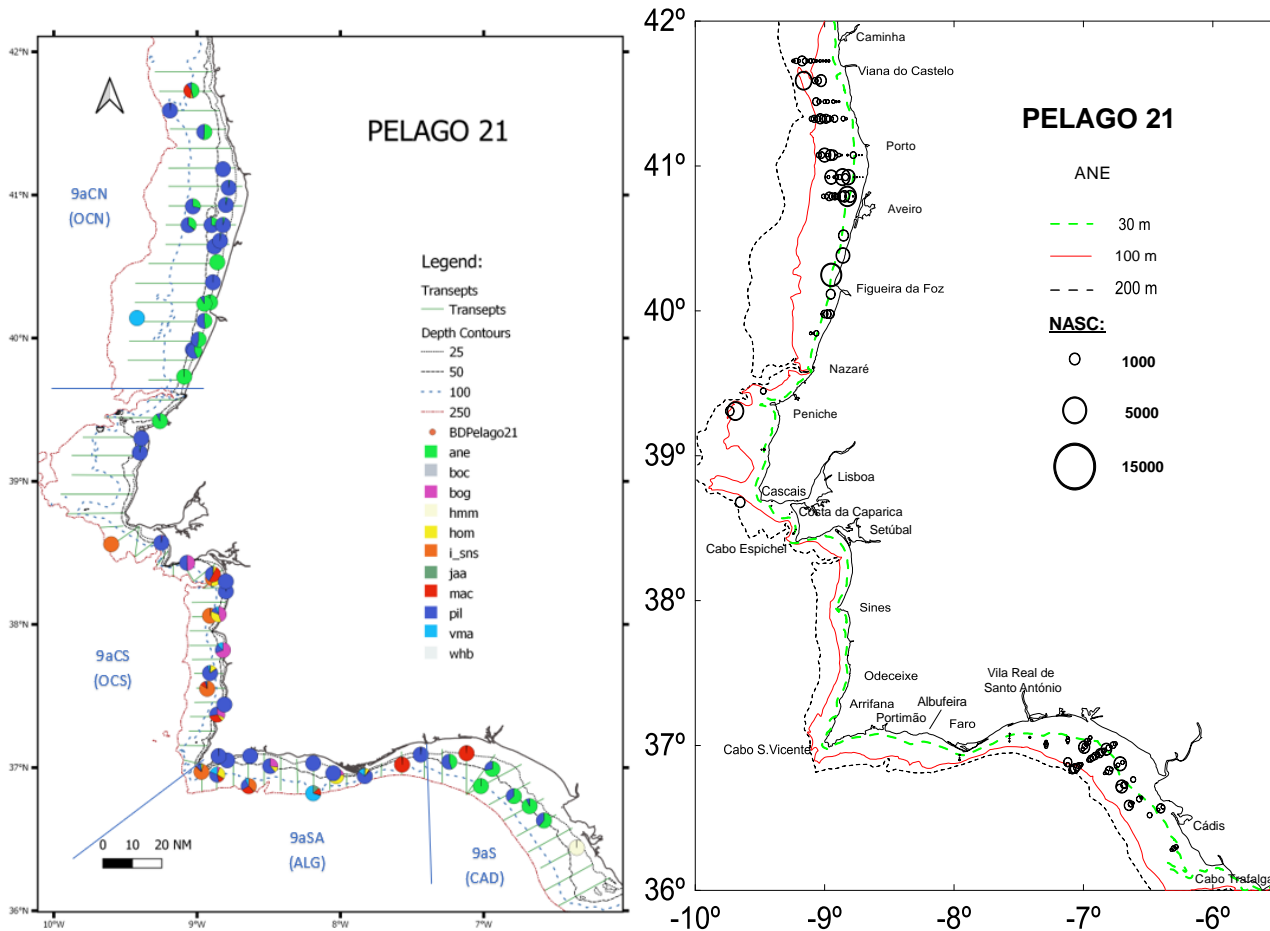


Figure still incomplete. *ECOCADIZ 2021* will start after WG .



# Fishery-independent information: Acoustic surveys in 2021. Spring surveys.

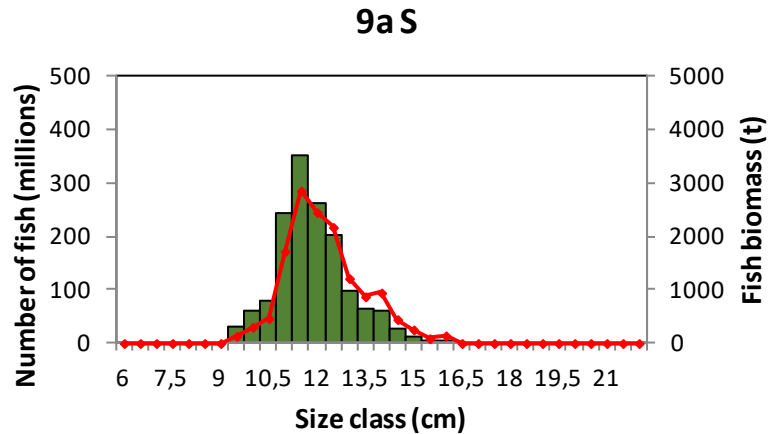
## PELAGO 21: 03 - 21/03/2021. 9a South. (I).



