

Acoustic assessment and distribution of the main pelagic fish species in ICES Subdivision 9a South during the *ECOCADIZ-RECLUTAS 2018-10* Spanish survey (October 2017).

By

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ABSTRACT

The present working document summarises the main results obtained during the *ECOCADIZ-RECLUTAS 2018-10* Spanish (pelagic ecosystem-) acoustic survey. The survey was conducted by IEO between 10th and 29th October 2018 in the Portuguese and Spanish shelf waters (20-200 m isobaths) off the Gulf of Cadiz onboard the R/V *Ramón Margalef*. The survey's main objective is the acoustic assessment of anchovy and sardine juveniles (age 0 fish) in the recruitment areas of the Gulf of Cadiz. The 21 foreseen acoustic transects were sampled. A total of 25 valid fishing hauls were carried out for echo-trace ground-truthing purposes. Chub mackerel was the most frequent species in those hauls, followed by sardine, anchovy, horse mackerel, mackerel, bogue and Mediterranean horse mackerel. Acoustic sampling was carried out with the recently installed *Simrad™ EK80* echo-sounder working in multi-frequency and in CW mode. A misconfiguration of the range of the acoustic active layer entailed to slow down the ping rate (1.5-2.0 seconds) in relation to the standard values (at about 0.3 seconds), resulting an acoustic sampling rate much lower than it should be. **Therefore, the results from this acoustic sampling and the resulting estimates from this survey should be considered with caution.** Anchovy abundance and biomass were of 953 million fish and 10 493 t. The abundance and biomass of age-0 anchovies were estimated at 543 million fish and 3 834 t, 57% and 36% of the total population abundance and biomass, respectively. Despite the methodological problems, these estimates seem to suggest a recent decrease in relation to previous years. The estimates for Gulf of Cadiz sardine in the surveyed area were of 1 134 million fish and 20 679 t. Estimates of age-0 sardine were of 1 036 million fish and 15 224 t, 91% and 74% of the total estimated abundance and biomass, respectively. Even taking into account a possible underestimation for the abovementioned methodological problems, the values reached in 2018 were above the historical mean for the total population and recruits abundance and for the recruit biomass, and they might suggest a relatively stable situation since the maxima registered in 2016.

INTRODUCTION

During the 2007 and 2008 meetings of the *ICES Working Group on Acoustic and Egg Surveys for Sardine and Anchovy in ICES areas VIII and IX* (WGACEGG) was advanced the possibility of carrying out, since 2009 on, internationally coordinated yearly surveys aimed at the direct estimation of the anchovy and sardine recruitment in the Division 9a (ICES, 2007, 2008). The conduction of such surveys would require, at least in the Gulf of Cadiz, of an appropriate acoustic sampling of the shallowest waters of its central part, an area which the conventional surveys (either Spanish or Portuguese) do not sample but, however, used to form a great part of the recruitment areas of these species.

The general objective of these surveys should initially be focused in the acoustic assessment by vertical echo-integration and mapping of the abundance and biomass of recruits of small pelagic species (especially

anchovy and secondarily sardine), as well as the mapping of both the oceanographic and biological conditions featuring the recruitment areas of these species in the Division 9a. The long term objective of the surveys would be to be able to assess the strength of the incoming recruitment to the fishery the next year.

The first attempt by the IEO of acoustically assessing the abundance of anchovy and sardine juveniles in their main recruitment areas off the Gulf of Cadiz dates back to 2009 (*ECOCADIZ-RECLUTAS 1009* survey). However, that survey was unsuccessful as to the achievement of their objectives because of the succession of a series of unforeseen problems which led to drastically reduce the foreseen sampling area to only the 6 easternmost transects. The continuation of this survey series was not guaranteed for next years and, in fact, no survey of these characteristics was carried out in 2010 and 2011. In 2012, the *ECOCADIZ-RECLUTAS 1112* survey was financed by the Spanish Fisheries Secretariat and planned and conducted by the IEO with the aim of obtaining an autumn estimate of Gulf of Cadiz anchovy biomass and abundance. The survey was conducted with the R/V *Emma Bardán*. Although the survey was restricted to the Spanish waters only it has been considered as the first survey within its series (Ramos *et al.*, 2013). *ECOCADIZ-RECLUTAS 2014-10* restarted the series and it was conducted with the R/V *Ramón Margalef*. The 2017 survey should be the fifth survey within its series. However, an unexpected a serious breakdown of the vessel's propulsion system led to an early termination of the survey, which restricted the surveyed area to the one comprised by the seven easternmost transects only.

The present survey, *ECOCADIZ-RECLUTAS 2018-10*, will be, therefore, the fifth survey in the series, although some methodological problems related with the acoustic sampling coverage (ping rate) should be carefully taken into account when dealing with the final acoustic estimates and interpreting their trends.

MATERIAL AND METHODS

The *ECOCADIZ-RECLUTAS 2018-10* survey was conducted between 10th and 29th October 2018 onboard the Spanish R/V *Ramón Margalef* covering a survey area which comprised the waters of the Gulf of Cadiz, both Spanish and Portuguese, between the 20 m and 200 m isobaths. The survey design consisted in a systematic parallel grid with tracks equally spaced by 8 nm, normal to the shoreline (**Figure 1**).

Echo-integration was carried out with a recently installed *Simrad™ EK80* echo-sounder working in the multi-frequency fashion (18, 38, 70, 120, 200, 333 kHz) and in CW mode. Average survey speed was about 10 knots and the acoustic signals were integrated over 1-nm intervals (ESDU). Raw acoustic data were stored for further post-processing using *Myriax Software Echoview™* software package (by *Myriax Software Pty. Ltd.*, ex *SonarData Pty. Ltd.*). Acoustic equipment was calibrated between 11st and 16th October in the Bay of Algeciras following the new ICES standard procedures (Demer *et al.*, 2015; see also Foote *et al.*, 1987).

Survey execution and abundance estimation followed the methodologies firstly adopted by the ICES *Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX* (ICES, 1998) and the recommendations given later by the *Working Group on Acoustic and Egg Surveys for Sardine and Anchovy in ICES areas VIII and IX* (WGACEGG; ICES, 2006a,b).

Fishing stations for echo-trace ground-truthing were opportunistic, according to the echogram information, and they were carried out using a *Gloria HOD 352* pelagic trawl gear (ca. 10 m-mean vertical opening net) at an average speed of 4-4.5 knots. Gear performance and geometry during the effective fishing was monitored with *Simrad™ Mesotech FS20/25* trawl sonar. Trawl sonar data from each haul were recorded and stored for further analyses.

Ground-truthing haul samples provided biological data on species and they were also used to identify fish species and to allocate the back-scattering values into fish species according to the proportions found at the fishing stations (Nakken and Dommasnes, 1975).

Length frequency distributions (LFD) by 0.5-cm class were obtained for all the fish species in trawl samples (either from the total catch or from a representative random sample of 100-200 fish). Only those LFDs based on a minimum of 30 individuals and showing a normal distribution were considered for the purpose of the acoustic assessment.

Individual biological sampling (length, weight, sex, maturity stage, stomach fullness, and mesenteric fat content) was performed in each haul for anchovy, sardine (in both species with otolith extraction), mackerel (2 spp.) and horse-mackerel species (3 spp.), and bogue.

The following TS/length relationship table was used for acoustic estimation of assessed species (recent IEO standards after ICES, 1998; and recommendations by ICES, 2006a,b):

Species	b_{20}
Sardine (<i>Sardina pilchardus</i>)	-72.6
Round sardinella (<i>Sardinella aurita</i>)	-72.6
Anchovy (<i>Engraulis encrasicolus</i>)	-72.6
Chub mackerel (<i>Scomber japonicus</i>)	-68.7
Mackerel (<i>S. scombrus</i>)	-84.9
Horse mackerel (<i>Trachurus trachurus</i>)	-68.7
Mediterranean horse-mackerel (<i>T. mediterraneus</i>)	-68.7
Blue jack mackerel (<i>T. picturatus</i>)	-68.7
Bogue (<i>Boops boops</i>)	-67.0
Blue whiting (<i>Micromesistius poutassou</i>)	-67.5
Boarfish (<i>Capros aper</i>)	-66.2* (-72.6)

*Boarfish b_{20} estimate following to Fässler *et al.* (2013). Between parentheses the usual IEO value considered in previous surveys.

The *PESMA* software (J. Miquel, IEO, unpublished) has got implemented the needed procedures and routines for the acoustic assessment following the above approach and it has been the software package used for the acoustic estimation.

A *Sea-bird Electronics™ SBE 21 SEACAT* thermosalinograph and a *Turner™ 10 AU 005 CE Field* fluorometer were used during the acoustic tracking to continuously collect some hydrographical variables (sub-surface sea temperature, salinity, and *in vivo* fluorescence). Vertical profiles of hydrographical variables were also recorded by night from 150 CTD_{O₂} casts using a *Sea-bird Electronics™ SBE 911+ SEACAT* (with coupled *Datasonics* altimeter, *SBE 43* oximeter, *WetLabs ECO-FL-NTU* fluorimeter and *WetLabs C-Star 25 cm* transmissometer sensors) profiler (**Figure 2**). *VMADCP RDI 150 kHz* records were also continuously recorded by night between CTD stations. Census of top predators was not recorded during the survey.

RESULTS

Acoustic sampling

The acoustic sampling was restricted to the period comprised between 17th and 28th October. The complete grid (21 transects) was acoustically sampled (**Table 1; Figure 1**). The sampling scheme followed to accomplish this grid was conditioned by the weather conditions during the survey. Thus, the acoustic sampling started by the coastal end of the transect R01 on 17th October and proceeded westward up to the R04 on 19th October. The survey was interrupted on 20th October in order to satisfy the R/V's refueling and provisioning needs. The second leg proceeded between 21st and 24th October by acoustically sampling the R05 to R12 transects in the usual E-W direction. On 25th October the acoustic sampling started by the

westernmost transect, the R21, and the sampling proceeded then in the W-E direction up to the transect R13, with the intent to avoid a very low pressure system approaching to Cape San Vicente. In order to perform the acoustic sampling with daylight, this sampling started at 06:45-07:00 UTC, although this time might vary depending on the duration of the works related with the hydrographic sampling the previous night.

Unfortunately, a misconfiguration of the echo-sounder ping rate was detected *a posteriori*, during the phase of acoustic data post-processing. The ping-rate during the acoustic sampling resulted to be very low, about 1.5-2.0 seconds, and this was caused by the erroneous generation of an active layer with a range deeper than the recording depth or visualization scale. Such an error entailed to slow down the ping rate (1.5-2.0 seconds) in relation to the standard values (at about 0.3 seconds), resulting an acoustic sampling rate much lower than it should be. Therefore, the recording of acoustic densities may possibly be lower than the real one. This error may have implications in the final estimates of abundance and biomass which may be computed from the above under-sampled acoustic densities. **Therefore, the results from this acoustic sampling and the resulting estimates from this survey should be considered with caution.**

Groundtruthing hauls

A total of twenty five (25) fishing operations for echo-trace ground-truthing (all of them were valid according to a correct gear performance and resulting catches), were carried out during the survey (**Table 2, Figure 3**). Because of many echo-traces usually occurred close to the bottom, all the pelagic hauls were carried out like a bottom-trawl haul, with the ground rope working over or very close to the bottom. According to the above, the sampled depth range in the valid hauls oscillated between 27 and 198 m.

During the survey were captured 3 Chondrichthyan, 42 Osteichthyes, 1 Crustacean, 7 Cephalopod, 1 Gastropod, and 2 Echinoderm species. The percentage of occurrence of the more frequent fish species in the hauls is shown in the enclosed Text Table below (see also **Figure 4**). The pelagic ichthyofauna was both the most frequently captured species set and the one composing the bulk of the overall yields of the catches. Within this pelagic fish species set, chub mackerel and sardine were the most frequent species in the valid hauls (96% and 92% presence index), followed by anchovy (84%), horse mackerel and mackerel (76%), bogue (52%) and Mediterranean horse mackerel (44%). Round sardinella, Blue jack mackerel, Pearlside, Blue whiting, Boarfish and Snipefish, Pearlside showed an incidental occurrence in the hauls performed in the surveyed area.

For the purposes of the acoustic assessment, anchovy, sardine, round sardinella, mackerel species, horse & jack mackerel species, bogue, blue whiting, boarfish, snipefish and pearlside were initially considered as the survey target species. Cephalopods were excluded from the computation of the total catches in weight and in number from those fishing stations where they occurred. Catches of the remaining non-target species were included in an operational category termed as "Others".

According to the above premises, during the survey were captured a total of 9355 kg and 495 thousand fish (**Table 3**). Forty seven per cent (47%) of this "total" fished biomass corresponded to anchovy, 27% to sardine, 17% to chub mackerel, 4% to horse mackerel, and contributions lower than 1% for the remaining species. The most abundant species in ground-truthing trawl hauls were also anchovy and sardine (68% and 25% respectively), followed by chub mackerel (5%), with each of the remaining species accounting for equal to or less than 1%.

Species	# of fishing stations	Occurrence (%)	Total weight (kg)	Total number
<i>Scomber colias</i>	24	96	1550,230	24645
<i>Sardina pilchardus</i>	23	92	2522,203	124535
<i>Merluccius merluccius</i>	21	84	89,903	704
<i>Engraulis encrasicolus</i>	21	84	4417,979	337002
<i>Trachurus trachurus</i>	19	76	383,048	3084
<i>Scomber scombrus</i>	19	76	46,133	222
<i>Boops boops</i>	13	52	49,557	238
<i>Spondyliosoma cantharus</i>	11	44	10,637	83
<i>Trachurus mediterraneus</i>	11	44	119,981	678
<i>Pagellus acarne</i>	6	24	21,249	76
<i>Pagellus erythrinus</i>	6	24	17,520	120
<i>Diplodus bellottii</i>	5	20	3,221	53
<i>Diplodus vulgaris</i>	4	16	47,886	299
<i>Capros aper</i>	4	16	0,272	25
<i>Thunnus thynnus</i>	4	16	4,873	6
<i>Zenopsis conchifer</i>	4	16	3,913	9
<i>Trachinotus ovatus</i>	4	16	4,900	21
<i>Pagellus bellottii bellottii</i>	3	12	1,565	12
<i>Alosa fallax</i>	3	12	1,178	5
<i>Mola mola</i>	3	12	10,481	5
<i>Spicara flexuosa</i>	3	12	0,702	10
<i>Sphoeroides pachygaster</i>	2	8	4,540	4
<i>Maurolicus muelleri</i>	2	8	1,822	2901
<i>Macroramphosus scolopax</i>	2	8	0,244	70
<i>Diplodus annularis</i>	2	8	0,149	6
<i>Pomadasys incisus</i>	2	8	3,688	37
<i>Pteromylaeus bovinus</i>	2	8	45,301	3
<i>Balistes carolinensis</i>	1	4	1,008	1
<i>Cepola macrophthalma</i>	1	4	0,015	1
<i>Serranus hepatus</i>	1	4	0,034	1
<i>Microchirus azevia</i>	1	4	0,135	1
<i>Serranus cabrilla</i>	1	4	0,172	1
<i>Zeus faber</i>	1	4	0,044	1
<i>Micromesistius poutassou</i>	1	4	0,184	6
<i>Torpedo marmorata</i>	1	4	1,276	1
<i>Squalus acanthias</i>	1	4	6,963	3
<i>Sardinella aurita</i>	1	4	0,79	2
<i>Argyrosomus regius</i>	1	4	31,62	1
<i>Mullus barbatus</i>	1	4	0,071	1
<i>Mullus surmuletus</i>	1	4	0,721	7
<i>Trachinus draco</i>	1	4	0,357	4
<i>Sarda sarda</i>	1	4	1,09	1
<i>Trachurus picturatus</i>	1	4	0,063	1
<i>Scorpaena notata</i>	1	4	0,056	1
<i>Lepidotrigla cavillone</i>	1	4	0,585	14

The species composition of these fishing hauls (as expressed in terms of percentages in number) is shown in **Figure 4**.

Back-scattering energy attributed to the “pelagic assemblage” and individual species

A total of 324 nmi (ESDU) from 21 transects has been acoustically sampled by echo-integration for assessment purposes. The enclosed text table below provides the nautical area-scattering coefficients attributed to each of the selected target species and for the whole “pelagic fish assemblage”.

S_A 2 $^{-2}$ (m nmi ²)	Total spp.	PIL	ANE	MAC	MAS	HOM	HMM	JAA	BOG	WHB
Total Area (%)	57392 (100,0)	20601 (35,9)	14392 (25,1)	7 (0,01)	11036 (19,2)	978 (1,7)	2746 (4,8)	0,03 (0,0001)	1214 (2,1)	0,2 (0,0003)
Portugal (%)	19346 (33,7)	3077 (14,9)	7443 (51,7)	4 (63,2)	6561 (59,5)	905 (92,6)	14 (0,5)	0,03 (100,0)	867 (71,5)	0 (0,0)
Spain (%)	38045 (66,3)	17524 (85,1)	6950 (48,3)	3 (36,8)	4475 (40,5)	72 (7,4)	2732 (99,5)	0 (0,0)	346 (28,5)	0,2 (100,0)

S_A 2 $^{-2}$ (m nmi ²)	BOC	SNS	MAV
Total Area (%)	0,1 (0,0001)	2 (0,004)	6415 (11,2)
Portugal (%)	0,1 (79,9)	2 (100,0)	472 (7,4)
Spain (%)	0,01 (20,1)	0 (0,0)	5943 (92,6)

For this “pelagic fish assemblage” has been estimated a total of 57 392 m² nmi⁻². The highest NASC value was recorded in the coastal waters (35 m) in front of Tavira (transect R13, **Figure 5**). By species, sardine accounted for 36% of this total back-scattered energy, followed by anchovy (25%), chub mackerel (19%) and pearlside (11%), and the remaining species with relative contributions of acoustic energies lower than 5%.

According to the resulting values of integrated acoustic energy and the availability and representativeness of the length frequency distributions, the species acoustically assessed in the present survey finally were anchovy, sardine, mackerel, chub mackerel, horse mackerel, Mediterranean horse mackerel, bogue and pearlside.

Spatial distribution and abundance/biomass estimates

Anchovy

Parameters of the survey’s length-weight relationship for anchovy are given in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 6**. The mapping of the backscattering energy (nautical area scattering coefficient, NASC, in m² nmi⁻²) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 7**. The estimated abundance and biomass by size and age class are given in **Tables 5 and 6** and **Figures 8 and 9**.

Anchovy avoid in autumn 2018 the easternmost waters of the Gulf. Something similar also happened in the shallower waters of the western Algarve. The spatial pattern of distribution of the acoustic density was further characterized by a concentration of a great part of the population in a relatively restricted area comprising the shelf waters between Cape Santa Maria and the Guadiana river mouth. The remaining population was widely distributed between this last landmark and the Bay of Cadiz (**Figure 7**). The size composition of anchovy catches indicates that smallest recruits occurred mainly in those last Spanish coastal waters (**Figure 6**).

Gulf of Cadiz anchovy abundance and biomass in autumn 2018 were of 953 million fish and 10 493 t. Spanish waters concentrated 58% (548 million) and 40% (4 234 t) of the total estimated abundance and biomass respectively. Portuguese estimates amounted to 405 million and 6 259 t (**Table 5, Figure 8**).

The size range recorded for the estimated population was comprised between 7.5 and 18.5 cm size classes, with two marked modes at the 9.0 (the dominant one) and 14.0 cm size classes. Both modes were also present in the size composition of the estimated biomass, but showing in this case a reversed importance (**Table 5, Figure 8**). The mean size and weight of the estimated population were 12.1 cm and 11.0 g, respectively. The anchovy size composition by coherent post-strata in the surveyed area evidences that juveniles were widely distributed in the coastal-inner shelf waters between the Guadiana river mouth and Bay of Cadiz, with the Matalascañas-Bay of Cadiz area being the area where the highest densities of anchovy juveniles were recorded (**Table 5, Figure 8**).

The age-0 population fraction was estimated at 543 million fish and 3 834 t, 57% and 36% of the total population abundance and biomass respectively (**Table 6, Figure 9**).

Sardine

Parameters of the survey's size-weight relationship for sardine are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 10**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 11**. Estimated abundance and biomass by size and age class are given in **Tables 8 and 9**, and **Figures 12 and 13**.

Sardine was widely distributed all over the surveyed area, although showed a main nucleus of acoustic density comprising the inner-mid shelf waters between the Guadiana river mouth and Bay of Cadiz. The species also showed relatively high densities all over the shelf waters between San Vicente and Santa Maria capes (**Figure 11**). The sardine size composition in the positive hauls indicates that juveniles were mainly distributed in the Spanish coastal waters between Matalascañas and Bay of Cadiz (**Figure 10**).

Sardine abundance and biomass in the surveyed area were of 1 134 million fish and 20 679 t (**Table 8, Figure 12**). Spanish waters concentrated 70% (792 million) and 75% (15 499 t) of the total estimated abundance and biomass, respectively. Portuguese estimates amounted to 343 million and 5 181 t (**Table 8, Figure 12**).

The size range recorded for the estimated population was comprised between 10.5 and 23.5 cm size classes, with a dominant mode at 12.0 cm size class. A similar size composition is also recorded for the estimated biomass (**Table 8, Figure 12**). The mean size and weight of the estimated population were 13.5 cm and 18.2 g, respectively. The sardine size and age composition by coherent post-strata in the surveyed area evidence that juveniles were also widely distributed in the coastal-inner shelf waters between the Guadiana river mouth and Bay of Cadiz, with the area comprised between Matalascañas and the Bay of Cadiz being the area where the highest densities of sardine juveniles were recorded (**Tables 8 and 9, Figures 12 and 13**).

The age-0 population fraction in the surveyed area was estimated at 1 036 million fish and 15 224 t, 91% and 74% of the total estimated abundance and biomass, respectively. Spanish waters concentrated the 97% of age-0 fish (1 004 million, 14 750 t), whereas the Portuguese ones recorded the remaining 3% of the recruits' population (32 million, 654 t), (**Table 9, Figure 13**).

Mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 14**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 15**. Estimated abundance and biomass by size class are given in **Table 11** and **Figure 16**.

Mackerel was absent in the easternmost waters and showed a scattered distribution over the shelf waters comprised between Cape San Vicente and the Bay of Cadiz, with the relatively highest densities being located in the western Algarve (**Figure 15**). The mackerel size composition in the positive hauls does not indicate any clear trend either in the latitudinal or bathymetric gradients (**Figure 14**).

Mackerel abundance and biomass in the surveyed area were estimated at about 1 million fish and 226 t (**Table 11, Figure 16**). Sixty two per cent (62%) of both total abundance and biomass were estimated in the Portuguese waters (0.9 million; 141 t). Spanish waters yielded a population of 0.5 million and 85 t.

The size range recorded for the estimated population was comprised between 21.0 and 35.5 cm size classes, with a dominant mode at 27.0 cm size class. A similar size composition is also recorded for the estimated biomass (**Table 11, Figure 16**).

Chub mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 17**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 18**. Estimated abundance and biomass by size class are given in **Table 12** and **Figure 19**.

Chub mackerel, although widely distributed, showed, however, a relatively wide void in the inner-middle shelf waters located between Doñana National Park and Chipiona. The highest integration values were recorded between Cape San Vicente and Guadiana (**Figure 18**). Size composition in the species' positive hauls indicates that juvenile/sub-adult fish mainly occurred in the outer-shelf waters of the surveyed area whereas larger fish were distributed in shallower waters (**Figure 17**).

Chub mackerel abundance and biomass in the surveyed area were of 108 million fish and 6 950 t (**Table 12, Figure 19**). Portuguese waters accounted for 63% (68 million) and 60% (4 179 t) of the total abundance and biomass, respectively. Spanish waters yielded a population of 40 million and 2 770 t.

The size range recorded for the estimated population was comprised between 16.0 and 31.5 cm size classes, with a dominant mode at 19.0 cm size class, a secondary mode at 21.5 cm size class and even a probable third mode at 28.5 cm size class. A rather similar size composition is also recorded for the estimated biomass (**Table 12, Figure 19**).

Horse mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 20**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 21**. Estimated abundance and biomass by size class are given in **Table 13** and **Figure 22**.

The species showed a scarce occurrence in the easternmost third of the surveyed area and the highest densities in the Portuguese waters (**Figure 21**). Size composition in the species' positive hauls does not show any clear trend excepting the localisation of larger specimens in the outer shelf of the central waters of the surveyed area, whereas spots of juvenile fish are mainly located in Spanish waters (**Figure 20**).

Horse mackerel abundance and biomass in the surveyed area were of 8 million fish and 740 t (**Table 13**, **Figure 22**). Portuguese waters accounted for 91% (7.7 million) and 96% (708 t) of the total abundance and biomass, respectively. Spanish waters yielded a population of 0.7 million and 32 t.

The size range recorded for the estimated population was comprised between 13.0 and 34.0 cm size classes, with a dominant mode at 20.0 cm size class (the dominant mode in Portuguese waters) and a secondary mode at 15.0 cm size class (the dominant mode in Spanish waters). A rather similar size composition is also recorded for the estimated biomass (**Table 13**, **Figure 22**).

Mediterranean horse-mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 23**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 24**. Estimated abundance and biomass by size class are given in **Table 14** and **Figure 25**.

The species was mainly distributed over the inner-middle shelf of the Spanish waters, especially in the easternmost waters, although a residual nucleus was also recorded west of Cape Santa Maria, in the western Algarve (**Figure 24**). Size composition in the species' positive hauls shows that the largest specimens were located in the outer shelf of easternmost waters of the surveyed area, whereas the rest of the surveyed area is frequented by smaller but adult fish (**Figure 23**).

Mediterranean horse mackerel abundance and biomass in the surveyed area were of 14 million fish and 2 156 t (**Table 14**, **Figure 25**). Spanish waters accounted for more than 99% of both the total abundance (14 million) and biomass (2 146 t), respectively. Portuguese waters yielded a population of 0.1 million and 10 t.

The size range recorded for the estimated population was comprised between 18.5 and 38.0 cm size classes, with a main mode at 26.0 cm and a secondary one at 30.0 cm. The same modal classes and relative importance were also recorded in the distribution of the estimated biomass by size class (**Table 14**, **Figure 25**).

Bogue

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 26**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and

the coherent strata considered for the acoustic estimation are shown in **Figure 27**. Estimated abundance and biomass by size class are given in **Table 15** and **Figure 28**.

The species showed a scattered distribution all over the shelf of the surveyed area, with several spots of high acoustic density, with the densest one being located in inner-middle shelf in front of Tavira coast (**Figure 27**). Size composition in the species' positive hauls shows that larger specimens are located in the middle-outer shelf of the central and eastern waters of the surveyed area, whereas the rest of the surveyed area was frequented by smaller adult fish (**Figure 26**).

Bogue abundance and biomass in the surveyed area were of 6 million fish and 806 t (**Table 15, Figure 28**). Portuguese waters accounted for 79% (5 million) and 71% (572 t) of the total abundance and biomass, respectively. Spanish waters yielded a population of 1 million and 234 t.

The size range recorded for the estimated population was comprised between 17.0 and 29.5 cm size classes, with a main mode at 24.0 cm. The same dominant modal class was also recorded in the distribution of the estimated biomass by size class (**Table 15, Figure 28**).

Pearlside

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 29**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 30**. Estimated abundance and biomass by size class are given in **Table 16** and **Figure 31**.

The species was acoustically detected over the outer shelf and shelf break of the central and western waters of the surveyed area, although showing a very scattered distribution pattern (**Figure 30**). The very low number of positive and representative hauls prevents from identifying any spatial pattern regarding the size composition in such hauls. Average size was 4.55 cm (**Figure 29**).

Pearlside abundance and biomass in the surveyed area were of 1 798 million fish and 1 161 t (**Table 16, Figure 31**). Spanish waters accounted for 87% of both the total abundance (1 570 million) and biomass (1 013 t), respectively. Portuguese waters yielded estimates of 228 million and 147 t.

The size range recorded for the estimated population was comprised between 3.0 and 6.5 cm size classes, with a main mode at 4.0 cm size class and a secondary one at 5.5 cm size class. The same modal classes were also recorded in the distribution of the estimated biomass by size class (**Table 16, Figure 31**).

Other species

The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to blue jack mackerel, blue whiting, boarfish and snipefish are shown in **Figure 32**.

Blue jack mackerel was only detected just to the west of Cape Santa Maria, between 85 and 180 m depth. Blue whiting only occurred in the outer shelf (100-200 m depth) in front of Punta Umbria coast. Boarfish also was detected both in that same location and depths that blue whiting and in front of Cape San Vicente. Snipefish only occurred over the shelf waters comprised between Quarteira and Fuzeta, just to the east of Cape Santa Maria.

(SHORT) DISCUSSION

The time series of anchovy and sardine estimates from this survey series are described in **Tables 7** and **10** and **Figure 33**. For those surveys covering the whole survey's area (i.e. 2014, 2015, 2016 and 2018), the 2018 anchovy estimates were the lowest ones in the series, both for the total population and recruit fraction. However, the 2018 estimates should be considered with caution because the abovementioned problems in the acoustic sampling coverage (lower ping rate than the standard), which could lead to a possible underestimation of the true population levels. The magnitude of this possible underestimation is hard to be assessed. Notwithstanding the above, such a decreasing trend in anchovy population levels should not be discarded (see in **Table 7** that 2017 abundance estimates, despite being only very partial ones, covering only a part of the Spanish waters, were even higher than the 2018 estimates).

The same above considerations on the acoustic sampling coverage are also valid for sardine (**Table 10**, **Figure 33**). In this case, even taking into account a possible underestimation, the values reached in 2018 were above the historical mean for the total population and recruits abundance and recruit biomass and they might suggest a relatively stable situation since the maxima registered in 2016.

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Table 1. *ECOCADIZ-RECLUTAS 2018-10* survey. Descriptive characteristics of the acoustic tracks.

Acoustic Track	Location	Date	Start				End			
			Latitude	Longitude	UTC time	Mean depth (m)	Latitude	Longitude	UTC time	Mean depth (m)
R01	Trafalgar	17/10/2018	36° 13,820' N	06° 07,222' W	06:44	26	36° 01,965' N	06° 28,770' W	08:47	246
R02	Sancti-Petri	17/10/2018	36° 08,483' N	06° 34,346' W	09:37	195	36° 19,350' N	06° 14,432' W	14:17	25
R03	Cádiz	18/10/2018	36° 27,287' N	06° 18,940' W	08:39	25	36° 17,348' N	06° 36,895' W	13:34	217
R04	Rota	19/10/2018	36° 34,690' N	06° 23,050' W	06:41	22	36° 24,692' N	06° 41,009' W	10:26	202
R05	Chipiona	21/10/2018	36° 40,440' N	06° 29,450' W	06:48	22	36° 31,100' N	06° 46,350' W	10:18	229
R06	Doñana	21/10/2018	36° 38,060' N	06° 51,460' W	13:48	183	36° 46,600' N	06° 35,580' W	17:20	19
R07	Matalascañas	22/10/2018	36° 53,710' N	06° 40,980' W	06:37	23	36° 44,010' N	06° 58,440' W	10:09	200
R08	Mazagón	22/10/18	37° 01,250' N	06° 44,610' W	13:34	22	36° 49,220' N	07° 06,010' W	17:39	217
R09	Punta Umbría	23/10/18	37° 03,800' N	06° 56,590' W	06:39	30	36° 48,830' N	07° 06,950' W	10:17	247
R10	El Rompido	23/10/18	36° 49,940' N	07° 06,520' W	13:03	218	37° 06,640' N	07° 06,510' W	16:38	21
R11	Isla Cristina	24/10/18	37° 06,770' N	07° 17,320' W	06:44	23	36° 53,470' N	07° 17,248' W	10:04	211
R12	V.R. do Sto. Antonio	24/10/18	36° 56,210' N	07° 26,310' W	11:00	141	37° 06,118' N	07° 26,487' W	14:03	24
R13	Tavira	28/10/18	37° 03,633' N	07° 36,230' W	07:42	34	36° 56,000' N	07° 36,320' W	11:00	200
R14	Fuzeta	27/10/18	36° 55'710' N	07° 46'330' W	16:29	130	36° 59,110' N	07° 46,330' W	16:51	60
R15	Cabo Sta. María	27/10/18	36° 52,146' N	07° 56,244' W	13:17	133	36° 55,060' N	07° 56,385' W	13:35	70
R16	Cuarreira	27/10/18	37° 01,222' N	08° 06,182' W	06:47	23	36° 49,880' N	08° 06,159' W	09:51	219
R17	Albufeira	26/10/18	36° 49,390' N	08° 15,712' W	11:23	185	37° 02,652' N	08° 15,865' W	12:38	20
R18	Alfanzinha	26/10/18	37° 04,010' N	08° 25,600' W	07:02	24	36° 50,160' N	08° 25,510' W	10:35	227
R19	Portimao	25/10/18	37° 05,710' N	08° 35,740' W	12:20	31	36° 51,090' N	08° 35,690' W	17:29	200
R20	Burgau	25/10/2018	36° 52,320' N	08° 45,380' W	10:18	112	37° 03,850' N	08° 45,370' W	11:23	35
R21	Ponta de Sagres	25/10/2018	36° 59,700' N	08° 55,351' W	6:54	31	36° 50,640' N	08° 55,360' W	7:46	231

Table 2. ECOCADIZ-RECLUTAS 2018-10 survey. Descriptive characteristics of the fishing hauls.

Fishing haul	Date	Start		End		UTC Time		Depth (m)		Duration (min)		Trawled Distance (nm)	Acoustic Transect	Zone (landmark)
		Latitude	Longitude	Latitude	Longitude	Start	End	Start	End	Effective Trawling	Total Manoeuvre			
1	17-10-2018	36° 10.5597 N	6° 30.4339 W	36° 09.0423 N	6° 33.4170 W	11:07	11:58	114,20	160,45	00:41		2,851	R02	Sancti-Petri
2	18-10-2018	36° 23.0844 N	6° 26.2970 W	36° 24.8778 N	6° 23.0325 W	10:54	11:40	59,31	48,77	00:45	1:20	3,186	R03	Cádiz
3	18-10-2018	36° 18.1122 N	6° 35.4080 W	36° 19.5097 N	6° 32.8911 W	14:08	14:45	199,10	109,35	00:37	1:22	2,467	R03	Cádiz
4	19-10-2018	36° 30.0358 N	6° 31.3561 W	36° 31.7728 N	6° 28.3226 W	8:01	8:45	62,36	47,58	00:43	1:16	2,998	R04	Rota
5	19-10-2018	36° 25.8781 N	6° 38.8791 W	36° 28.0515 N	6° 34.8876 W	11:17	12:13	122,90	86,82	00:56	1:36	3,883	R04	Rota
6	21-10-2018	36° 36.2281 N	6° 36.9245 W	36° 37.9672 N	6° 33.9639 W	0,3	8:41	60,91	41,18	00:43	1:14	2,949	R05	Chipiona
7	21-10-2018	36° 32.0076 N	6° 44.6475 W	36° 34.1137 N	6° 40.8500 W	11:11	12:05	132,50	91,54	00:54	1:42	3,713	R05	Chipiona
8	21-10-2018	36° 42.6492 N	6° 42.6762 W	36° 40.9432 N	6° 46.1030 W	15:01	15:48	56,97	90,28	00:46	1:23	3,24	R06	Doñana
9	22/10/2018	36° 50.3900 N	6° 46.7255 W	36° 52.0101 N	6° 43.8381 W	7:33	8:14	44,98	27,40	0:41	1:14	2,826	R07	Matalascañas
10	22/10/2018	36° 46.4678 N	6° 53.9155 W	36° 47.9163 N	6° 51.3246 W	11:08	0,5	105,10	84,7	0:37	1:24	2,535	R07	Matalascañas
11	22/10/2018	36° 56.3362 N	6° 53.1560 W	36° 58.0814 N	6° 49.9278 W	14:58	15:43	50,04	37,66	0:45	1:20	3,12	R08	Mazagón
12	23/10/2018	36° 55.2982 N	7° 02.5734 W	36° 57.8259 N	7° 00.7698 W	08:04	8:46	90,15	63,48	0:42	1:17	2,909	R09	Punta Umbría
13	23/10/2018	36° 49.4726 N	7° 06.0735 W	36° 52.1596 N	7° 04.0302 W	11:11	11:57	198,80	114,85	0:45	1:36	3,145	R09	Punta Umbría
14	23/10/2018	37° 04.1596 N	7° 06.5007 W	37° 00.9786 N	7° 06.5121 W	14:52	15:38	38,79	56,00	0:46	1:16	3,177	R10	El Rompido
15	24/10/2018	36° 56.1778 N	7° 17.4102 W	36° 59.2590 N	7° 17.3515 W	08:14	8:58	112,60	90,40	0:44	1:23	3,078	R11	Isla Cristina
16	24/10/2018	36° 59.7296 N	7° 26.2778 W	36° 56.7858 N	7° 26.3352 W	11:44	12:27	99,75	135,29	0:43	1:28	2,94	R12	Vila R. do Sto Antonio
17	25/10/2018	36° 53.2951 N	8° 55.4324 W	36° 55.2914 N	8° 55.4380 W	08:21	8:51	120,9	110,67	0:29	1:22	1,994	R21	Ponta de Sagres
18	25/10/2018	37° 04.0755 N	8° 34.5544 W	37° 03.8899 N	8° 37.1072 W	13:26	13:55	40,72	41,08	0:28	1:02	2,052	R19	Portimao
19	25/10/2018	36° 54.8672 N	8° 34.2443 W	36° 55.0481 N	8° 37.3169 W	15:57	16:33	99,70	101,00	0:36	1:10	2,471	R19	Portimao
20	26/10/2018	36° 54.3837 N	8° 25.8487 W	36° 57.6797 N	8° 25.6522 W	8:29	9:18	114,50	77,48	0:48	1:28	3,296	R18	Alfanzina
21	26/10/2018	37° 00.6081 N	8° 17.7079 W	37° 00.5492 N	8° 14.6373 W	13:45	14:21	40,48	41,41	0:35	1:10	2,46	R17	Albufeira
22	27/10/2018	36° 56.0608 N	8° 06.1255 W	36° 59.1617 N	8° 06.1655 W	7:44	8:29	49,33	38,82	0:44	1:19	3,097	R16	Cuarteira
23	27/10/2018	36° 52.1869 N	8° 04.7961 W	36° 51.2938 N	8° 08.0353 W	11:01	11:41	113,30	104,58	0:40	1:26	2,748	R16	Cuarteira
24	27/10/2018	36° 52.9063 N	7° 58.0099 W	36° 53.2713 N	7° 54.8999 W	14:37	15:13	104,60	104,92	0:36	1:29	2,521	R15	Cabo de Sta María
25	28/10/2018	37° 02.4592 N	7° 35.2349 W	37° 01.2892 N	7° 38.6924 W	8:53	9:38	75,52	74,56	0:45	1:43	3,005	R13	Tavira

Table 3. ECOCADIZ-RECLUTAS 2018-10 survey. Catches by species in number (upper panel) and weight (in kg, lower panel) from valid fishing stations.

Fishing haul	CATCH IN NUMBER (n)														TOTAL
	Anchovy	Sardine	Round sardinella	Chub mack.	Mackerel	Blue Jack mack.	Horse-mack.	Medit. Horse-mack.	Bogue	Blue whiting	Boarfish	Snipefish	Pearlside	Other spp.	
01	1	0	0	1079	0	0	0	0	0	0	0	0	0	0	1080
02	2	564	2	152	0	0	2	384	11	0	0	0	0	24	1141
03	0	3	0	6231	2	0	10	12	0	0	1	0	0	13	6272
04	1897	4237	0	12	0	0	5	23	7	0	0	0	0	8	6189
05	4869	23	0	483	16	0	2	0	0	0	4	0	0	118	5515
06	22552	12939	0	2	9	0	1	2	0	0	0	0	0	36	35541
07	103463	2177	0	287	17	0	1	0	0	0	0	0	0	105	106050
08	23401	30234	0	2	6	0	0	0	0	0	0	0	0	11	53654
09	305	27350	0	44	1	0	0	148	37	0	0	0	0	137	28022
10	100181	9	0	11	50	0	0	1	1	0	0	0	0	33	100286
11	488	10869	0	146	2	0	0	90	18	0	0	0	0	45	11658
12	9215	3429	0	172	22	0	44	3	2	0	0	0	0	54	12941
13	3314	2	0	2898	6	0	73	0	0	6	12	0	2900	32	9243
14	14	23338	0	7138	4	0	0	9	7	0	0	1	0	2	30513
15	7584	50	0	2	3	0	2	0	0	0	0	0	0	37	7678
16	3536	0	0	0	1	0	1	0	0	0	0	0	0	16	3554
17	169	1	0	4	52	0	519	0	45	0	8	0	0	113	911
18	0	8555	0	4	0	0	3	0	4	0	0	0	0	135	8701
19	186	4	0	7	2	0	1	0	0	0	0	0	0	37	237
20	526	55	0	829	10	0	5	0	7	0	0	0	0	90	1522
21	0	1	0	87	0	0	118	5	14	0	0	0	0	31	256
22	0	23	0	259	0	0	431	1	35	0	0	0	0	266	1015
23	41093	44	0	1769	10	1	10	0	0	0	0	0	1	24	42952
24	2028	49	0	2119	3	0	1689	0	0	0	0	0	0	40	5928
25	12178	579	0	908	6	0	167	0	50	0	0	69	0	43	14000
TOTAL	337002	124535	2	24645	222	1	3084	678	238	6	25	70	2901	1450	494859

Table 3. ECOCADIZ-RECLUTAS 2018-10 survey. Cont'd.

Fishing haul	CATCH IN WEIGHT (kg)														
	Anchovy	Sardine	Round sardinella	Chub mack.	Mackerel	Blue Jack mack.	Horse-mack.	Medit. Horse-mack.	Bogue	Blue whiting	Boarfish	Snipefish	Pearlside	Other spp.	TOTAL
01	0,028	0	0	86,770	0	0	0	0	0	0	0	0	0	0	86,798
02	0,037	13,740	0,790	13,780	0	0	0,111	71,680	2,092	0	0	0	0	4,547	106,777
03	0	0,115	0	388,280	0,188	0	0,453	5,773	0	0	0,006	0	0	4,106	398,921
04	13,198	51,652	0	0,989	0	0	0,233	2,707	1,350	0	0	0	0	32,352	102,481
05	65,320	0,529	0	38,060	2,486	0	0,054	0	0	0	0,167	0	0	16,935	123,551
06	107,178	188,370	0	0,177	2,059	0	0,079	0,832	0	0	0	0	0	3,595	302,290
07	1446,998	36,093	0	21,350	2,680	0	0,180	0	0	0	0	0	0	17,335	1524,636
08	163,201	433,137	0	0,094	1,161	0	0	0	0	0	0	0	0	1,206	598,799
09	2,050	380,840	0	4,046	0,212	0	0	21,540	7,035	0	0	0	0	14,929	430,652
10	1263,338	0,122	0	0,797	8,120	0	0	0,122	0,164	0	0	0	0	13,673	1286,336
11	4,048	347,642	0	13,120	0,469	0	0	14,960	2,999	0	0	0	0	6,304	389,542
12	99,940	82,520	0	10,620	4,142	0	1,519	0,295	0,313	0	0	0	0	4,077	203,426
13	56,007	0,143	0	174,287	0,921	0	16,120	0	0	0,184	0,045	0	1,821	4,180	253,708
14	0,116	417,777	0	421,251	1,127	0	0	1,280	1,165	0	0	0,003	0	0,220	842,939
15	99,780	0,867	0	0,094	0,398	0	0,056	0	0	0	0	0	0	4,713	105,908
16	55,680	0	0	0	0,124	0	0,204	0	0	0	0	0	0	3,145	59,153
17	4,012	0,025	0	0,170	13,240	0	56,740	0	4,324	0	0,054	0	0	28,310	106,875
18	0	553,334	0	0,253	0	0	0,309	0	0,306	0	0	0	0	21,864	576,066
19	4,040	0,139	0	0,472	0,333	0	0,141	0	0	0	0	0	0	8,457	13,582
20	10,816	1,327	0	40,840	2,154	0	0,369	0	0,073	0	0	0	0	10,588	66,167
21	0	0,068	0	9,660	0	0	9,180	0,645	1,138	0	0	0	0	4,411	25,102
22	0	0,414	0	14,660	0	0	37,560	0,147	3,418	0	0	0	0	43,750	99,949
23	777,672	0,874	0	125,020	1,289	0,063	0,680	0	0	0	0	0	0,001	1,887	907,486
24	43,000	1,695	0	127,620	4,360	0	247,540	0	0	0	0	0	0	4,550	428,765
25	201,520	10,780	0	57,820	0,670	0	11,520	0	25,180	0	0	0,241	0	7,079	314,810
TOTAL	4417,979	2522,203	0,790	1550,230	46,133	0,063	383,048	119,981	49,557	0,184	0,272	0,244	1,822	262,213	9354,719

Table 4. ECOCADIZ-RECLUTAS 2018-10 survey. Parameters of the size-weight relationships for the survey's target species susceptible of being assessed. FAO codes for the species: ANE: *Engraulis encrasicolus*; PIL: *Sardina pilchardus*; SAA: *Sardinella aurita*; MAS: *Scomber colias*; MAC: *Scomber scombrus*; HMM: *Trachurus mediterraneus*.