**PELAGO 21** survey: Pelagic ecosystem survey of the Portuguese and Gulf of Cadiz shelf waters (30-150/200 m depth). Spring.

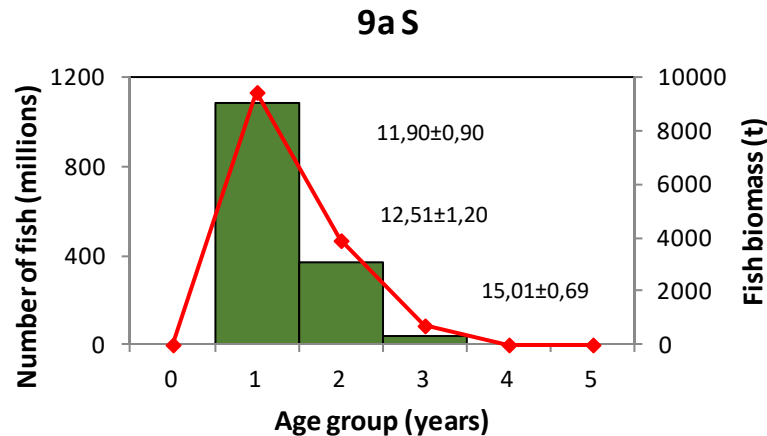
Anchovy population in 9a S restricted to the Cape Sta. Maria – Sancti-Petri shelf waters, mainly in Spanish waters (Punta Umbría-Bay of Cádiz). Almost absent in Algarve.

# Fishery-independent information: Acoustic surveys in 2021. Spring surveys. PELAGO 21: 03 - 21/03/2021. 9a South. (II).



A total of **14 065 t** and **1494 million** fish were estimated for this species for the Sub-division 9a S (99% of the population and biomass in Spanish waters).

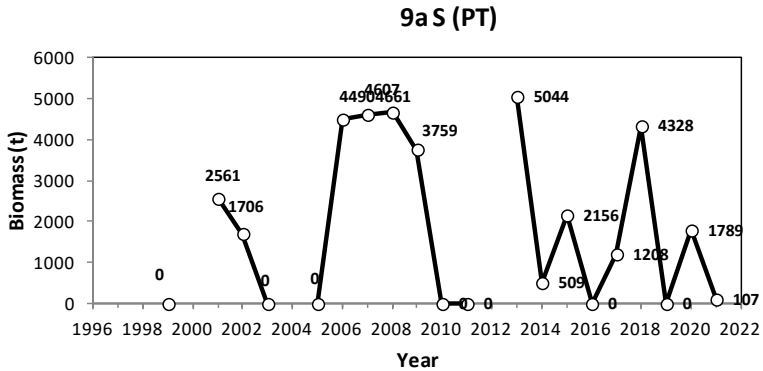
The estimates represent **72% and 74% decrease in B and N**, respectively, in relation to the 2020 estimates (49 787 t; 5639 million).



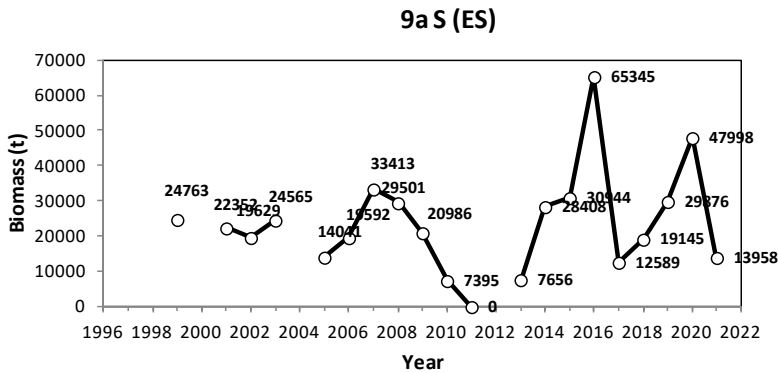
Mode at 11.5 cm. Age-1, Age-2 and Age-3 fish. Age-1 olds is the dominant age group.