Parameter	ANE	PIL	MAS	MAC	HOM	HMM	BOG	MAV
Size range (mm)	76-184	104-233	165-318	200-386	20-341	117-482	160-312	32-66
n	944	985	836	220	378	205	286	129
a	0,005886134	0,001959529	0,001311841	0,000667182	0,049940934	0,01862158	0,009774912	0,006143344
b	2,984386331	3,466989068	3,553312648	3,699042765	2,407050492	2,720476789	2,975809544	3,028111499
r ²	0,987059273	0,97005141	0,932427064	0,946022212	0,773164253	0,935408782	0,929407994	0,9373326

Table 5. ECOCADIZ-RECLUTAS 2017-10 survey. Anchovy (*E. encrasicolus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 7.**

ECOCADIZ-RECLUTAS 2018-10 . <i>Engraulis encrasicolus</i> . ABUNDANCE (in numbers and million fish)																			
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	POL12	<i>n</i>			Millions			
													PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7,5	618	20	0	0	0	0	0	0	0	0	0	0	0	638	0	638	0,001	0	0,001
8	618	20	0	0	0	0	0	0	0	0	0	0	0	638	0	638	0,001	0	0,001
8,5	618	20	0	0	499554	1945070	0	0	65439696	0	0	0	0	500192	67384766	67884958	1	67	68
9	824	26	0	0	3562404	13870621	0	0	105172435	0	0	0	0	3563254	119043056	122606310	4	119	123
9,5	412	13	0	0	7374468	28713321	0	0	32719848	0	0	0	0	7374893	61433169	68808062	7	61	69
10	1030	33	0	0	9381903	36529493	0	0	16359924	0	0	0	0	9382966	52889417	62272383	9	53	62
10,5	824	26	0	93484	7882321	30690701	150733	0	4678750	41029	162	33	7976655	35561408	43538063	8	36	44	
11	412	13	0	823377	5719093	22267931	1327604	0	4678750	361364	1430	288	6542895	28637367	35180262	7	29	35	
11,5	412	13	0	2629994	4025628	15674236	4240576	0	4678750	1154254	4567	921	6656047	25753304	32409351	7	26	32	
12	0	0	728010	10906220	2966553	11550606	17585082	9894	2334141	4786531	18940	3818	14600783	36289012	50889795	15	36	51	
12,5	0	0	7719558	12719846	1397404	5440951	20509355	104917	0	5582496	22089	4453	21836808	31664261	53501069	22	32	54	
13	232531	7384	26973016	15259059	690825	2689805	24603557	366590	0	6696908	26499	5342	43162815	34388701	77551516	43	34	78	
13,5	1014992	32231	43524545	11602675	895998	3488668	18708039	591542	0	5092191	20149	4062	57070441	27904651	84975092	57	28	85	
14	3974894	126223	75278354	7490760	140945	548787	12078028	1023109	0	3287551	13008	2622	87011176	16953105	103964281	87	17	104	
14,5	8547496	271427	61846173	2722093	144982	564504	4389077	840552	0	1194675	4727	953	73532171	6994488	80526659	74	7	81	
15	10502179	333498	21265493	724148	0	0	1167610	289019	0	317815	1258	254	32825318	1775956	34601274	33	2	35	
15,5	9320916	295987	12748604	280453	0	0	452200	173266	0	123086	487	98	22645960	749137	23395097	23	1	23	
16	6050243	192126	832603	93484	0	0	150733	11316	0	41029	162	33	7168456	203273	7371729	7	0	7	
16,5	1829693	58102	0	93484	0	0	150733	0	0	41029	162	33	1981279	191957	2173236	2	0	2	
17	757126	24043	0	0	0	0	0	0	0	0	0	0	781169	0	781169	1	0	1	
17,5	45765	1453	0	0	0	0	0	0	0	0	0	0	47218	0	47218	0,05	0	0,05	
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18,5	50684	1609	0	0	0	0	0	0	0	0	0	0	52293	0	52293	0,05	0	0,05	
TOTAL <i>n</i>	42332287	1344267	250916356	65439077	44682078	173974694	105513327	3410205	236062294	28719958	113640	22910	404714065	547817028	952531093	405	548	953	
Millions	42	1	251	65	45	174	106	3	236	29	0,1	0,02							

Table 5. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*E. encrasicolus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10. <i>Engraulis encrasicolus</i> . BIOMASS (t)															
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	POL12	PORTUGAL	SPAIN	TOTAL
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7,5	0,002	0	0	0	0	0	0	0	0	0	0	0	0,002	0	0,002
8	0,002	0	0	0	0	0	0	0	0	0	0	0	0,002	0	0,002
8,5	0,002	0	0	0	1,904	7,414	0	0	249,452	0	0	0	1,906	256,866	258,772
9	0,004	0	0	0	16,029	62,412	0	0	473,230	0	0	0	16,033	535,642	551,675
9,5	0,002	0	0	0	38,827	151,177	0	0	172,271	0	0	0	38,829	323,448	362,277
10	0,006	0	0	0	57,347	223,287	0	0	100,000	0	0	0	57,353	323,287	380,640
10,5	0,006	0	0	0,659	55,540	216,251	1,062	0	32,967	0,289	0,001	0	56,205	250,570	306,775
11	0,003	0	0	6,645	46,153	179,703	10,714	0	37,758	2,916	0,012	0,002	52,801	231,105	283,906
11,5	0,004	0	0	24,165	36,989	144,020	38,964	0	42,990	10,606	0,042	0,008	61,158	236,63	297,788
12	0	0	7,575	113,481	30,867	120,186	182,976	0,103	24,287	49,805	0,197	0,040	151,923	377,594	529,517
12,5	0	0	90,509	149,136	16,384	63,793	240,465	1,230	0	65,453	0,259	0,052	256,029	371,252	627,281
13	3,058	0,097	354,720	200,671	9,085	35,373	323,559	4,821	0	88,070	0,348	0,070	567,631	452,241	1019,872
13,5	14,908	0,473	639,292	170,421	13,160	51,242	274,785	8,689	0	74,795	0,296	0,060	838,254	409,867	1248,121
14	64,951	2,063	1230,069	122,401	2,303	8,967	197,358	16,718	0	53,720	0,213	0,043	1421,787	277,019	1698,806
14,5	154,809	4,916	1120,134	49,301	2,626	10,224	79,493	15,224	0	21,637	0,086	0,017	1331,786	126,681	1458,467
15	210,109	6,672	425,442	14,487	0	0	23,359	5,782	0	6,358	0,025	0,005	656,710	35,529	692,239
15,5	205,322	6,520	280,828	6,178	0	0	9,961	3,817	0	2,711	0,011	0,002	498,848	16,502	515,350
16	146,304	4,646	20,134	2,261	0	0	3,645	0,274	0	0,992	0,004	0,001	173,345	4,916	178,261
16,5	48,433	1,538	0	2,475	0	0	3,990	0	0	1,086	0,004	0,001	52,446	5,081	57,527
17	21,880	0,695	0	0	0	0	0	0	0	0	0	0	22,575	0	22,575
17,5	1,440	0,046	0	0	0	0	0	0	0	0	0	0	1,486	0	1,486
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18,5	1,879	0,060	0	0	0	0	0	0	0	0	0	0	1,939	0	1,939
TOTAL	873,124	27,726	4168,703	862,281	327,214	1274,049	1390,331	56,658	1132,955	378,438	1,498	0,301	6259,048	4234,230	10493,278

Table 6. *ECOCADIZ-RECLUTAS 2018-10* survey. Anchovy (*E. encrasicolus*). Estimated abundance (thousands of individuals) and biomass (tonnes) by age group. Polygons (i.e., coherent or homogeneous post-strata) numbered as in **Figure 7** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	POL12	PORTUGAL	SPAIN	SURVEYED AREA
	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
0	1103	35	28594	24659	41401	161200	39759	389	235127	10822	43	9	95791	447348	543140
I	34688	1102	211794	39969	3251	12659	64446	2878	935	17542	69	14	290804	98544	389348
II	6541	208	10529	811	30	116	1308	143	0	356	1	0	18119	1925	20043
III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	42332	1344	250916	65439	44682	173975	105513	3410	236062	28720	114	23	404714	547817	952531

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	POL12	PORTUGAL	SPAIN	SURVEYED AREA
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0	19	1	413	285	286	1114	460	6	1124	125	0,5	0,1	1005	2830	3834
I	703	22	3557	563	41	158	907	48	9	247	1	0,2	4885	1371	6256
II	151	5	199	14	0	2	23	3	0	6	0,02	0,005	369	34	403
III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	873	28	4169	862	327	1274	1390	57	1133	378	1	0,3	6259	4234	10493

Table 7. ECOCADIZ-RECLUTAS surveys series. Anchovy (*E. encrasicolus*). Acoustic estimates of biomass (t) and abundance (million fish) for the whole Gulf of Cadiz anchovy population and for the juvenile fraction (*i.e.* age 0 fish, between parentheses). The 2017 estimates correspond to an incomplete coverage (only the seven easternmost transects) of the standard surveyed area due to a research vessels' breakdown.

Estimate/Year	Total Population (Recruits at age 0)					
	2012	2014	2015	2016	2017	2018
Biomass (t)	13680 (13354)	8113 (5131)	30827 (29219)	19861 (15969)	7642 (7290)	10493 (3834)
Abundance (millions)	2469 (2619)	986 (814)	5227 (5117)	3667 (3445)	1492 (1433)	953 (543)

Table 8. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 11.**

ECOCADIZ-RECLUTAS 2018-10. <i>Sardina pilchardus</i> . ABUNDANCE (in numbers and million fish)																	
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	n			Millions		
												PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	672416	0	3529078	0	0	0	0	672416	3529078	4201494	1	4	4
11	0	0	0	0	3892241	0	20427855	0	0	0	0	3892241	20427855	24320096	4	20	24
11,5	0	0	0	0	28748690	0	150883289	223970	0	0	0	28748690	151107259	179855949	29	151	180
12	0	0	0	147738	40549540	601163	212818321	959871	38663	192227	0	40697278	214610245	255307523	41	215	255
12,5	35218	0	0	705541	24096335	2870922	126466085	1401411	184641	1153364	2	24837094	132076425	156913519	25	132	157
13	264135	8758	0	5149452	17729254	20953675	93049394	671909	1347616	2146539	15	23151599	118169148	141320747	23	118	141
13,5	308157	70068	0	9067082	8827281	36894931	46328690	127983	2372863	800947	26	18272588	86525440	104798028	18	87	105
14	633924	183928	741	6579441	4146547	26772455	21762547	537527	1721846	2595069	19	11544581	53389463	64934044	12	53	65
14,5	1056540	332822	0	2188704	1322899	8906071	6943042	1017463	572786	2338766	6	4900965	19778134	24679099	5	20	25
15	783600	183928	741	704349	1399639	2866071	7345802	9176362	184329	2242652	2	3072257	21815218	24887475	3	22	25
15,5	220112	271513	4447	262327	797009	1067438	4182983	13271810	68651	2691183	1	1555408	21282066	22837474	2	21	23
16	281744	1138602	13342	91187	401420	371051	2106794	23369648	23864	2146539	0	1926295	28017896	29944191	2	28	30
16,5	114458	1015983	8895	146200	117466	594904	616503	8638835	38261	1089288	0	1403002	10977791	12380793	1	11	12
17	0	2531200	5189	143987	83152	585897	436413	5080915	37681	448530	0	2763528	6589436	9352964	3	7	9
17,5	35218	1261221	1482	168258	35690	684661	187316	3045989	44033	96114	0	1501869	4058113	5559982	2	4	6
18	35218	9643084	0	161571	17721	657448	93008	2034926	42283	0	0	9857594	2827665	12685259	10	3	13
18,5	70436	8802270	0	148018	0	602300	0	0	38736	0	0	9020724	641036	9661760	9	1	10
19	0	12156767	741	65416	0	266186	0	0	17120	0	0	12222924	283306	12506230	12	0	13
19,5	35218	7129401	0	39153	0	159316	0	10246	96114	0	0	7203772	265676	7469448	7	0	7
20	0	5027366	0	19576	0	79658	0	0	5123	0	0	5046942	84781	5131723	5	0	5
20,5	0	8381863	741	19576	0	79658	0	0	5123	0	0	8402180	84781	8486961	8	0	8
21	0	7549808	0	13553	0	55148	0	0	3547	0	0	7563361	58695	7622056	8	0	8
21,5	0	5447773	0	6023	0	24510	0	0	1576	0	0	5453796	26086	5479882	5	0	5
22	0	3354497	0	6023	0	24510	0	0	1576	0	0	3360520	26086	3386606	3	0	3
22,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	420407	0	0	0	0	0	0	0	0	0	420407	0	420407	0	0	0
23,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	3873978	74911259	36319	25833175	132837300	105117973	697177120	69558619	6760564	18037332	71	237492031	896651679	1134143710	237	897	1134
Millions	4	75	0,04	26	133	105	697	70	7	18	0,0001						

Table 8. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10 . Sardina pilchardus . BIOMASS (t)														
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	PORTUGAL	SPAIN	TOTAL
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	4,962	0	26,043	0	0	0	0	0	31,005	31,005
11	0	0	0	0	33,627	0	176,485	0	0	0	0	0	210,112	210,112
11,5	0	0	0	0	288,788	0	1515,662	2,250	0	0	0	0	1806,700	1806,700
12	0	0	0	1,715	470,645	6,977	2470,111	11,141	0,449	2,231	0	1,715	2961,555	2963,269
12,5	0,470	0	0	9,407	321,288	38,279	1686,232	18,686	2,462	15,378	0,00003	9,877	2082,325	2092,202
13	4,024	0,133	0	78,455	270,117	319,243	1417,671	10,237	20,532	32,704	0,0002	82,613	2070,504	2153,117
13,5	5,338	1,214	0	157,073	152,919	639,148	802,573	2,217	41,106	13,875	0,0005	163,625	1651,839	1815,464
14	12,429	3,606	0,015	129,004	81,302	524,932	426,702	10,539	33,761	50,882	0,0004	145,055	1128,119	1273,173
14,5	23,347	7,354	0	48,365	29,233	196,801	153,423	22,483	12,657	51,681	0,0001	79,066	466,278	545,343
15	19,437	4,562	0,018	17,471	34,718	71,092	182,211	227,618	4,572	55,628	0,00005	41,489	575,839	617,328
15,5	6,106	7,532	0,123	7,277	22,109	29,611	116,037	368,163	1,904	74,654	0,00003	21,038	612,479	633,517
16	8,710	35,200	0,412	2,819	12,410	11,471	65,131	722,469	0,738	66,360	0	47,141	878,579	925,720
16,5	3,930	34,889	0,305	5,020	4,034	20,429	21,171	296,656	1,314	37,406	0	44,145	381,009	425,154
17	0	96,253	0,197	5,475	3,162	22,280	16,595	193,209	1,433	17,056	0	101,925	253,735	355,660
17,5	1,479	52,954	0,062	7,065	1,498	28,746	7,865	127,890	1,849	4,035	0	61,560	171,884	233,444
18	1,628	445,812	0	7,470	0,819	30,395	4,300	94,077	1,955	0	0	454,910	131,546	586,456
18,5	3,576	446,918	0	7,515	0	30,581	0	0	1,967	0	0	458,009	32,547	490,557
19	0	676,203	0,041	3,639	0	14,806	0	0	0,952	0	0	679,883	15,758	695,641
19,5	2,141	433,433	0	2,380	0	9,686	0	0	0,623	5,843	0	437,954	16,152	454,106
20	0	333,314	0	1,298	0	5,281	0	0	0,340	0	0	334,612	5,621	340,233
20,5	0	604,755	0,053	1,412	0	5,747	0	0	0,370	0	0	606,221	6,117	612,338
21	0	591,598	0	1,062	0	4,321	0	0	0,278	0	0	592,660	4,599	597,259
21,5	0	462,730	0	0,512	0	2,082	0	0	0,134	0	0	463,241	2,216	465,457
22	0	308,289	0	0,554	0	2,253	0	0	0,145	0	0	308,842	2,397	311,239
22,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	44,998	0	0	0	0	0	0	0	0	0	44,998	0	44,998
23,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	92,616	4591,746	1,228	494,989	1731,631	2014,162	9088,212	2107,635	129,539	427,734	0,001	5180,579	15498,915	20679,494

Table 9. *ECOCADIZ-RECLUTAS 2017-07* survey. Sardine (*Sardina pilchardus*). Estimated abundance (thousands of individuals) and biomass (tonnes) by age group. Polygons (i.e., coherent or homogeneous post-strata) numbered as in **Figure 11** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	PORTUGAL	SPAIN	SURVEYED AREA
	N	N	N	N	N	N	N	N	N	N	N	N	N	N
0	3542	3792	24	24857	132445	101145	695118	52558	6505	16409	0,1	32215	1004180	1036395
I	208	12938	9	557	325	2268	1705	13514	146	1300	0,001	13713	19258	32971
II	106	27465	2	333	63	1357	333	3244	87	259	0,00004	27906	5344	33250
III	13	13739	1	52	4	214	21	242	14	57	0	13805	551	14357
IV	4	7558	0	20	0	81	0	0	5	12	0	7582	98	7681
V	0	5436	0	9	0	36	0	0	2	0	0	5445	38	5483
VI	0	3983	0	5	0	18	0	0	1	0	0	3987	20	4007
TOTAL	3874	74911	36	25833	132837	105118	697177	69559	6761	18037	0,1	104655	1029489	1134144

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	PORTUGAL	SPAIN	SURVEYED AREA
	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0	79	121	1	453	1720	1843	9025	1492	119	372	0,001	654	14570	15224
I	7	618	0,3	20	10	81	51	479	5	43	0,00001	646	668	1314
II	5	1537	0,1	16	2	66	11	128	4	9	0,000001	1558	221	1779
III	1	974	0,03	3	0,2	13	1	9	1	3	0	978	27	1006
IV	0,3	542	0,04	1	0	6	0	0	0,4	1	0	544	7	550
V	0	446	0	1	0	3	0	0	0,2	0	0	447	3	450
VI	0	353	0	0,4	0	2	0	0	0,1	0	0	354	2	356
TOTAL	93	4592	1	495	1732	2014	9088	2108	130	428	0,001	5181	15499	20679

Table 10. *ECOCADIZ-RECLUTAS* surveys series. Sardine (*Sardina pilchardus*). Acoustic estimates of biomass (t) and abundance (million fish) for the whole Gulf of Cadiz anchovy population and for the juvenile fraction (*i.e.* age 0 fish, between parentheses). Note that the 2012 survey only surveyed the Spanish waters. The 2017 estimates correspond to an incomplete coverage (only the seven easternmost transects) of the standard surveyed area due to a research vessels' breakdown.

Estimate/Year	Total Population (Recruits at age 0)					
	2012	2014	2015	2016	2017	2018
Biomass (t)	22119 (9182)	36571 (705)	30992 (8645)	35173 (21899)	12119 (8778)	20679 (15224)
Abundance (millions)	603 (359)	507 (26)	861 (509)	2379 (1940)	591 (483)	1134 (1036)

Table 11. ECOCADIZ-RECLUTAS 2018-10 survey. Atlantic mackerel (*Scomber scombrus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 15**.

ECOCADIZ-RECLUTAS 2018-10 . <i>Scomber scombrus</i> . ABUNDANCE (in numbers and million fish)											
Size class	POL01	POL02	POL03	POL04	POL05	n			Millions		
						PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
20	0	0	0	0	0	0	0	0	0	0	0
20,5	0	0	0	0	0	0	0	0	0	0	0
21	15995	0	1801	6887	3948	17796	10835	28631	0,02	0,01	0,03
21,5	0	0	0	0	0	0	0	0	0	0	0
22	15995	0	1801	6887	3948	17796	10835	28631	0,02	0,01	0,03
22,5	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0
24,5	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0
25,5	0	0	0	0	0	0	0	0	0	0	0
26	79976	0	9003	34434	19739	88979	54173	143152	0,1	0,1	0,1
26,5	79976	0	9003	34434	19739	88979	54173	143152	0,1	0,1	0,1
27	143956	0	16206	61982	35530	160162	97512	257674	0,2	0,1	0,3
27,5	79976	0	9003	34434	19739	88979	54173	143152	0,1	0,1	0,1
28	63981	0	7202	27548	15791	71183	43339	114522	0,1	0,04	0,1
28,5	47985	0	5402	20661	11843	53387	32504	85891	0,1	0,03	0,1
29	79976	0	9003	34434	19739	88979	54173	143152	0,1	0,1	0,1
29,5	31990	264	3601	13774	7895	35855	21669	57524	0,0	0,02	0,1
30	63981	264	7202	27548	15791	71447	43339	114786	0,1	0,04	0,1
30,5	15995	660	1801	6887	3948	18456	10835	29291	0,02	0,01	0,03
31	63981	660	7202	27548	15791	71843	43339	115182	0,1	0,04	0,1
31,5	15995	660	1801	6887	3948	18456	10835	29291	0,02	0,01	0,03
32	0	2242	0	0	0	2242	0	2242	0,002	0	0,002
32,5	0	132	0	0	0	132	0	132	0,0001	0	0,0001
33	0	1055	0	0	0	1055	0	1055	0,001	0	0,001
33,5	0	528	0	0	0	528	0	528	0,001	0	0,001
34	0	132	0	0	0	132	0	132	0,0001	0	0,0001
34,5	0	132	0	0	0	132	0	132	0,0001	0	0,0001
35	0	0	0	0	0	0	0	0	0	0	0
35,5	0	132	0	0	0	132	0	132	0,0001	0	0,0001
36	0	0	0	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0
38,5	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0
39,5	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	799758	6861	90031	344345	197389	896650	541734	1438384	1	1	1
Millions	1	0,01	0,1	0,3	0,2						

Table 11. *ECOCADIZ-RECLUTAS 2018-10* survey. Atlantic mackerel (*Scomber scombrus*). Cont'd.