# Trends in *PELAGO* acoustic estimates (9a S)



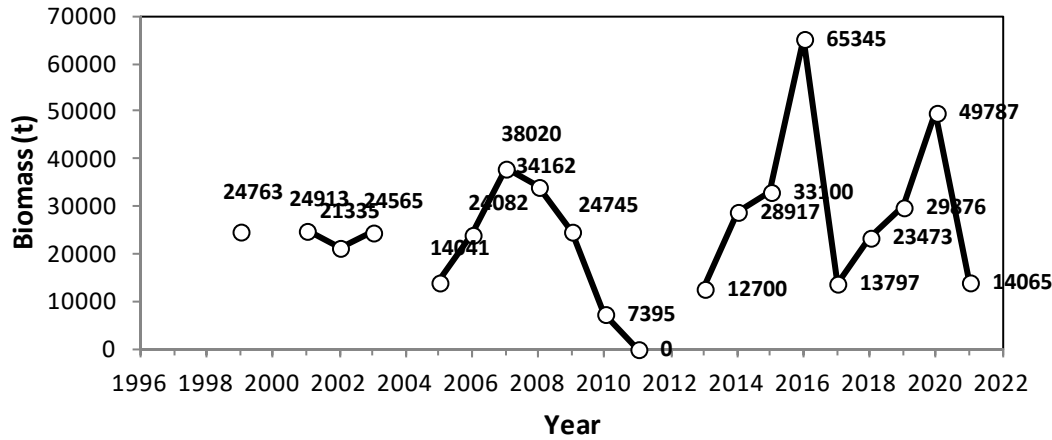
○ PELAGO



○ PELAGO

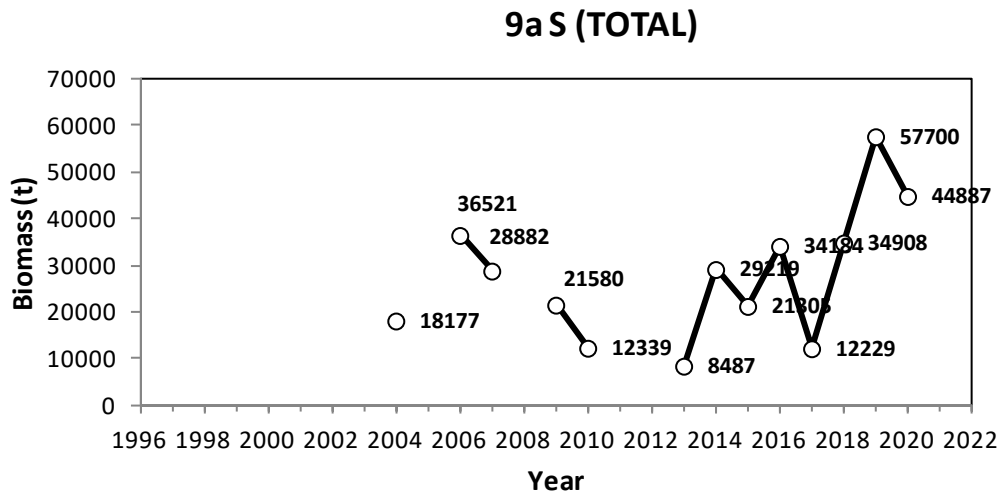
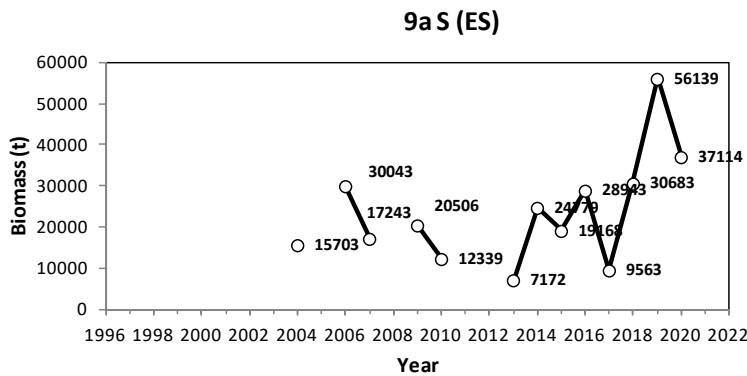
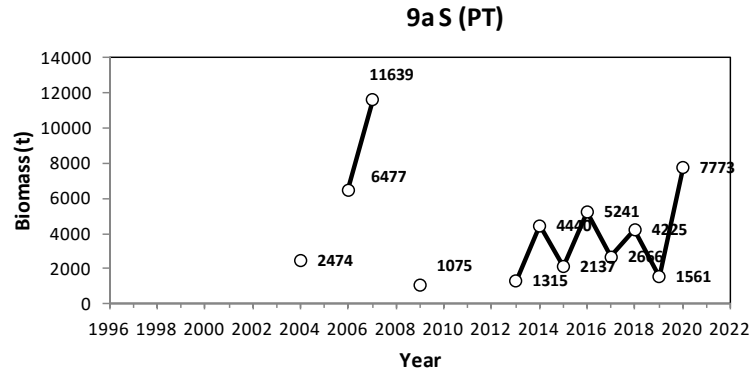
- 2010: strong drop.
- 2011: No anchovy detected (but DEPM estimated later on in summer 33 kt for the South).
- 2012: No survey.
- 2014-2016: increasing trend with historical peak in 2016.
- 2017: Strong decrease, below the historical mean.
- **2018-2020: new increasing trend.**
- **2020 is the second highest record in the time-series.**