<i>ECOCADIZ-RECLUTAS 2018-10 . Scomber scombrus . BIOMASS (t)</i>								
Size class	POL01	POL02	POL03	POL04	POL05	PORTUGAL	SPAIN	TOTAL
20	0	0	0	0	0	0	0	0
20,5	0	0	0	0	0	0	0	0
21	0,867333	0	0,098	0,373	0,214	0,965	0,588	1,553
21,5	0	0	0	0	0	0	0	0
22	1,028	0	0,116	0,443	0,254	1,144	0,696	1,840
22,5	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
24,5	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
25,5	0	0	0	0	0	0	0	0
26	9,476	0	1,067	4,080	2,339	10,543	6,419	16,961
26,5	10,161	0	1,144	4,375	2,508	11,305	6,883	18,188
27	19,586	0	2,205	8,433	4,834	21,791	13,267	35,059
27,5	11,638	0	1,310	5,011	2,873	12,949	7,883	20,832
28	9,947	0	1,120	4,283	2,455	11,066	6,738	17,804
28,5	7,960	0	0,896	3,427	1,965	8,856	5,392	14,248
29	14,141	0	1,592	6,088	3,490	15,732	9,578	25,311
29,5	6,022	0,050	0,678	2,593	1,486	6,750	4,079	10,829
30	12,810	0,053	1,442	5,516	3,162	14,305	8,677	22,983
30,5	3,403	0,140	0,383	1,465	0,840	3,926	2,305	6,231
31	14,448	0,149	1,626	6,221	3,566	16,223	9,787	26,010
31,5	3,830	0,158	0,431	1,649	0,945	4,420	2,595	7,014
32	0	0,569	0	0	0	0,569	0	0,569
32,5	0	0,035	0	0	0	0,035	0	0,035
33	0	0,300	0	0	0	0,300	0	0,300
33,5	0	0,159	0	0	0	0,159	0	0,159
34	0	0,042	0	0	0	0,042	0	0,042
34,5	0	0,044	0	0	0	0,044	0	0,044
35	0	0	0	0	0	0	0	0
35,5	0	0,049	0	0	0	0,049	0	0,049
36	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
38,5	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0
39,5	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
TOTAL	125,318	1,748	14,107	53,957	30,930	141,173	84,887	226,060

Table 12. ECOCADIZ-RECLUTAS 2018-10 survey. Chub mackerel (*Scomber colias*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 18**.

ECOCADIZ-RECLUTAS 2018-10 . <i>Scomber colias</i> . ABUNDANCE (in numbers and million fish)											
Size class	POL01	POL02	POL03	POL04	POL05	n			Millions		
						PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	2346	23296	2346	23296	25642	0,00	0,02	0,03
16,5	0	381971	546	4692	46592	387209	46592	433801	0,4	0,05	0,4
17	0	879541	1257	19918	197768	900716	197768	1098484	1	0,2	1,1
17,5	0	3389687	4843	72924	724071	3467454	724071	4191525	3	1	4
18	0	6147747	8784	153073	1519889	6309604	1519889	7829493	6	2	8
18,5	0	8052937	11506	295738	2936431	8360181	2936431	11296612	8	3	11
19	0	9029951	12902	459013	4557610	9501866	4557610	14059476	10	5	14
19,5	0	6467372	9241	464361	4610715	6940974	4610715	11551689	7	5	12
20	0	5434663	7765	411315	4084010	5853743	4084010	9937753	6	4	10
20,5	110804	3909694	5586	352946	3504455	4379030	3504455	7883485	4	4	8
21	55402	2291182	3274	289276	2872270	2639134	2872270	5511404	3	3	6
21,5	221609	4123463	5892	289698	2876455	4640662	2876455	7517117	5	3	8
22	147739	2890991	4131	283108	2811021	3325969	2811021	6136990	3	3	6
22,5	55402	2674537	3821	235934	2342626	2969694	2342626	5312320	3	2	5
23	313945	2740111	3915	229139	2275152	3287110	2275152	5562262	3	2	6
23,5	221609	1676094	2395	133839	1328905	2033937	1328905	3362842	2	1	3
24	147739	1129753	1614	125066	1241800	1404172	1241800	2645972	1	1	3
24,5	92337	658218	940	41277	409845	792772	409845	1202617	1	0	1
25	92337	356564	509	68946	684577	518356	684577	1202933	1	1	1
25,5	36935	174924	250	18099	179711	230208	179711	409919	0,2	0,2	0,4
26	55402	0	0	19968	198262	75370	198262	273632	0,1	0,2	0,3
26,5	0	0	0	4580	45472	4580	45472	50052	0,00	0,05	0,1
27	0	49470	71	13582	134854	63123	134854	197977	0,1	0,1	0,2
27,5	36935	0	0	12109	120233	49044	120233	169277	0,05	0,1	0,2
28	36935	0	0	12109	120233	49044	120233	169277	0,05	0,1	0,2
28,5	0	49470	71	18626	184938	68167	184938	253105	0,1	0,2	0,3
29	0	0	0	339	3368	339	3368	3707	0,0003	0,003	0,004
29,5	0	0	0	2994	29729	2994	29729	32723	0,003	0,03	0,03
30	0	0	0	57	561	57	561	618	0,0001	0,001	0,001
30,5	0	0	0	170	1684	170	1684	1854	0,0002	0,002	0,002
31	0	0	0	113	1123	113	1123	1236	0,0001	0,001	0,001
31,5	0	0	0	113	1123	113	1123	1236	0,0001	0,001	0,001
32	0	0	0	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	1625130	62508340	89313	4035468	40068779	68258251	40068779	108327030	68	40	108
Millions	2	63	0,1	4	40						

Table 12. ECOCADIZ-RECLUTAS 2018-10 survey. Chub mackerel (*Scomber colias*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10 . <i>Scomber colias</i> . BIOMASS (t)								
Size class	POL01	POL02	POL03	POL04	POL05	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0
16	0	0	0	0,062	0,613	0,062	0,613	0,675
16,5	0	11,200	0,016	0,138	1,366	11,354	1,366	12,720
17	0	28,631	0,041	0,648	6,438	29,320	6,438	35,758
17,5	0	122,133	0,174	2,628	26,089	124,935	26,089	151,024
18	0	244,489	0,349	6,088	60,444	250,926	60,444	311,370
18,5	0	352,539	0,504	12,947	128,550	365,990	128,55	494,540
19	0	434,061	0,62	22,064	219,080	456,745	219,080	675,825
19,5	0	340,537	0,487	24,451	242,775	365,475	242,775	608,250
20	0	312,745	0,447	23,670	235,02	336,862	235,020	571,882
20,5	6,954	245,358	0,351	22,150	219,927	274,813	219,927	494,740
21	3,784	156,481	0,224	19,757	196,168	180,246	196,168	376,414
21,5	16,439	305,882	0,437	21,490	213,378	344,248	213,378	557,626
22	11,881	232,495	0,332	22,768	226,063	267,476	226,063	493,539
22,5	4,822	232,760	0,333	20,533	203,875	258,448	203,875	462,323
23	29,516	257,619	0,368	21,543	213,904	309,046	213,904	522,95
23,5	22,471	169,958	0,243	13,571	134,753	206,243	134,753	340,996
24	16,132	123,361	0,176	13,656	135,596	153,325	135,596	288,921
24,5	10,841	77,279	0,110	4,846	48,118	93,076	48,118	141,194
25	11,639	44,946	0,064	8,691	86,293	65,340	86,293	151,633
25,5	4,992	23,641	0,034	2,446	24,288	31,113	24,288	55,401
26	8,017	0	0	2,890	28,690	10,907	28,690	39,597
26,5	0	0	0	0,709	7,036	0,709	7,036	7,745
27	0	8,176	0,012	2,245	22,287	10,433	22,287	32,720
27,5	6,512	0	0	2,135	21,197	8,647	21,197	29,844
28	6,938	0	0	2,275	22,585	9,213	22,585	31,798
28,5	0	9,891	0,014	3,724	36,975	13,629	36,975	50,604
29	0	0	0	0,072	0,716	0,072	0,716	0,788
29,5	0	0	0	0,676	6,712	0,676	6,712	7,388
30	0	0	0	0,014	0,134	0,014	0,134	0,148
30,5	0	0	0	0,043	0,428	0,043	0,428	0,471
31	0	0	0	0,030	0,302	0,030	0,302	0,332
31,5	0	0	0	0,032	0,319	0,032	0,319	0,351
32	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
TOTAL	160,938	3734,182	5,336	278,992	2770,119	4179,448	2770,119	6949,567

Table 13. *ECOCADIZ-RECLUTAS 2018-10* survey. Horse mackerel (*Trachurus trachurus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 21**.

ECOCADIZ-RECLUTAS 2018-10. <i>Trachurus trachurus</i> . ABUNDANCE (in numbers and million fish)																	
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	n			Millions		
												PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	4714	0	5878	7402	0	8252	0	0	0	10592	15654	26246	0,01	0,02	0,03
13,5	0	0	32201	0	40148	22207	0	24755	0	0	0	72349	46962	119311	0,1	0,0	0,1
14	0	0	4714	0	5878	37012	0	41258	0	0	0	10592	78270	88862	0,01	0,1	0,1
14,5	0	0	40535	0	50538	74025	0	82516	0	0	0	91073	156541	247614	0,1	0,2	0,2
15	0	0	52217	0	65103	96232	0	107271	0	0	0	117320	203503	320823	0,1	0,2	0,3
15,5	0	0	26960	0	33613	37012	0	41258	0	0	0	60573	78270	138843	0,1	0,1	0,1
16	0	0	29716	0	37050	7402	0	8252	0	0	0	66766	15654	82420	0,1	0,02	0,1
16,5	0	0	44155	0	55051	29610	0	33007	0	0	0	99206	62617	161823	0,1	0,1	0,2
17	0	0	36388	0	45368	0	0	0	0	0	0	81756	0	81756	0,1	0	0,1
17,5	0	0	18058	0	22515	0	0	0	0	0	0	40573	0	40573	0,04	0	0,04
18	0	0	39441	0	49174	0	0	0	0	0	0	88615	0	88615	0,1	0	0,1
18,5	0	0	51730	0	64496	0	0	0	0	0	0	116226	0	116226	0,1	0	0,1
19	0	0	68926	0	85935	0	0	0	0	0	0	154861	0	154861	0,2	0	0,2
19,5	0	0	60528	0	75464	0	0	0	0	0	0	135992	0	135992	0,1	0	0,1
20	0	0	122361	0	152557	0	0	0	0	0	0	274918	0	274918	0,3	0	0,3
20,5	0	0	127519	0	158988	0	0	0	0	0	0	286507	0	286507	0,3	0	0,3
21	18915	21	262402	0	327156	7402	0	8252	0	0	0	608494	15654	624148	1	0,02	1
21,5	44135	49	290480	7193	362163	0	0	0	0	0	0	704020	0	704020	1	0	1
22	56745	63	334467	15185	417005	0	0	0	0	0	0	823465	0	823465	1	0	1
22,5	147116	163	190592	0	237626	7402	0	8252	0	0	0	575497	15654	591151	1	0,02	1
23	166031	184	201747	7193	251533	0	0	0	0	0	0	626688	0	626688	1	0	1
23,5	210165	233	53121	44757	66229	0	0	0	0	0	0	374505	0	374505	0,4	0	0,4
24	191250	212	98327	142262	122591	0	493	0	1	2	0	554642	496	555138	1	0,0005	1
24,5	172336	191	62170	119883	77512	0	0	0	0	0	0	432092	0	432092	0,4	0	0,4
25	25220	28	22813	202204	28443	0	0	0	0	0	0	278708	0	278708	0,3	0	0,3
25,5	37830	42	48866	179825	60925	0	493	0	1	2	0	327488	496	327984	0,3	0,0005	0,3
26	12610	14	29485	262145	36761	0	0	0	0	0	0	341015	0	341015	0,3	0	0,3
26,5	0	0	3620	135069	4513	0	493	0	1	2	0	143202	496	143698	0,1	0,0005	0,1
27	0	0	0	157447	0	0	493	0	1	2	0	157447	496	157943	0,2	0,0005	0,2
27,5	0	0	3620	52749	4513	0	1972	0	5	10	0	60882	1987	62869	0,1	0,002	0,1
28	0	0	0	7193	0	0	1479	0	4	7	0	7193	1490	8683	0,01	0,001	0,01
28,5	0	0	0	15185	0	0	1479	0	4	7	0	15185	1490	16675	0,02	0,001	0,02
29	0	0	0	0	0	0	2465	0	6	12	0	0	2483	2483	0	0,002	0,002
29,5	0	0	0	0	0	0	2465	0	6	12	0	0	2483	2483	0	0,002	0,002
30	0	0	0	0	0	0	3943	0	10	20	0	0	3973	3973	0	0,004	0,004
30,5	0	0	0	0	0	0	2958	0	7	15	0	0	2980	2980	0	0,003	0,003
31	0	0	0	0	0	0	5915	0	14	30	0	0	5959	5959	0	0,01	0,01
31,5	6305	7	0	0	0	0	3943	0	10	20	0	6312	3973	10285	0,01	0,004	0,01
32	0	0	0	0	0	0	1972	0	5	10	0	0	1987	1987	0	0,002	0,002
32,5	0	0	0	0	0	0	886	0	2	5	0	0	993	993	0	0,001	0,001
33	0	0	0	0	0	0	493	0	1	2	0	0	496	496	0	0,0005	0,0005
33,5	0	0	0	0	0	0	1972	0	5	10	0	0	1987	1987	0	0,002	0,002
34	0	0	0	0	0	0	1972	0	5	10	0	0	1987	1987	0	0,002	0,002
34,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	1088658	1207	2361873	1348290	2944726	325705	35986	363073	88	178	0	7744754	725031	8469785	8	1	8
Millions	1	0,001	2	1	3	0,3	0,04	0,4	0,0001	0,0002	0,0000				8	1	8

Table 13. ECOCADIZ-RECLUTAS 2018-10 survey. Horse mackerel (*Trachurus trachurus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10. <i>Trachurus trachurus</i> . BIOMASS (t)														
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	POL11	PORTUGAL	SPAIN	TOTAL
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0,118	0	0,148	0,186	0	0,207	0	0	0	0,266	0,393	0,659
13,5	0	0	0,884	0	1,102	0,609	0	0,679	0	0	0	1,985	1,289	3,274
14	0	0	0,141	0	0,176	1,107	0	1,234	0	0	0	0,317	2,341	2,657
14,5	0	0	1,317	0	1,642	2,405	0	2,681	0	0	0	2,959	5,087	8,046
15	0	0	1,838	0	2,292	3,388	0	3,777	0	0	0	4,131	7,165	11,296
15,5	0	0	1,026	0	1,279	1,408	0	1,570	0	0	0	2,305	2,978	5,283
16	0	0	1,219	0	1,520	0,304	0	0,339	0	0	0	2,739	0,642	3,381
16,5	0	0	1,949	0	2,429	1,307	0	1,457	0	0	0	4,378	2,763	7,141
17	0	0	1,724	0	2,149	0	0	0	0	0	0	3,872	0	3,872
17,5	0	0	0,916	0	1,142	0	0	0	0	0	0	2,059	0	2,059
18	0	0	2,140	0	2,668	0	0	0	0	0	0	4,807	0	4,807
18,5	0	0	2,995	0	3,734	0	0	0	0	0	0	6,729	0	6,729
19	0	0	4,251	0	5,300	0	0	0	0	0	0	9,552	0	9,552
19,5	0	0	3,971	0	4,951	0	0	0	0	0	0	8,922	0	8,922
20	0	0	8,526	0	10,630	0	0	0	0	0	0	19,155	0	19,155
20,5	0	0	9,422	0	11,748	0	0	0	0	0	0	21,170	0	21,170
21	1,480	0,002	20,533	0	25,600	0,579	0	0,646	0	0	0	47,614	1,225	48,839
21,5	3,652	0,004	24,038	0,595	29,970	0	0	0	0	0	0	58,260	0	58,260
22	4,960	0,006	29,235	1,327	36,449	0	0	0	0	0	0	71,977	0	71,977
22,5	13,566	0,015	17,575	0	21,912	0,683	0	0,761	0	0	0	53,067	1,443	54,510
23	16,132	0,018	19,603	0,699	24,440	0	0	0	0	0	0	60,892	0	60,892
23,5	21,494	0,024	5,433	4,577	6,773	0	0	0	0	0	0	38,301	0	38,301
24	20,565	0,023	10,573	15,297	13,182	0	0,053	0	0,0001	0,000215	0	59,640	0,053	59,694
24,5	19,464	0,022	7,022	13,540	8,755	0	0	0	0	0	0	48,802	0	48,802
25	2,989	0,003	2,704	23,964	3,371	0	0	0	0	0	0	33,031	0	33,031
25,5	4,700	0,005	6,071	22,342	7,569	0	0,061	0	0,0001	0,000248	0	40,688	0,062	40,749
26	1,641	0,002	3,837	34,113	4,784	0	0	0	0	0	0	44,376	0	44,376
26,5	0	0	0,493	18,393	0,615	0	0,067	0	0,0001	0,0003	0	19,501	0,068	19,568
27	0	0	0	22,418	0	0	0,070	0	0,0001	0,0003	0	22,418	0,071	22,488
27,5	0	0	0,538	7,847	0,671	0	0,293	0	0,001	0,001	0	9,056	0,296	9,352
28	0	0	0	1,117	0	0	0,230	0	0,001	0,001	0	1,117	0,231	1,348
28,5	0	0	0	2,460	0	0	0,240	0	0,001	0,001	0	2,460	0,241	2,701
29	0	0	0	0	0	0	0,416	0	0,001	0,002	0	0	0,419	0,419
29,5	0	0	0	0	0	0	0,434	0	0,001	0,002	0	0	0,437	0,437
30	0	0	0	0	0	0	0,722	0	0,002	0,004	0	0	0,727	0,727
30,5	0	0	0	0	0	0	0,563	0	0,001	0,003	0	0	0,568	0,568
31	0	0	0	0	0	0	1,171	0	0,003	0,006	0	0	1,180	1,180
31,5	1,297	0,001	0	0	0	0	0,811	0	0,002	0,004	0	1,298	0,817	2,116
32	0	0	0	0	0	0	0,421	0	0,001	0,002	0	0	0,424	0,424
32,5	0	0	0	0	0	0	0,219	0	0,000	0,001	0	0	0,220	0,220
33	0	0	0	0	0	0	0,113	0	0,000	0,000	0	0	0,114	0,114
33,5	0	0	0	0	0	0	0,470	0	0,001	0,002	0	0	0,473	0,473
34	0	0	0	0	0	0	0,487	0	0,001	0,002	0	0	0,491	0,491
34,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	111,940	0,124	190,090	168,688	237,000	11,976	6,841	13,350	0,017	0,034	0,000	707,843	32,218	740,061

Table 14. ECOCADIZ-RECLUTAS 2018-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 24**.

ECOCADIZ-RECLUTAS 2018-10 . <i>Trachurus mediterraneus</i> . ABUNDANCE (in numbers and million fish)										
Size class	POL01	POL02	POL03	POL04	n			Millions		
					PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
16	0	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
18,5	144	13	32012	33	157	32045	32202	0,0002	0,03	0,03
19	0	0	0	0	0	0	0	0	0	0
19,5	144	13	32012	33	157	32045	32202	0,0002	0,03	0,03
20	144	13	32012	33	157	32045	32202	0,0002	0,03	0,03
20,5	0	0	0	0	0	0	0	0	0	0
21	110	10	24485	25	120	24510	24630	0,0001	0,02	0,02
21,5	254	23	56497	58	277	56555	56832	0,0003	0,1	0,1
22	490	45	109140	112	535	109252	109787	0,001	0,11	0,11
22,5	165	15	36727	38	180	36765	36945	0,0002	0,04	0,04
23	440	40	97939	100	480	98039	98519	0,0005	0,1	0,1
23,5	1278	117	284388	291	1395	284679	286074	0,001	0,3	0,3
24	1468	134	326740	335	1602	327075	328677	0,002	0,3	0,3
24,5	2779	254	618292	633	3033	618925	621958	0,003	1	1
25	6078	555	1352440	1385	6633	1353825	1360458	0,01	1	1
25,5	5896	538	1311990	1344	6434	1313334	1319768	0,01	1	1
26	11238	1025	2500514	2561	12263	2503075	2515338	0,01	3	3
26,5	7951	726	1769178	1812	8677	1770990	1779667	0,01	2	2
27	3907	357	869443	890	4264	870333	874597	0,004	1	1
27,5	1967	180	437782	448	2147	438230	440377	0,002	0,4	0,4
28	3282	299	730194	748	3581	730942	734523	0,004	1	1
28,5	1695	155	377248	386	1850	377634	379484	0,002	0,4	0,4
29	2533	231	563697	577	2764	564274	567038	0,003	1	1
29,5	2625	240	584145	598	2865	584743	587608	0,003	1	1
30	3120	285	694327	711	3405	695038	698443	0,003	1	1
30,5	1802	164	400873	411	1966	401284	403250	0,002	0,4	0,4
31	1442	132	320933	329	1574	321262	322836	0,002	0,3	0,3
31,5	964	88	214606	220	1052	214826	215878	0,001	0,2	0,2
32	660	60	146909	150	720	147059	147779	0,001	0,1	0,1
32,5	512	47	113854	117	559	113971	114530	0,001	0,1	0,1
33	165	15	36727	38	180	36765	36945	0,0002	0,04	0,04
33,5	237	22	52642	54	259	52696	52955	0,0003	0,1	0,05
34	165	15	36727	38	180	36765	36945	0,0002	0,04	0,04
34,5	0	0	0	0	0	0	0	0	0	0
35	110	10	24485	25	120	24510	24630	0,0001	0,02	0,02
35,5	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0	0	0
38	110	10	24485	25	120	24510	24630	0,0001	0,02	0,02
38,5	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0
39,5	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
TOTAL n	63875	5831	14213443	14558	69706	14228001	14297707			
Millions	0,1	0,01	14	0,01				0,1	14	14

Table 14. ECOCADIZ-RECLUTAS 2018-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10 .Trachurus mediterraneus . BIOMASS (t)							
Size class	POL01	POL02	POL03	POL04	PORTUGAL	SPAIN	TOTAL
16	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
18,5	0,008	0,001	1,732	0,002	0,008	1,734	1,742
19	0	0	0	0	0	0	0
19,5	0,009	0,001	1,995	0,002	0,010	1,997	2,007
20	0,010	0,001	2,135	0,002	0,010	2,137	2,148
20,5	0	0	0	0	0	0	0
21	0,008	0,001	1,862	0,002	0,009	1,864	1,873
21,5	0,021	0,002	4,577	0,005	0,022	4,582	4,604
22	0,042	0,004	9,405	0,010	0,046	9,415	9,461
22,5	0,015	0,001	3,362	0,003	0,016	3,366	3,382
23	0,043	0,004	9,512	0,010	0,047	9,522	9,569
23,5	0,132	0,012	29,268	0,030	0,144	29,298	29,441
24	0,160	0,015	35,587	0,036	0,174	35,624	35,798
24,5	0,320	0,029	71,187	0,073	0,349	71,260	71,609
25	0,739	0,067	164,420	0,168	0,806	164,588	165,395
25,5	0,756	0,069	168,242	0,172	0,825	168,414	169,239
26	1,518	0,139	337,874	0,346	1,657	338,220	339,877
26,5	1,131	0,103	251,646	0,258	1,234	251,903	253,138
27	0,584	0,053	130,059	0,133	0,638	130,192	130,830
27,5	0,309	0,028	68,808	0,070	0,337	68,878	69,216
28	0,542	0,049	120,481	0,123	0,591	120,604	121,195
28,5	0,293	0,027	65,288	0,067	0,320	65,355	65,675
29	0,459	0,042	102,241	0,105	0,501	102,345	102,847
29,5	0,499	0,046	110,949	0,114	0,544	111,063	111,607
30	0,620	0,057	137,994	0,141	0,677	138,135	138,812
30,5	0,374	0,034	83,305	0,085	0,409	83,390	83,799
31	0,313	0,029	69,684	0,071	0,342	69,756	70,098
31,5	0,219	0,020	48,654	0,050	0,239	48,704	48,942
32	0,156	0,014	34,752	0,035	0,170	34,788	34,958
32,5	0,126	0,012	28,084	0,029	0,138	28,113	28,251
33	0,042	0,004	9,441	0,010	0,046	9,450	9,497
33,5	0,063	0,006	14,092	0,014	0,069	14,107	14,176
34	0,046	0,004	10,233	0,011	0,050	10,244	10,294
34,5	0	0	0	0	0	0	0
35	0,033	0,003	7,378	0,008	0,036	7,385	7,421
35,5	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0
38	0,041	0,004	9,214	0,009	0,045	9,223	9,268
38,5	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0
39,5	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0
TOTAL	9,633	0,879	2143,459	2,195	10,512	2145,655	2156,167

Table 15. *ECOCADIZ-RECLUTAS 2018-10* survey. Bogue (*Boops boops*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 27**.

ECOCADIZ-RECLUTAS 2018-10. <i>Boops boops</i> . ABUNDANCE (in numbers and million fish)												
Size class	POL01	POL02	POL03	POL04	POL05	POL06	n			Millions		
							PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0	0	0	0
17	11420	688	0	0	0	0	12108	0	12108	0,01	0	0,01
17,5	0	0	0	0	0	0	0	0	0	0	0	0
18	22840	1377	0	0	0	0	24217	0	24217	0,02	0	0,02
18,5	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
19,5	34260	2065	0	0	0	0	36325	0	36325	0,04	0	0,04
20	54561	3289	20014	0	0	0	77864	0	77864	0,1	0	0,1
20,5	49486	2983	20014	0	0	0	72483	0	72483	0,1	0	0,1
21	93896	5660	60043	0	0	0	159599	0	159599	0,2	0	0,2
21,5	78670	4742	140100	0	0	0	223512	0	223512	0,2	0	0,2
22	143382	8643	360258	0	0	0	512283	0	512283	1	0	1
22,5	87552	5277	360258	0	0	0	453087	0	453087	0,5	0	0,5
23	62175	3748	460329	17947	16660	10	526252	34617	560869	1	0,03	1
23,5	52024	3136	580415	0	0	0	635575	0	635575	1	0	1
24	52024	3136	620444	0	0	0	675604	0	675604	1	0	1
24,5	22840	1377	580415	0	0	0	604632	0	604632	1	0	1
25	11420	688	360258	53842	49981	29	372366	103852	476218	0,4	0,1	0,5
25,5	11420	688	180129	0	0	0	192237	0	192237	0,2	0	0,2
26	11420	688	100072	89736	83301	49	112180	173086	285266	0,1	0,2	0,3
26,5	0	0	20014	143578	133281	78	20014	276937	296951	0,02	0,3	0,3
27	0	0	20014	143578	133281	78	20014	276937	296951	0,02	0,3	0,3
27,5	0	0	0	17947	16660	10	0	34617	34617	0	0,03	0,03
28	0	0	0	89736	83301	49	0	173086	173086	0	0,2	0,2
28,5	0	0	0	35894	33320	19	0	69233	69233	0	0,1	0,1
29	0	0	0	35894	33320	19	0	69233	69233	0	0,1	0,1
29,5	0	0	20014	35894	33320	19	20014	69233	89247	0,02	0,1	0,1
30	0	0	0	0	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	799390	48185	3902791	664046	616425	360	4750366	1280831	6031197	5	1	6
Millions	1	0,05	4	1	1							

Table 15. ECOCADIZ-RECLUTAS 2018-10 survey. Bogue (*Boops boops*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10 . <i>Boops boops</i> . BIOMASS (t)									
Size class	POL01	POL02	POL03	POL04	POL05	POL06	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0
17	0,535	0,032	0	0	0	0	0,567	0	0,567
17,5	0	0	0	0	0	0	0	0	0
18	1,265	0,076	0	0	0	0	1,341	0	1,341
18,5	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
19,5	2,400	0,145	0	0	0	0	2,545	0	2,545
20	4,118	0,248	1,510	0	0	0	5,877	0	5,877
20,5	4,016	0,242	1,624	0	0	0	5,882	0	5,882
21	8,180	0,493	5,230	0	0	0	13,903	0	13,903
21,5	7,344	0,443	13,079	0	0	0	20,866	0	20,866
22	14,322	0,863	35,985	0	0	0	51,171	0	51,171
22,5	9,343	0,563	38,445	0	0	0	48,352	0	48,352
23	7,079	0,427	52,408	2,043	1,897	0,001	59,913	3,941	63,854
23,5	6,310	0,380	70,399	0	0	0	77,089	0	77,089
24	6,714	0,405	80,067	0	0	0	87,185	0	87,185
24,5	3,132	0,189	79,591	0	0	0	82,912	0	82,912
25	1,662	0,100	52,431	7,836	7,274	0,004	54,193	15,114	69,308
25,5	1,762	0,106	27,791	0	0	0	29,659	0	29,659
26	1,866	0,112	16,349	14,660	13,609	0,008	18,327	28,277	46,604
26,5	0	0	3,459	24,811	23,032	0,013	3,459	47,856	51,315
27	0	0	3,654	26,217	24,337	0,014	3,654	50,567	54,222
27,5	0	0	0	3,459	3,211	0,002	0	6,672	6,672
28	0	0	0	18,240	16,932	0,010	0	35,183	35,183
28,5	0	0	0	7,687	7,136	0,004	0	14,827	14,827
29	0	0	0	8,092	7,512	0,004	0	15,608	15,608
29,5	0	0	4,745	8,510	7,900	0,005	4,745	16,415	21,160
30	0	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
TOTAL	80,047	4,825	486,769	121,556	112,839	0,066	571,640	234,461	806,101

Table 16. ECOCADIZ-RECLUTAS 2018-10 survey. Pearlside (*Maurolicus muelleri*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 30**.

ECOCADIZ-RECLUTAS 2018-10 . <i>Maurolicus muelleri</i> . ABUNDANCE (in numbers and million fish)									
Size class	POL01	POL02	POL03	n			Millions		
				PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
0	0	0	0	0	0	0	0	0	0
0,5	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1,5	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
2,5	0	0	0	0	0	0	0	0	0
3	1160953	571730	11911250	1732683	11911250	13643933	2	12	14
3,5	23746756	11694484	243639207	35441240	243639207	279080447	35	244	279
4	62902519	30977389	645373188	93879908	645373188	739253096	94	645	739
4,5	37942039	18685187	389281310	56627226	389281310	445908536	57	389	446
5	8284979	4080076	85003012	12365055	85003012	97368067	12	85	97
5,5	13034331	6418972	133730853	19453303	133730853	153184156	19	134	153
6	4749351	2338897	48727841	7088248	48727841	55816089	7	49	56
6,5	1160953	571730	11911250	1732683	11911250	13643933	2	12	14
7	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
TOTAL n	152981881	75338465	1569577911	228320346	1569577911	1797898257	228	1570	1798
Millions	153	75	1570						

ECOCADIZ-RECLUTAS 2018-10 . <i>Maurolicus muelleri</i> . BIOMASS (t)						
Size class	POL01	POL02	POL03	PORTUGAL	SPAIN	TOTAL
0	0	0	0	0	0	0
0,5	0	0	0	0	0	0
1	0	0	0	0	0	0
1,5	0	0	0	0	0	0
2	0	0	0	0	0	0
2,5	0	0	0	0	0	0
3	0,253	0,125	2,597	0,378	2,597	2,974
3,5	7,984	3,932	81,919	11,916	81,919	93,835
4	30,896	15,215	316,991	46,112	316,991	363,103
4,5	26,099	12,853	267,776	38,952	267,776	306,729
5	7,716	3,800	79,170	11,517	79,170	90,687
5,5	15,990	7,875	164,057	23,865	164,057	187,922
6	7,500	3,693	76,948	11,193	76,948	88,141
6,5	2,314	1,140	23,746	3,454	23,746	27,200
7	0	0	0	0	0	0
7,5	0	0	0	0	0	0
8	0	0	0	0	0	0
8,5	0	0	0	0	0	0
9	0	0	0	0	0	0
9,5	0	0	0	0	0	0
10	0	0	0	0	0	0
TOTAL	98,754	48,633	1013,204	147,387	1013,204	1160,591

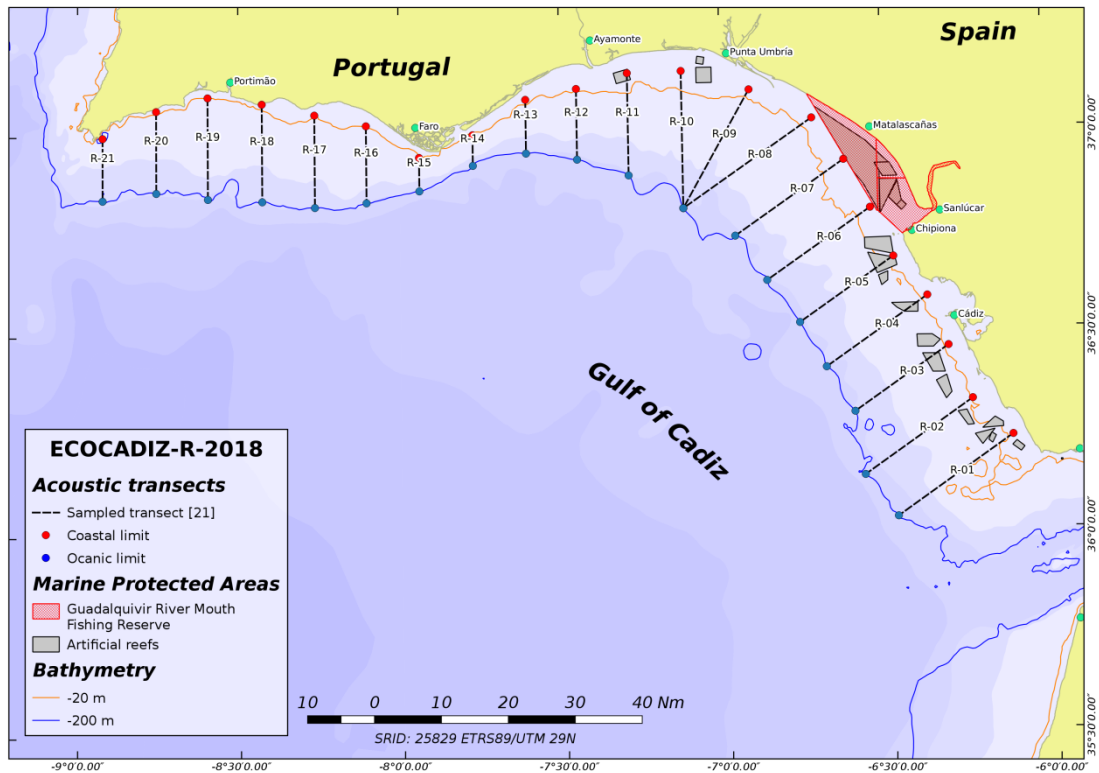


Figure 1. ECOCADIZ-RECLUTAS 2018-10 survey. Location of the acoustic transects sampled during the survey. The different protected areas inside the Guadalquivir river mouth Fishing Reserve and artificial reef polygons are also shown.

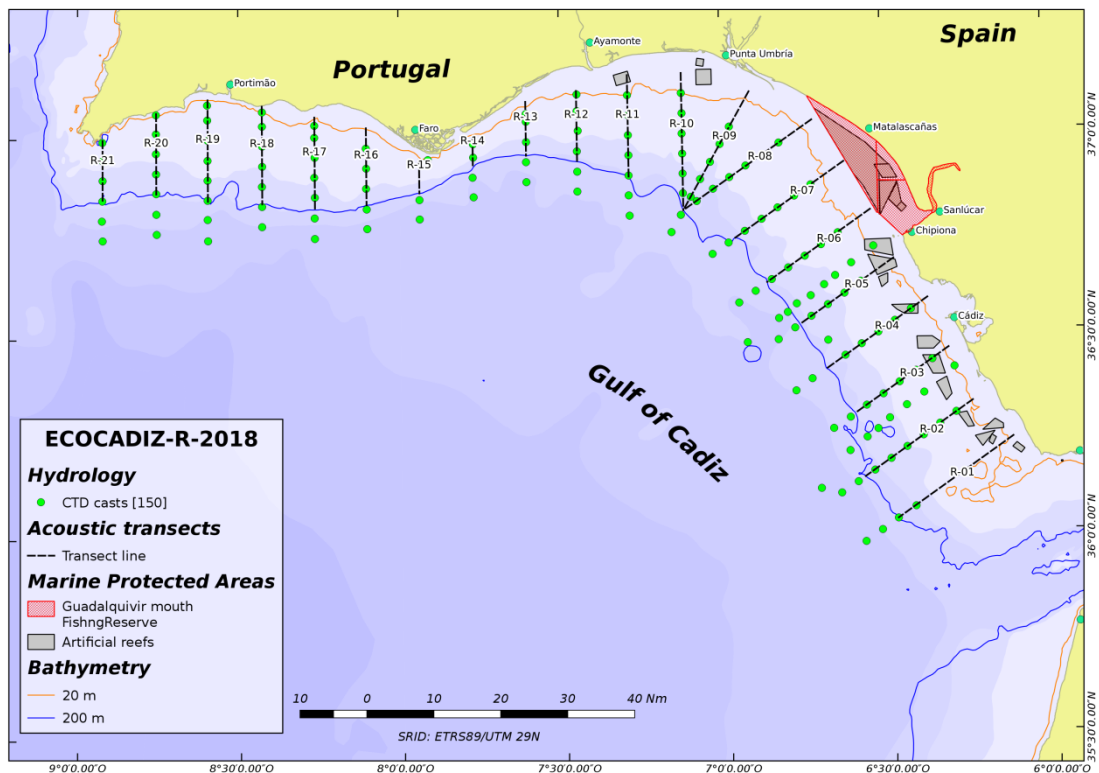


Figure 2. ECOCADIZ-RECLUTAS 2018-10 survey. Location of CTD stations.

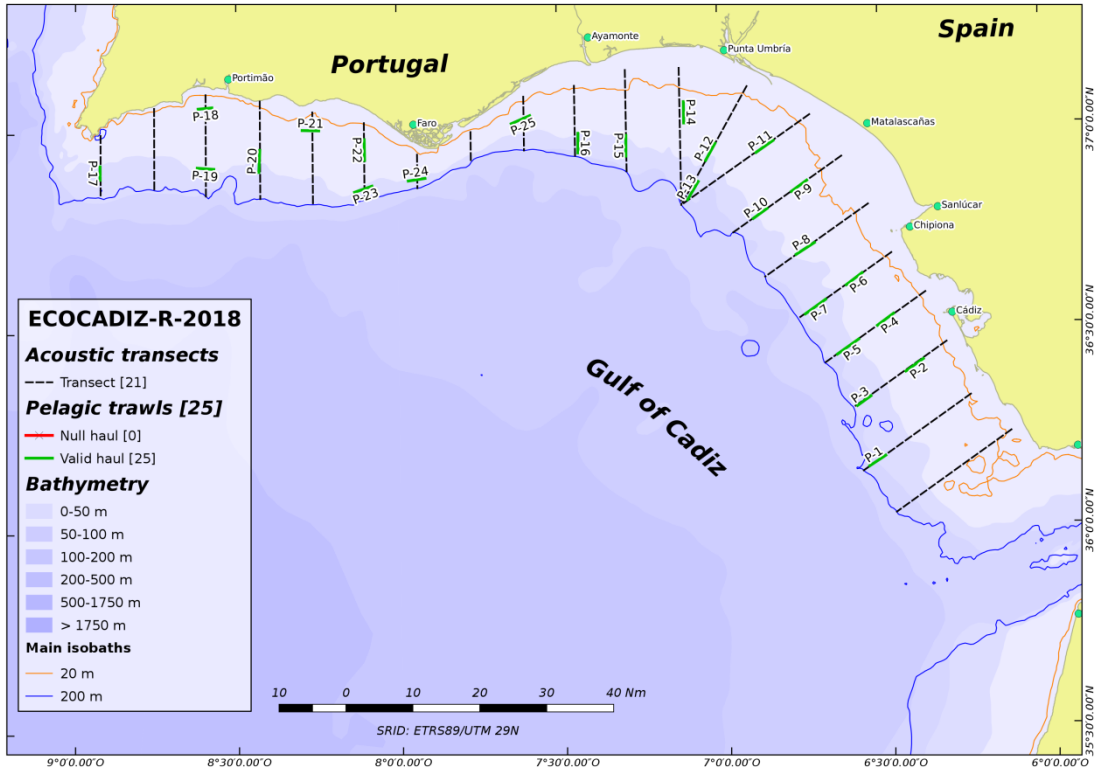


Figure 3. ECOCADIZ-RECLUTAS 2018-10 survey. Location of ground-truthing fishing hauls.

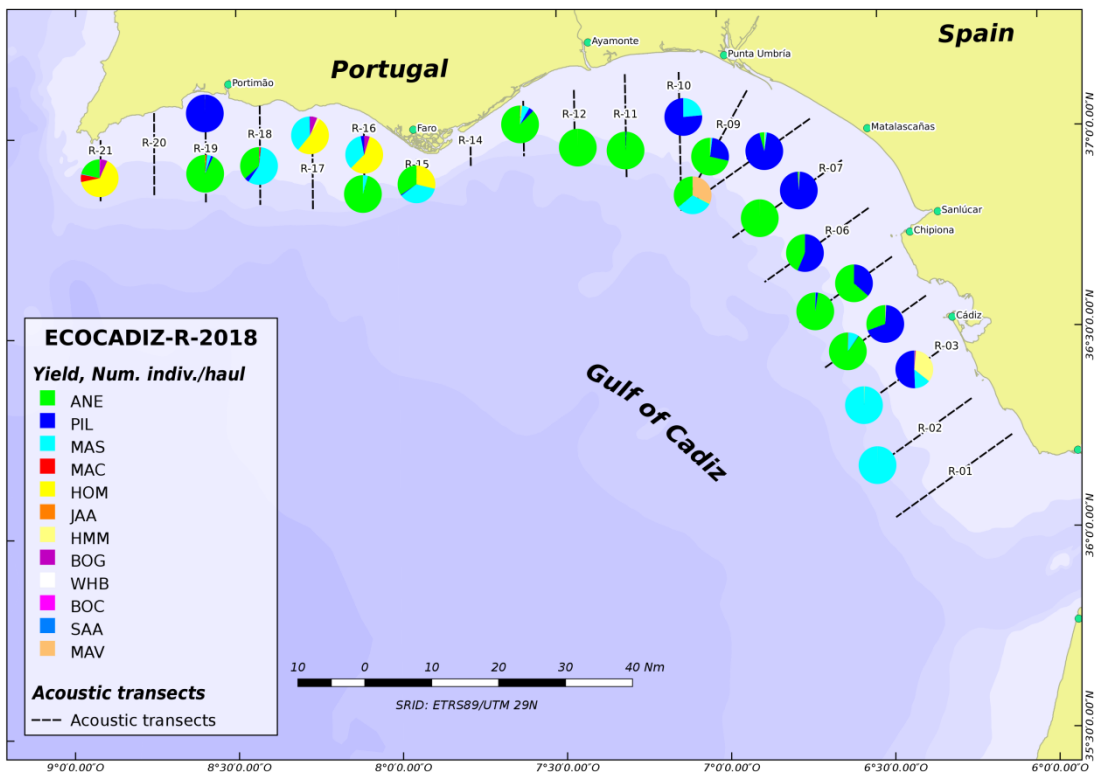


Figure 4. ECOCADIZ-RECLUTAS 2018-10 survey. Species composition (percentages in number) in valid fishing hauls.