• **Strong (-74% in B) decrease in 9a S (TOTAL) 2021.**



○ PELAGO

# Trends in *ECOCADIZ* acoustic estimates

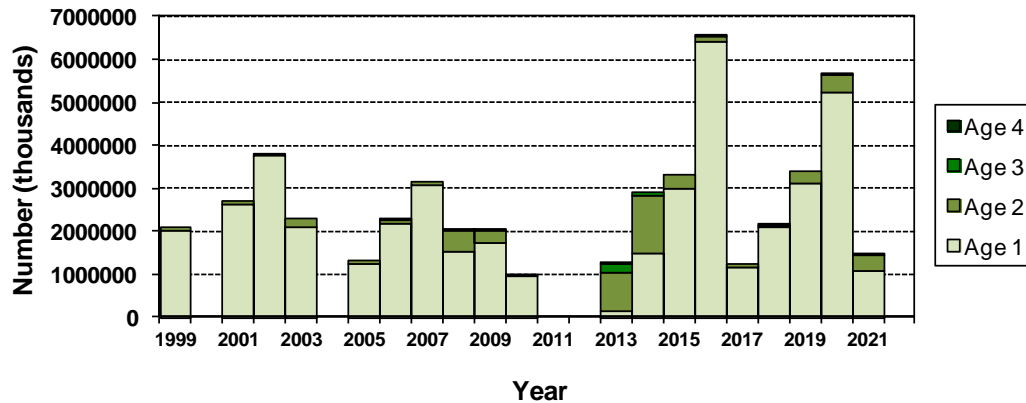


- Gaps in 2005, 2008 and 2011 (when DEPM surveys), and in 2012 (no standard survey).
- Partial estimate in 2010 (only Spanish part): 12 339 t.
- **Similar trends than *PELAGO* but with a relatively different magnitude.**
- **Historical record in 2019.**
- **-22% decrease in 2020, but still well above the time-series average (26.3 kt).**

# Population Age structure in 9a South

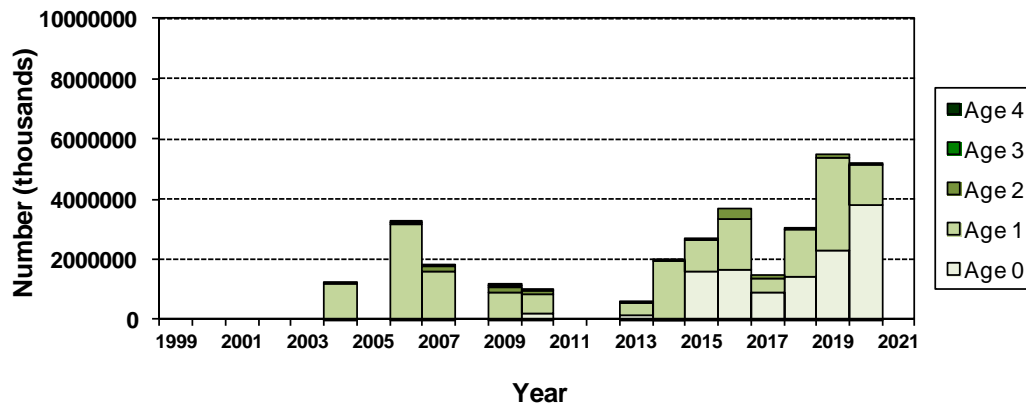
Age structure estimated applying Spanish ALKs until 2012

Portuguese Spring Acoustic Surveys  
Anchovy in Sub-division 9.a South



- Ages 1-4.
- Failed recruitment in 2016.
- Progressively good recruitments since 2017, especially in 2019.
- Failed recruitment in 2020.
- Strong 2015 and 2018-2019 year classes.

Spanish Summer Acoustic Surveys  
Anchovy in Sub-division 9a South



- Ages 0-4. Occurrence of Age 0 anchovies in 2010, and 2013-2020 due to the later dates of the survey (late July-early August).
- Failed recruitment in 2016 also evidenced.
- Relatively good recruitment in 2018 is confirmed.
- Strong 2018 year class.