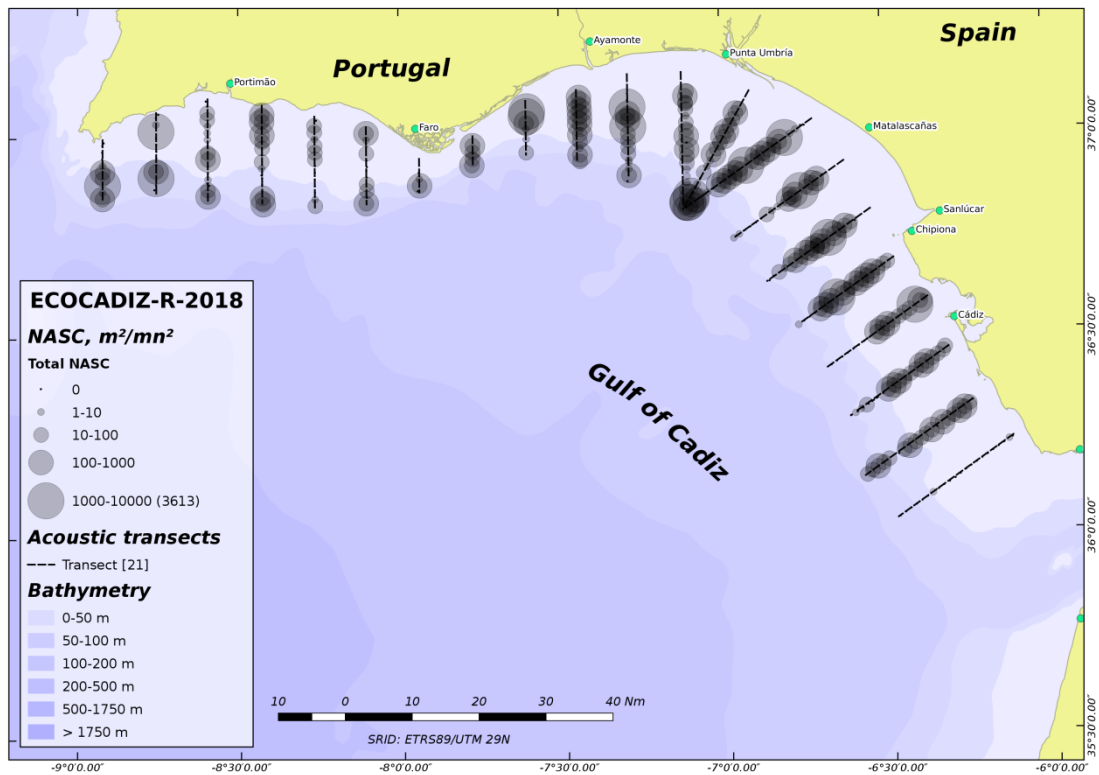


Figure 5. ECOCADIZ-RECLUTAS 2018-10 survey. Distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the pelagic fish species assemblage.

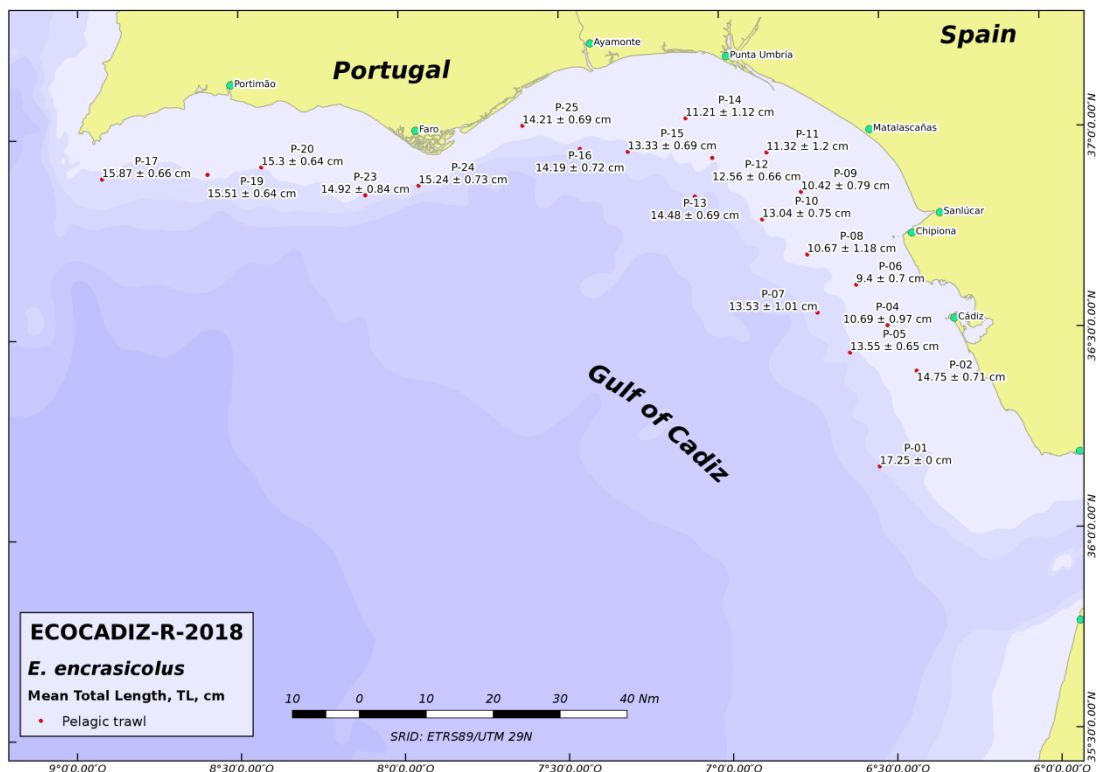
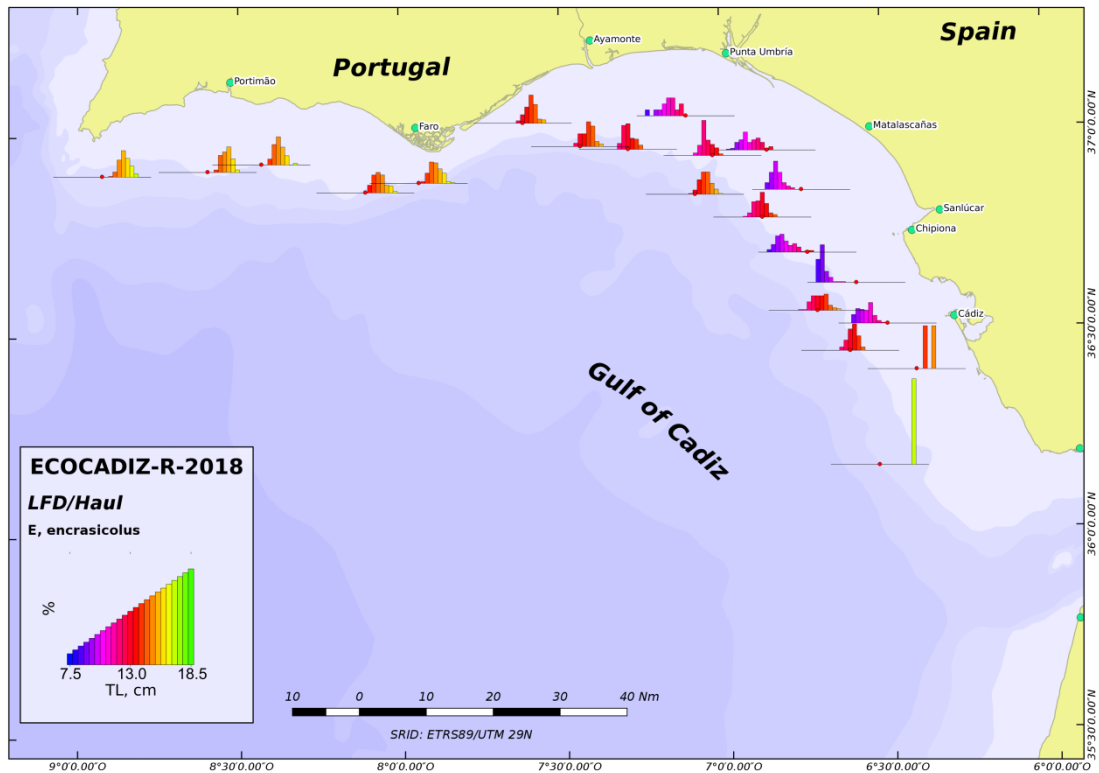


Figure 6. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

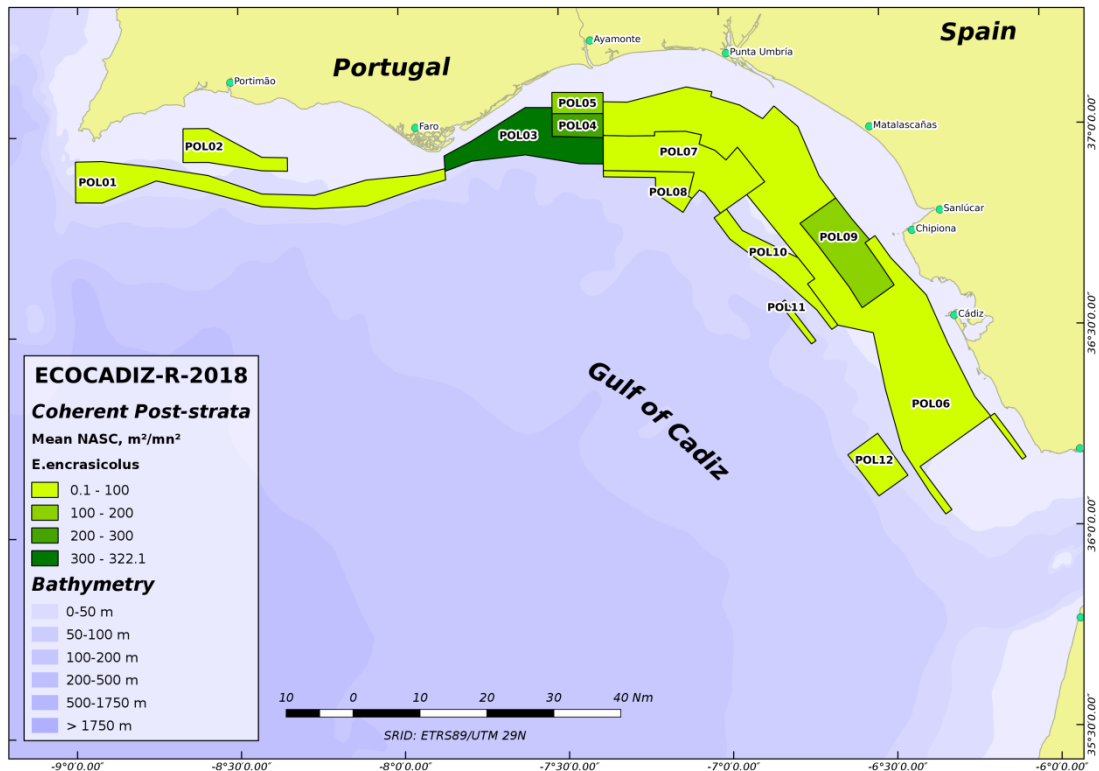
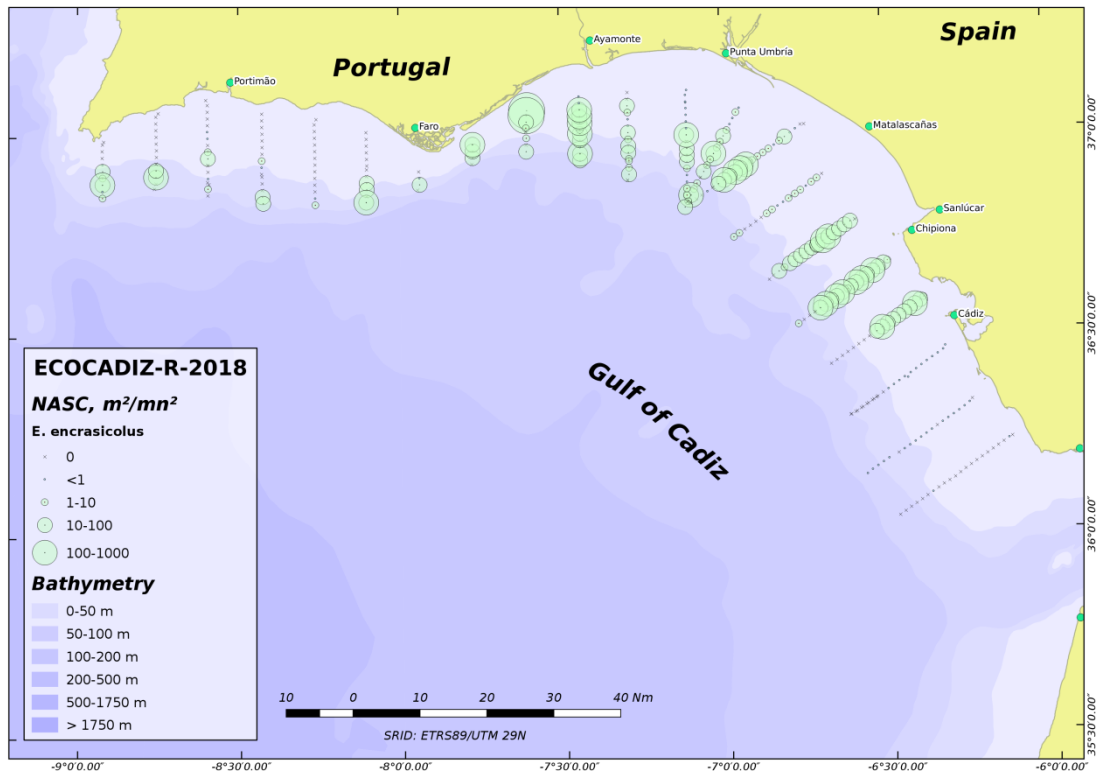


Figure 7. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2\ mn^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Anchovy (*E. encrasicolus*)

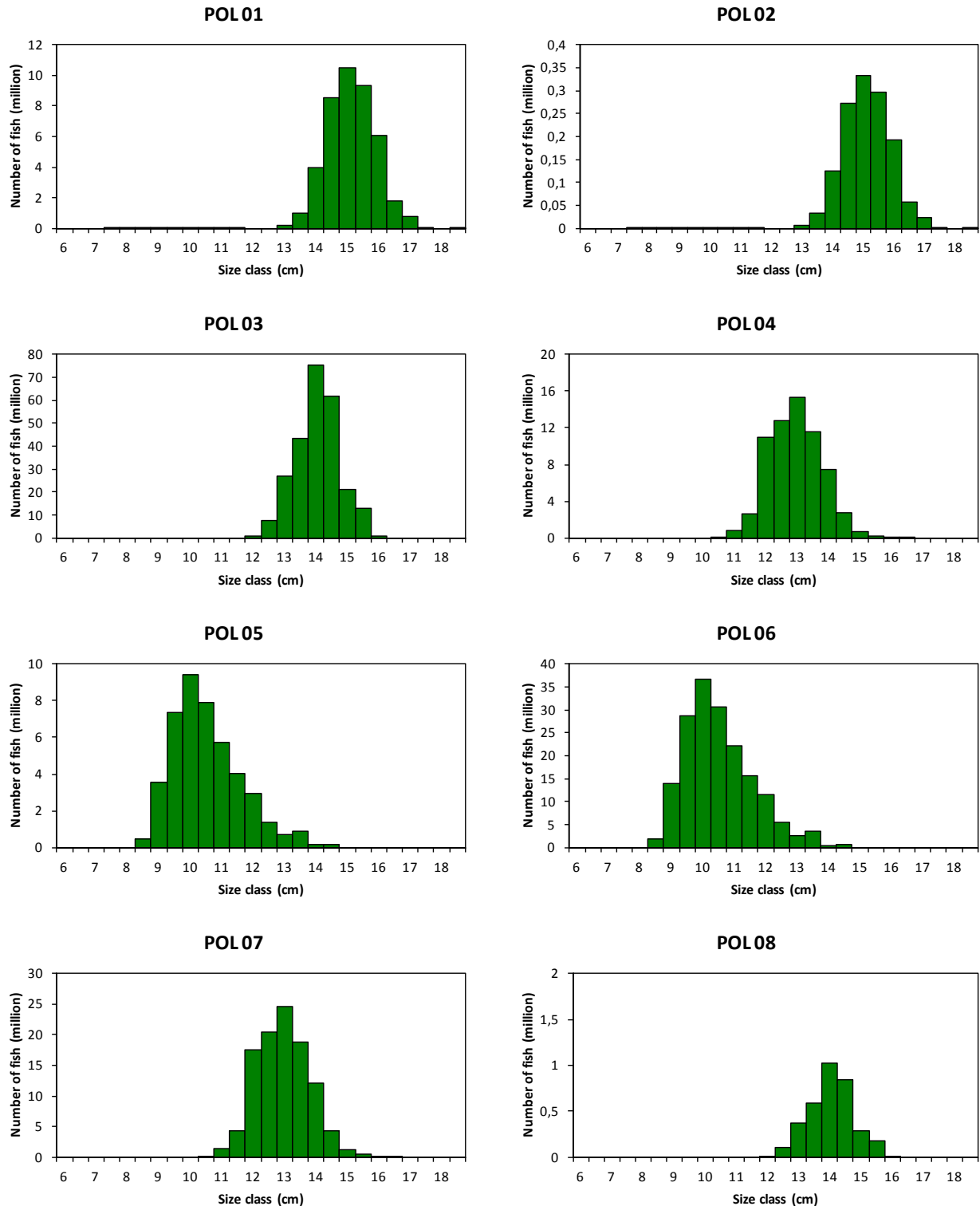


Figure 8. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POL0n, numeration as in **Figure 7**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Anchovy (*E. encrasicolus*)

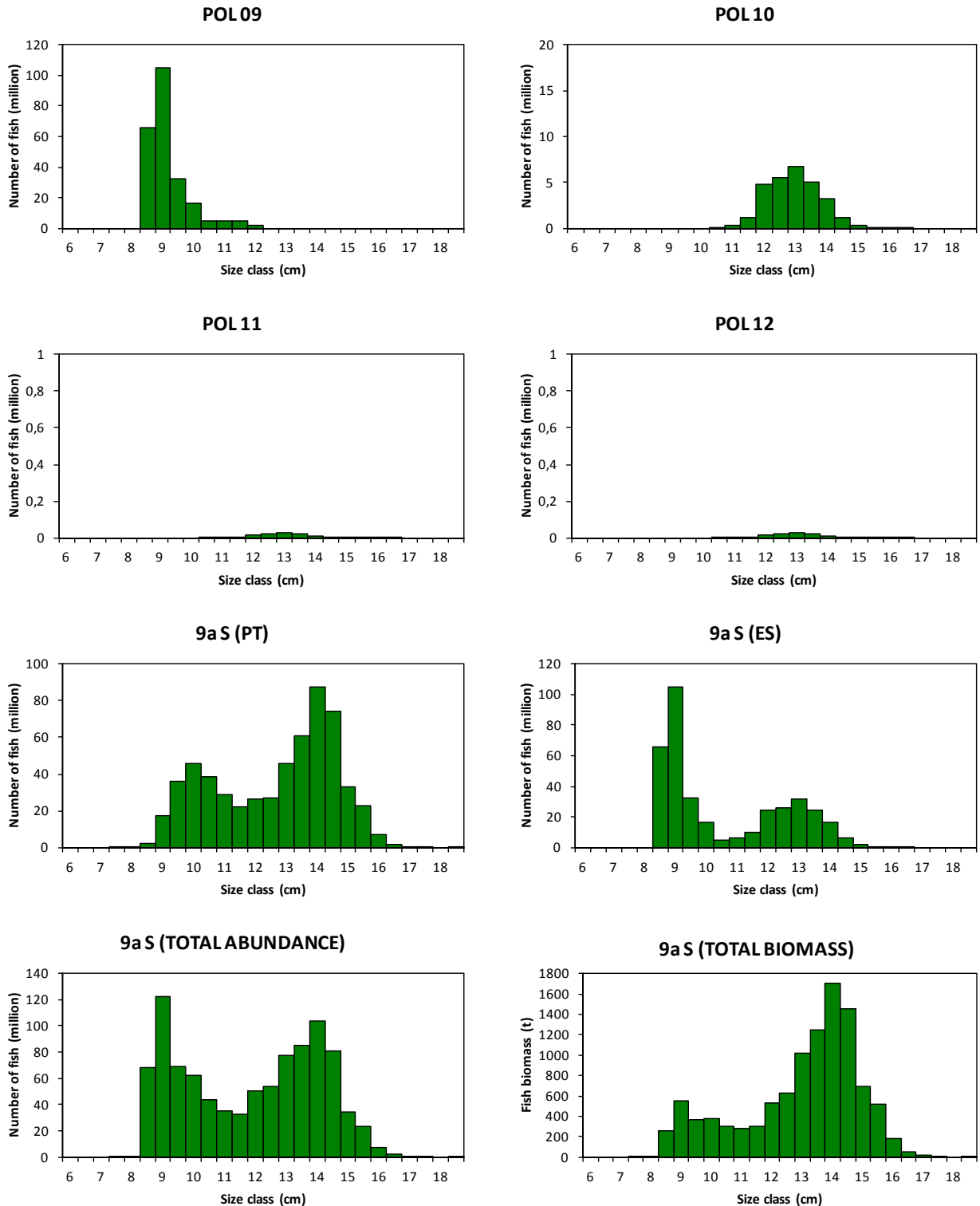


Figure 8. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10: Anchovy (*E. encrasicolus*)

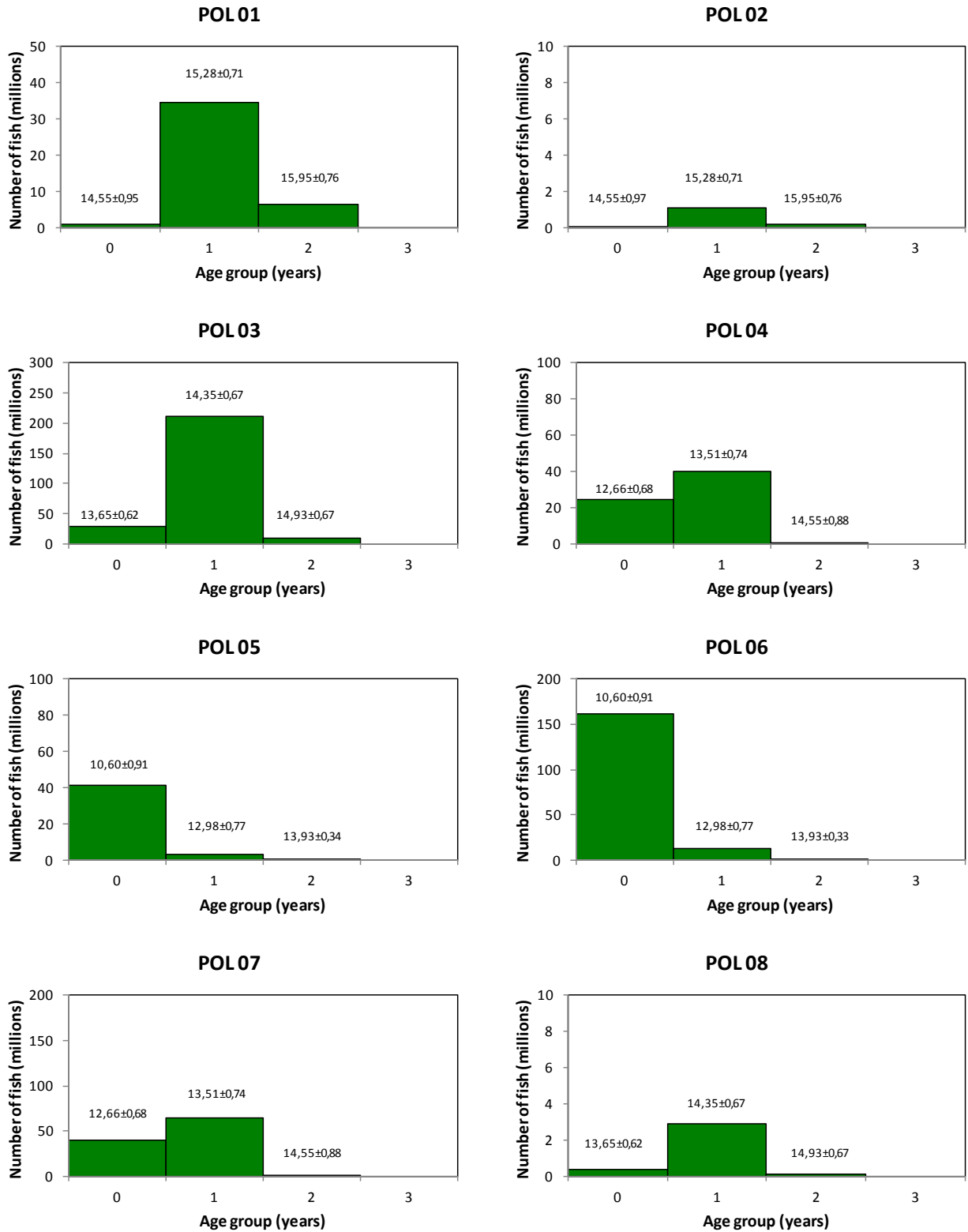


Figure 9. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 7**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Anchovy (*E. encrasicolus*)

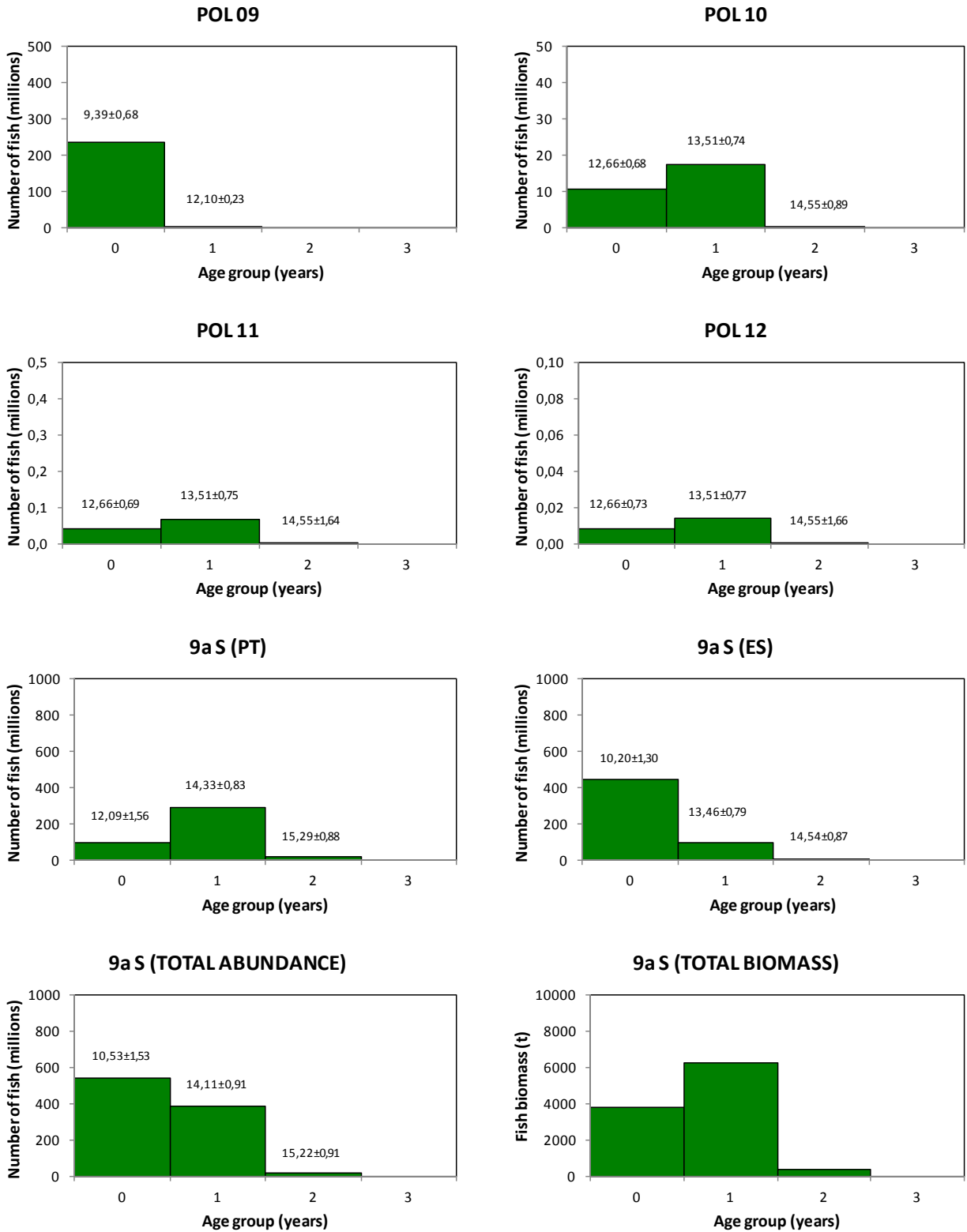


Figure 9. ECOCADIZ-RECLUTAS 2018-10 survey. Anchovy (*Engraulis encrasicolus*). Cont'd.

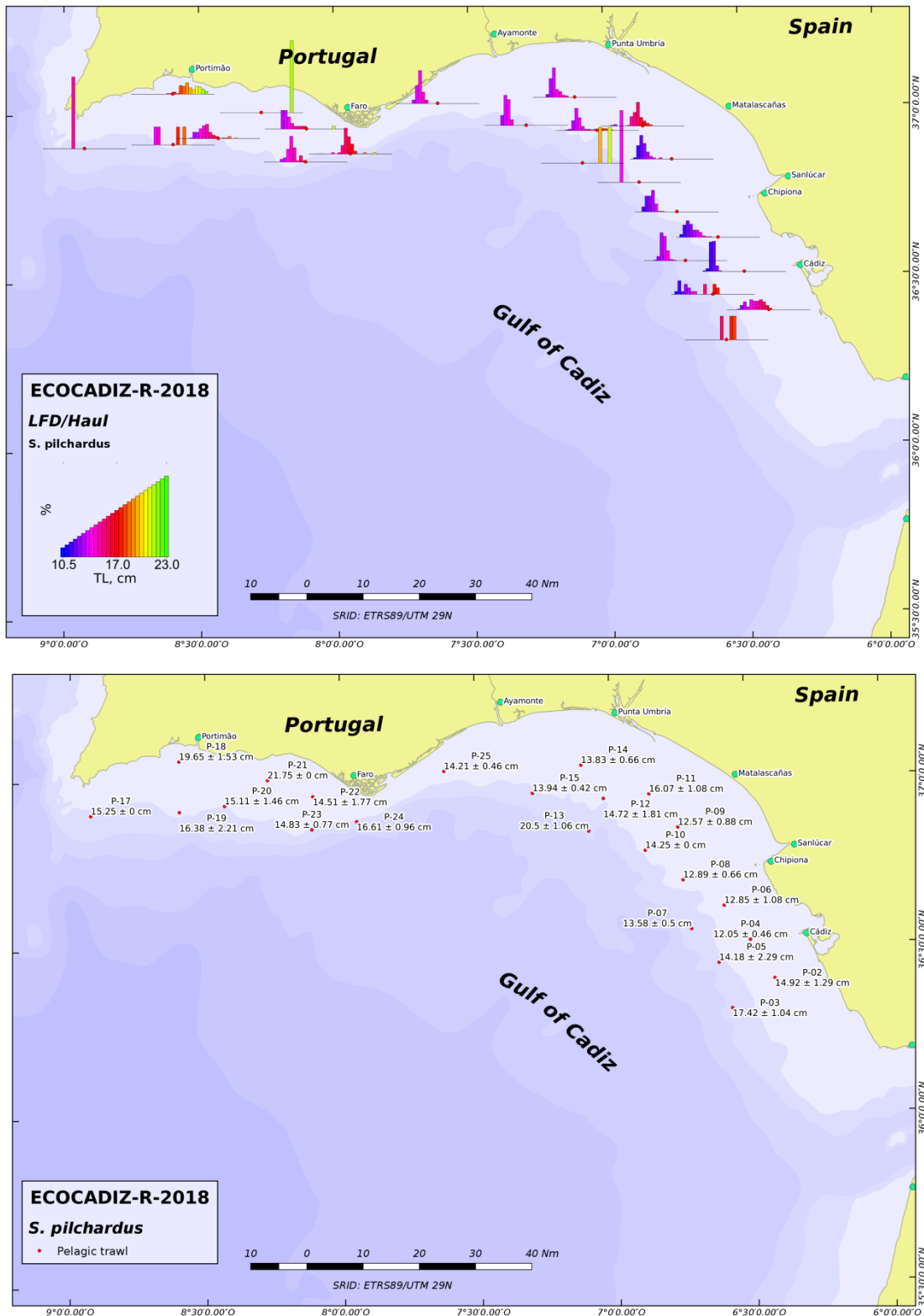


Figure 10. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

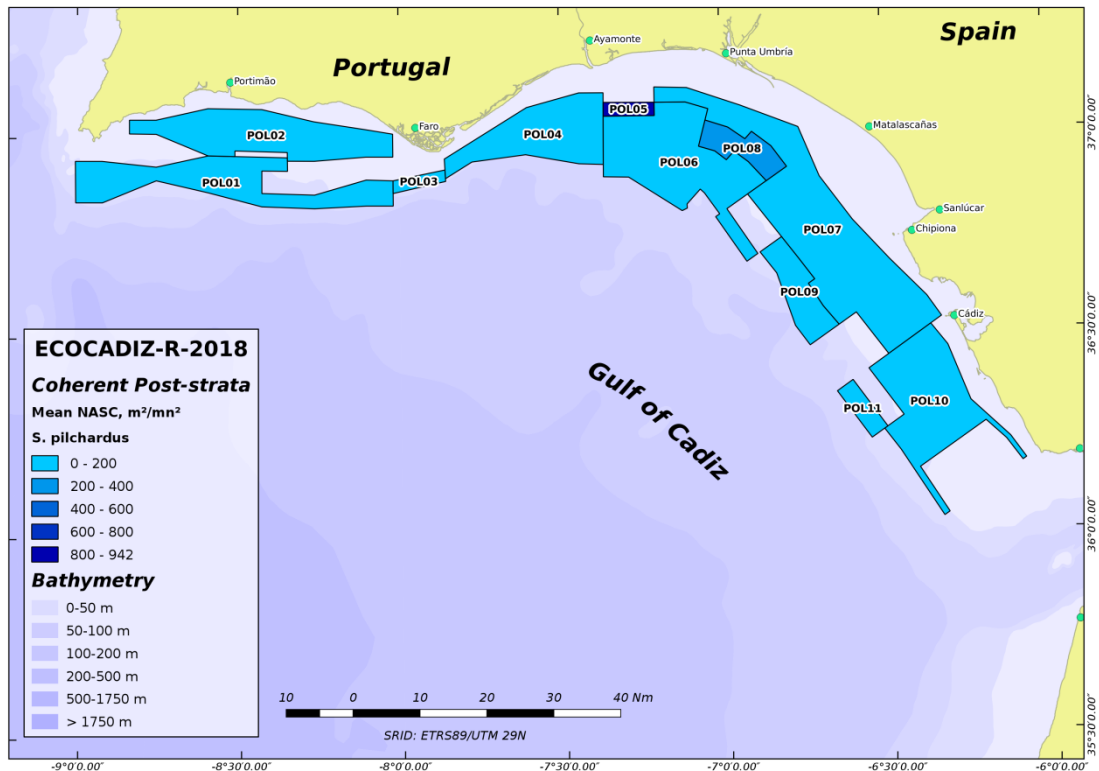
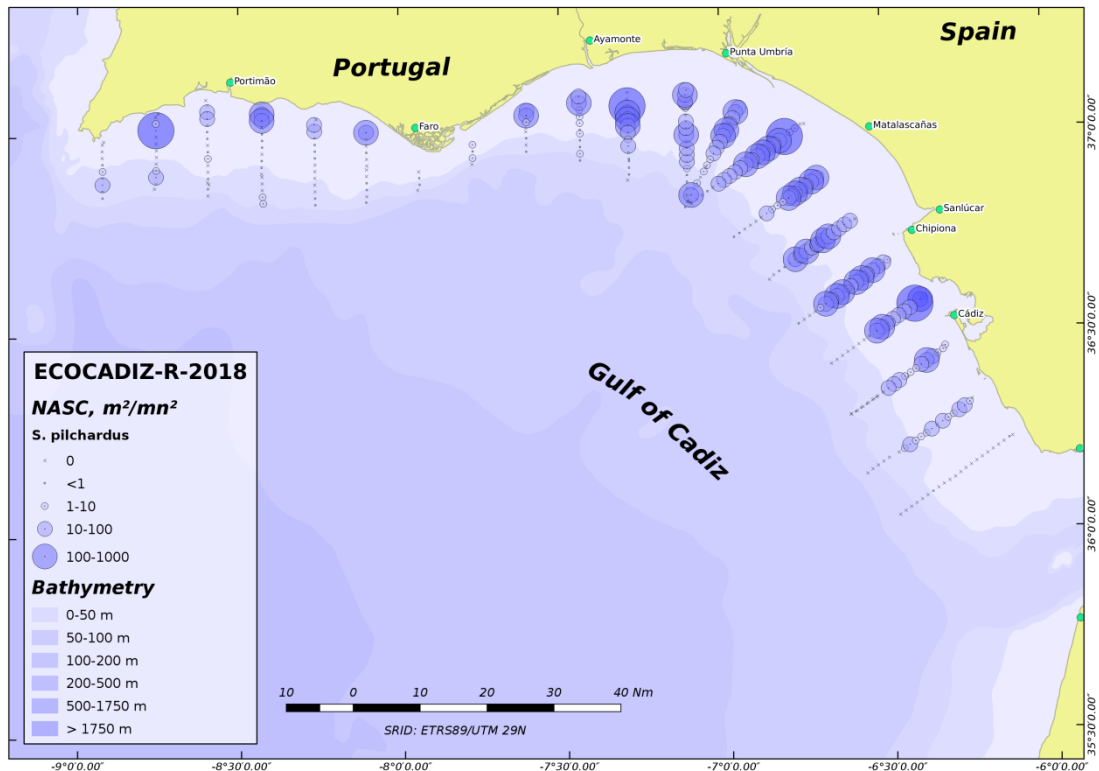


Figure 11. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2\ mn^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Sardine (*S. pilchardus*)

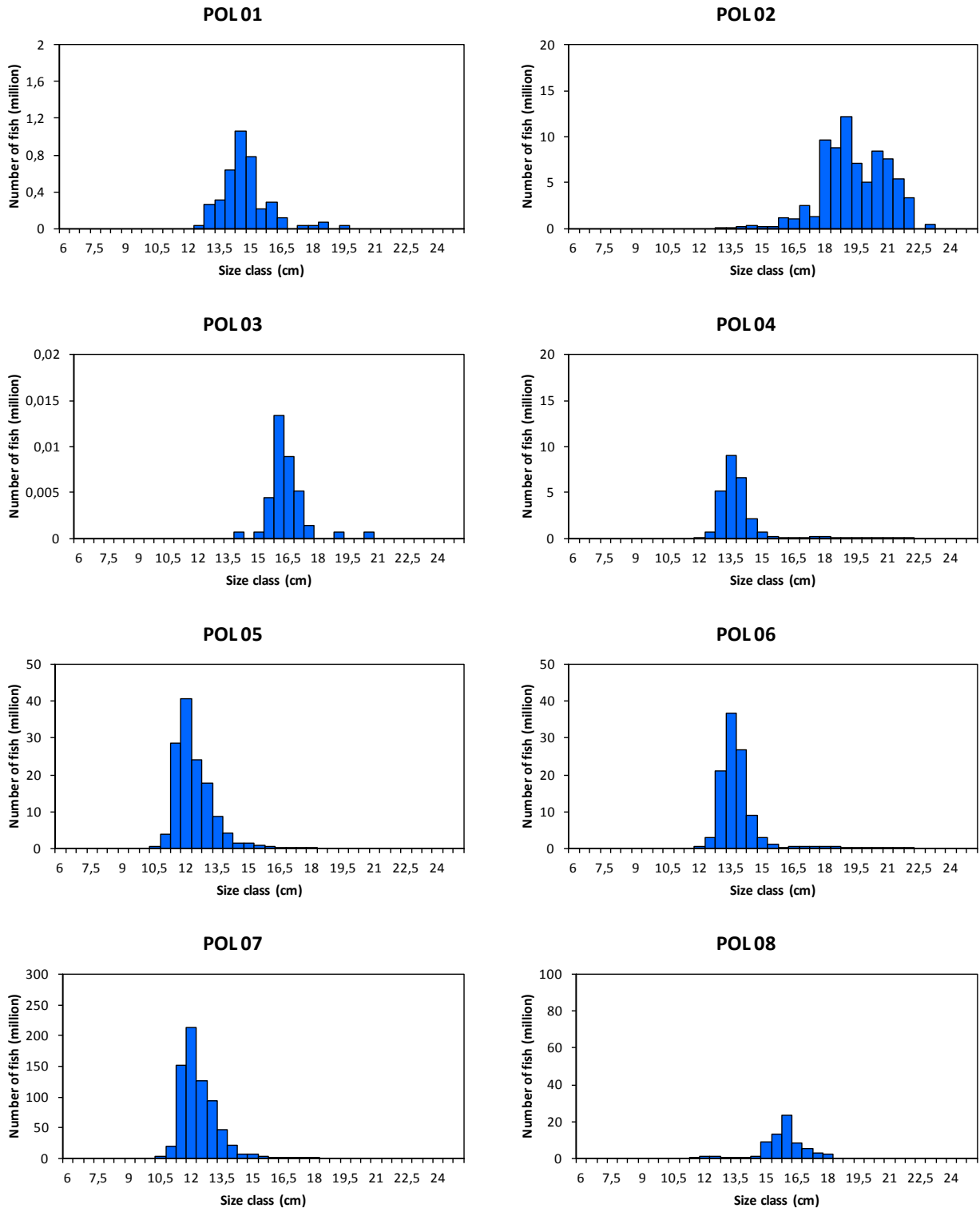


Figure 12. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 11**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Sardine (*S. pilchardus*)

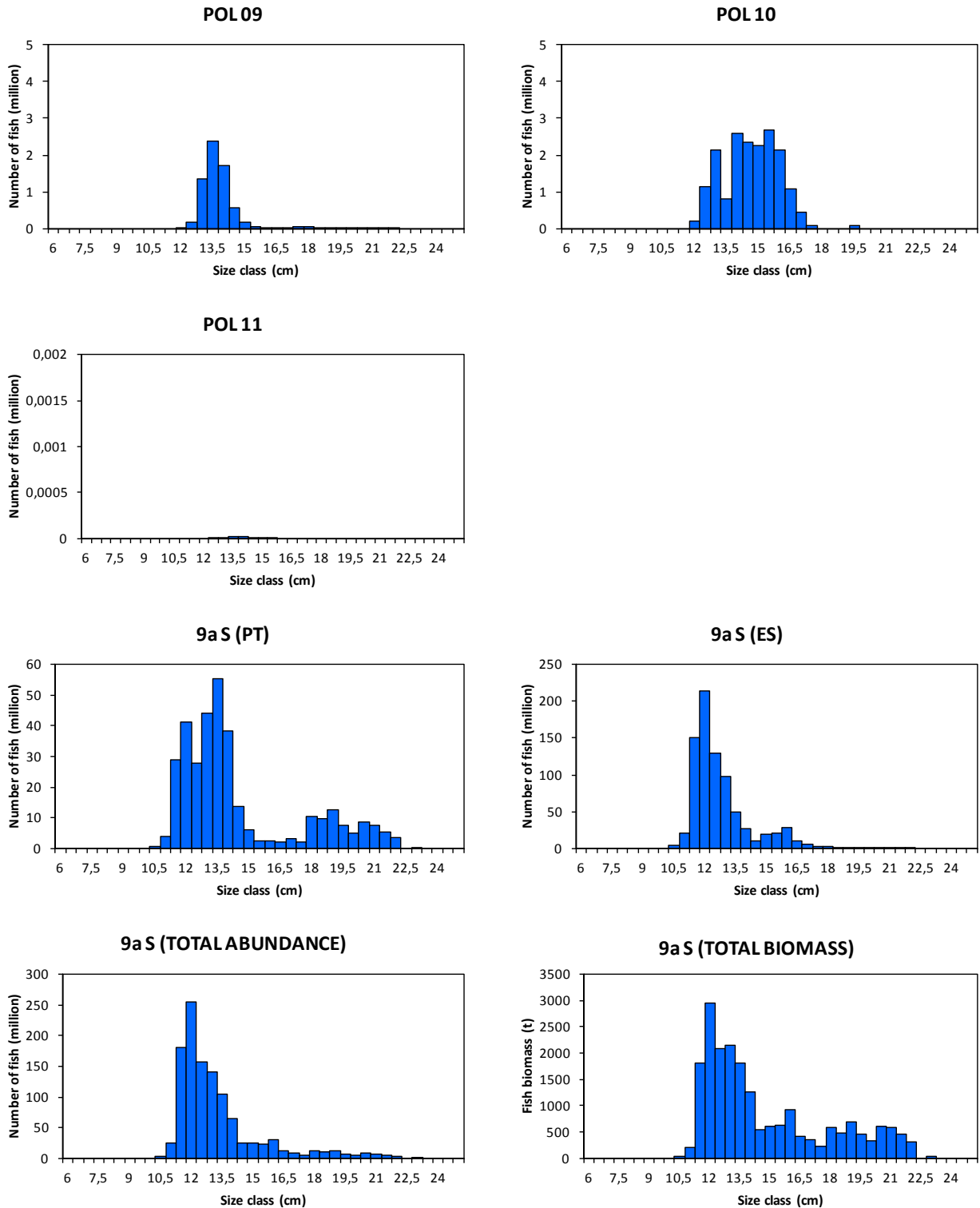


Figure 12. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Cont'd.

ECOCADIZ-RECLUTAS 2018-10: Sardine (*S. pilchardus*)

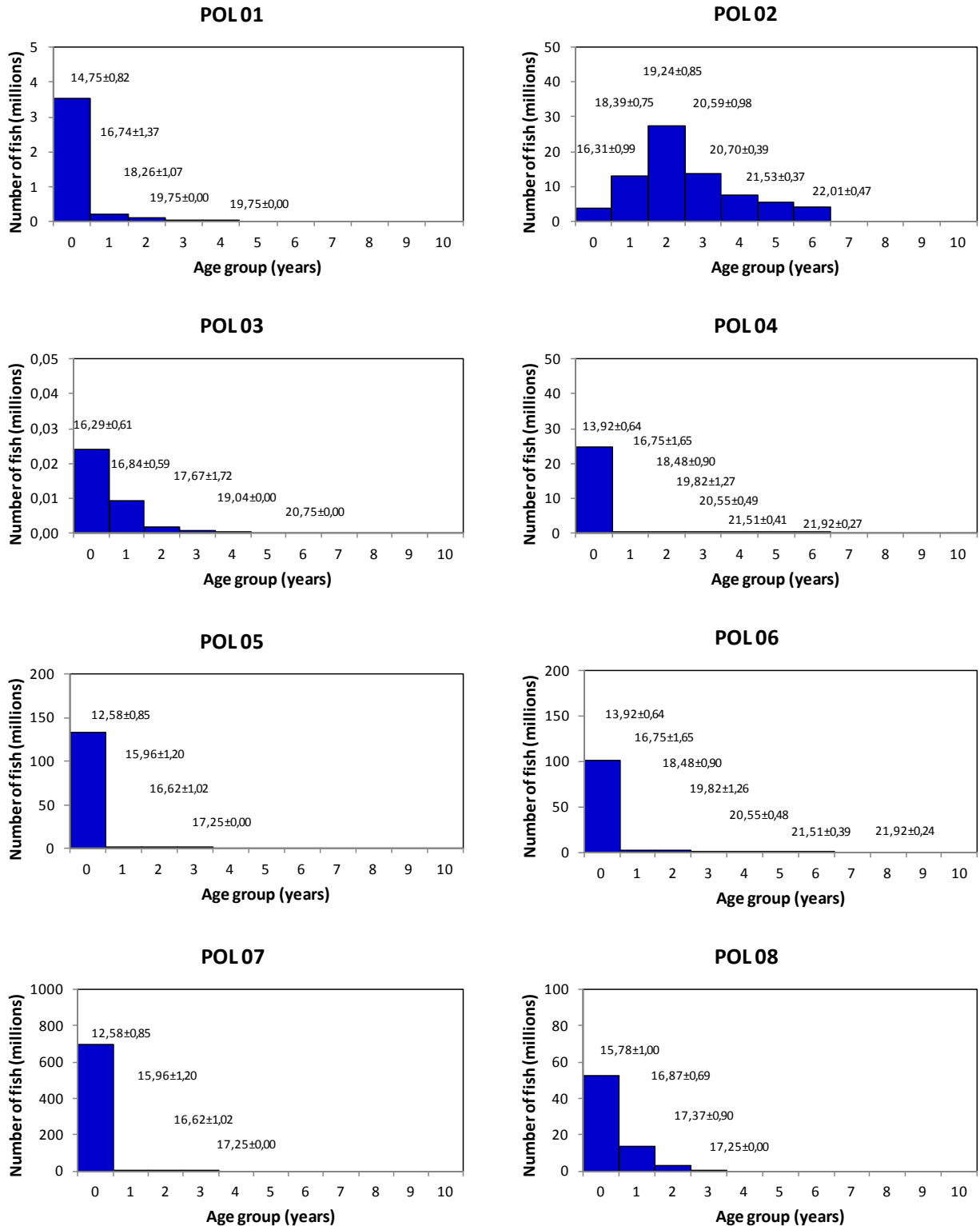


Figure 13. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in Figure 11) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Sardine (*S. pilchardus*)

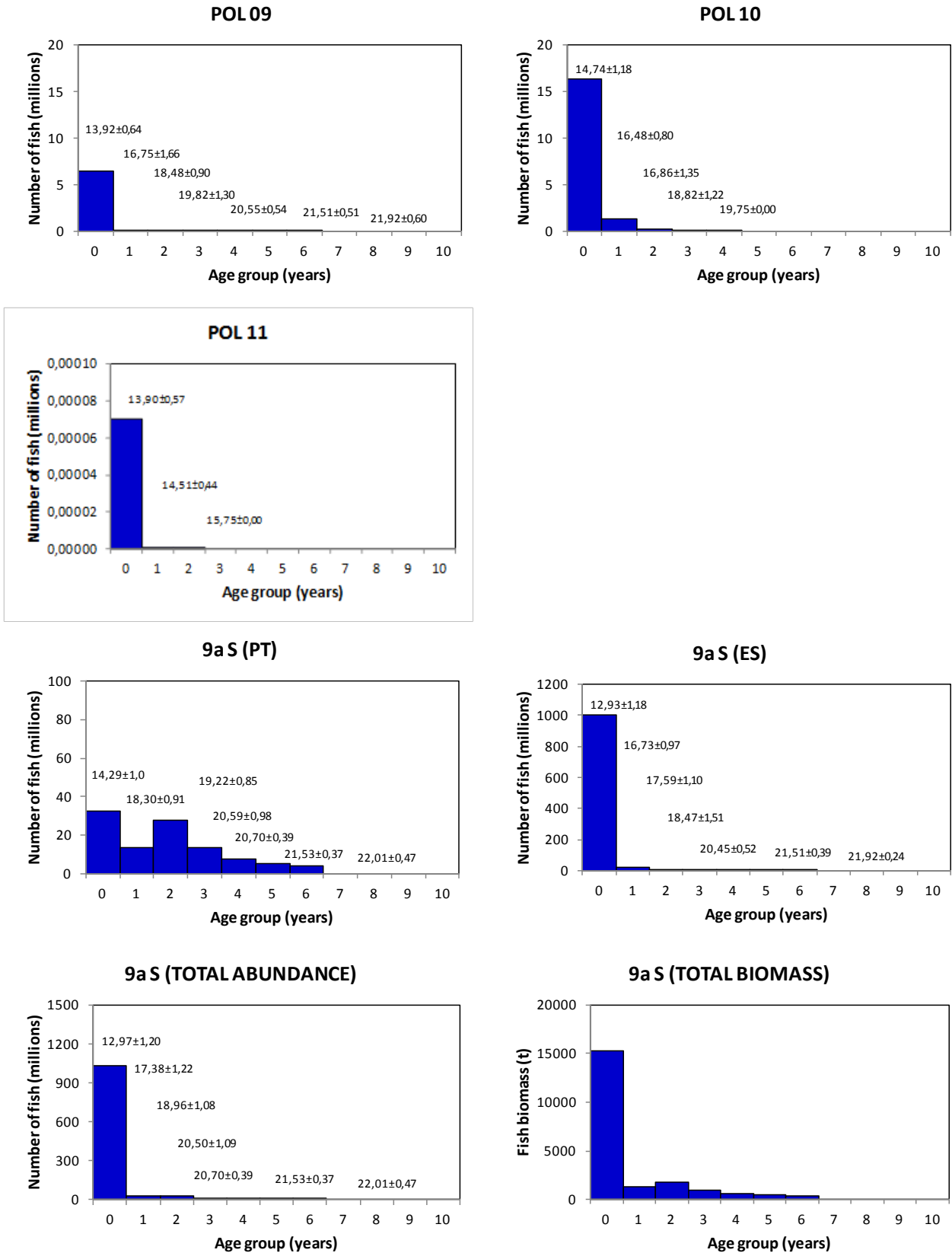


Figure 13. ECOCADIZ-RECLUTAS 2018-10 survey. Sardine (*Sardina pilchardus*). Cont'd

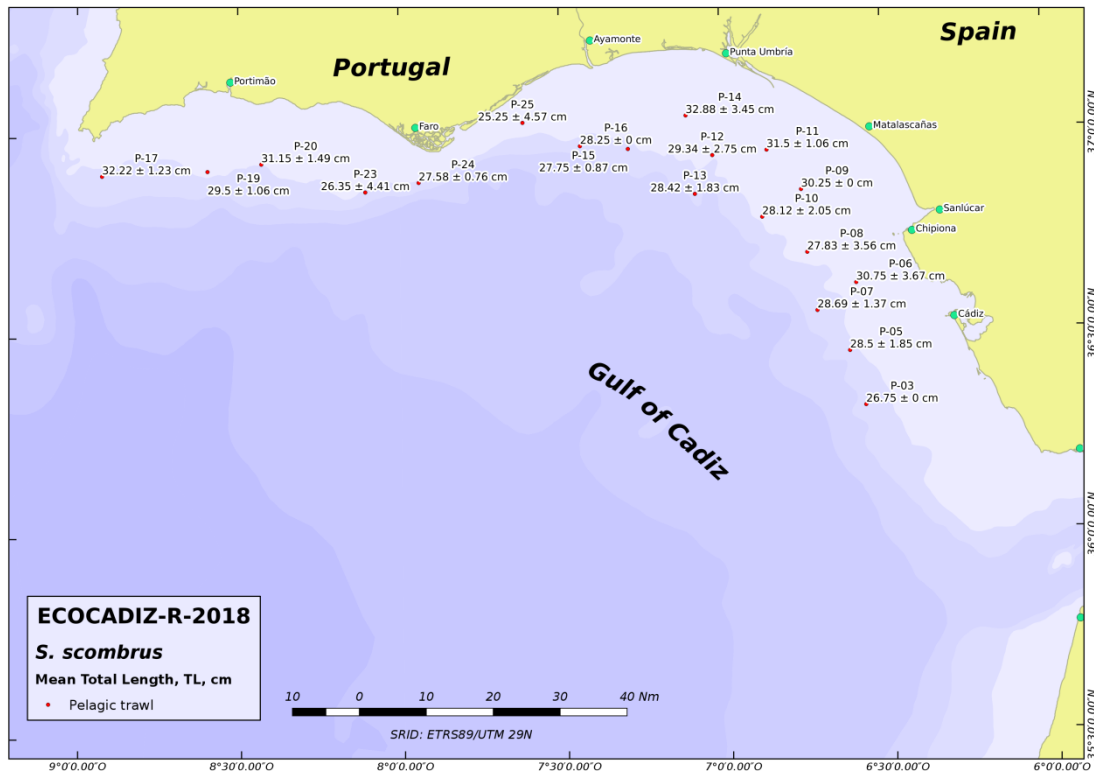
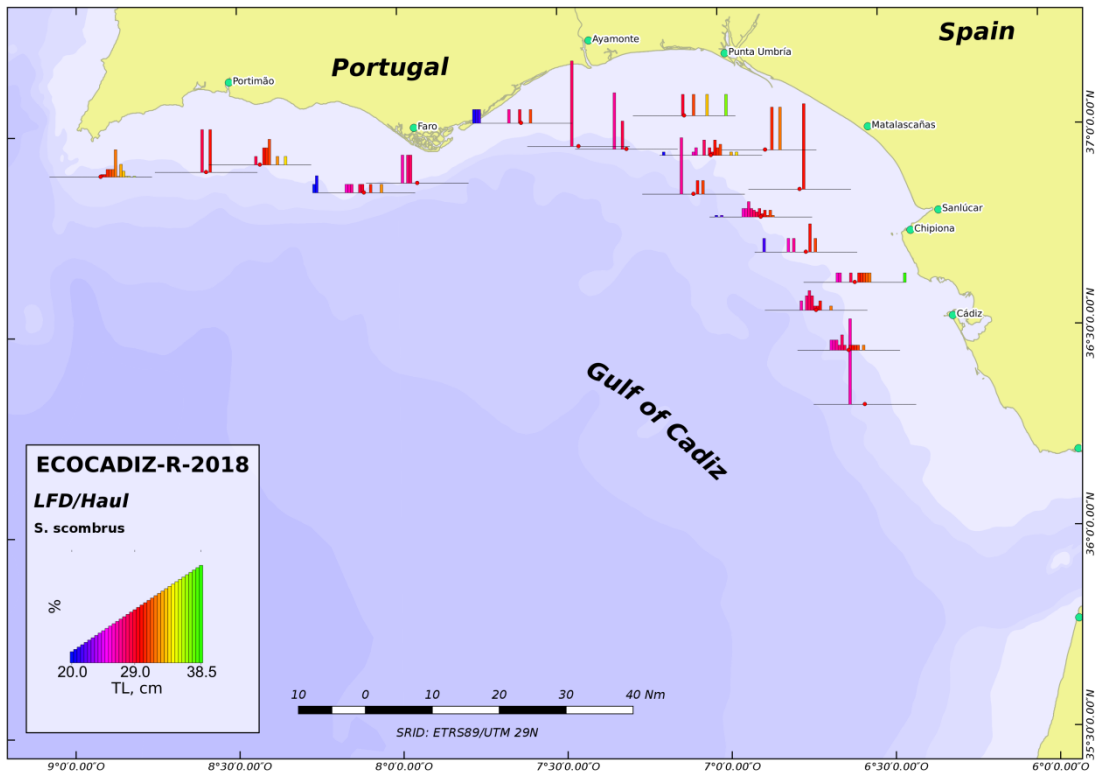


Figure 14. ECOCADIZ-RECLUTAS 2017-10 survey. Atlantic mackerel (*Scomber scombrus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

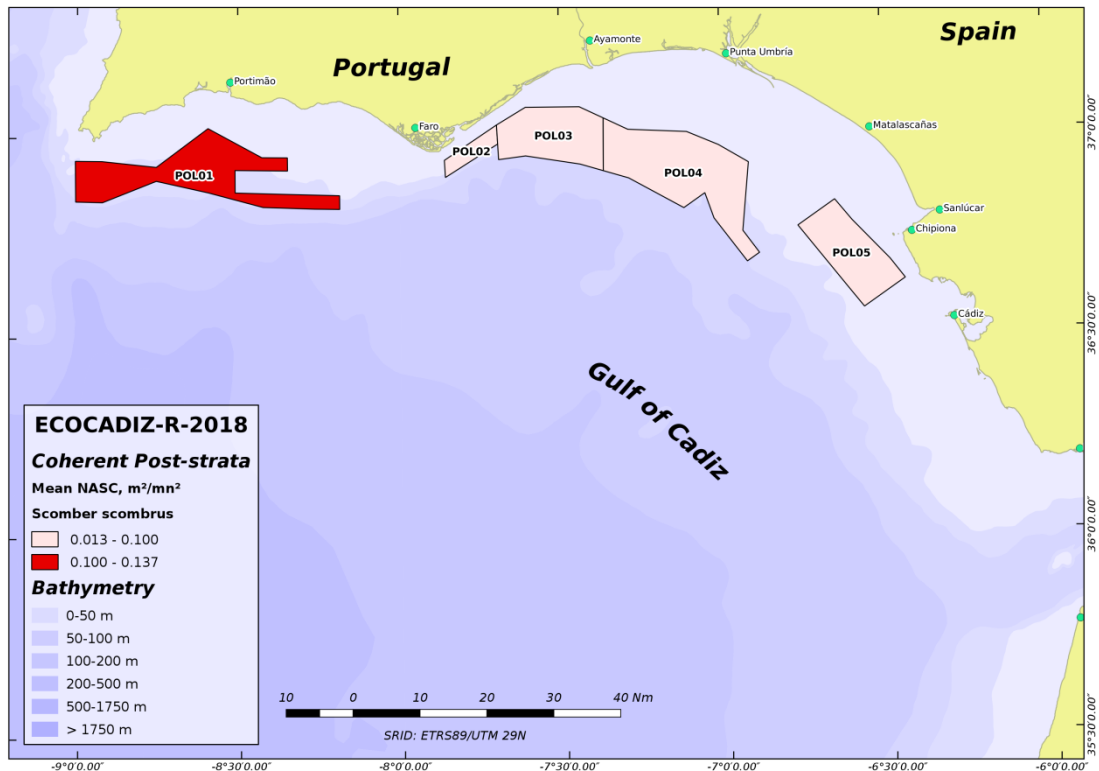
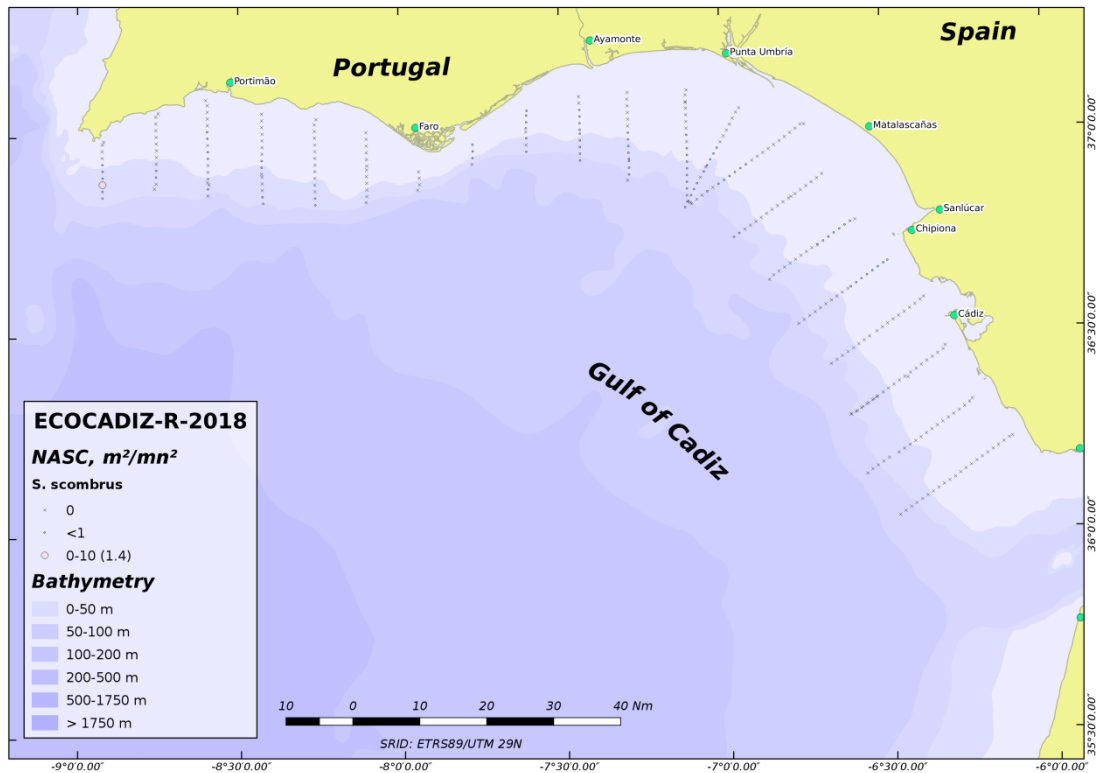


Figure 15. ECOCADIZ-RECLUTAS 2018-10 survey. Atlantic mackerel (*Scomber scombrus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2\ nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Atlantic mackerel (*S. scombrus*)

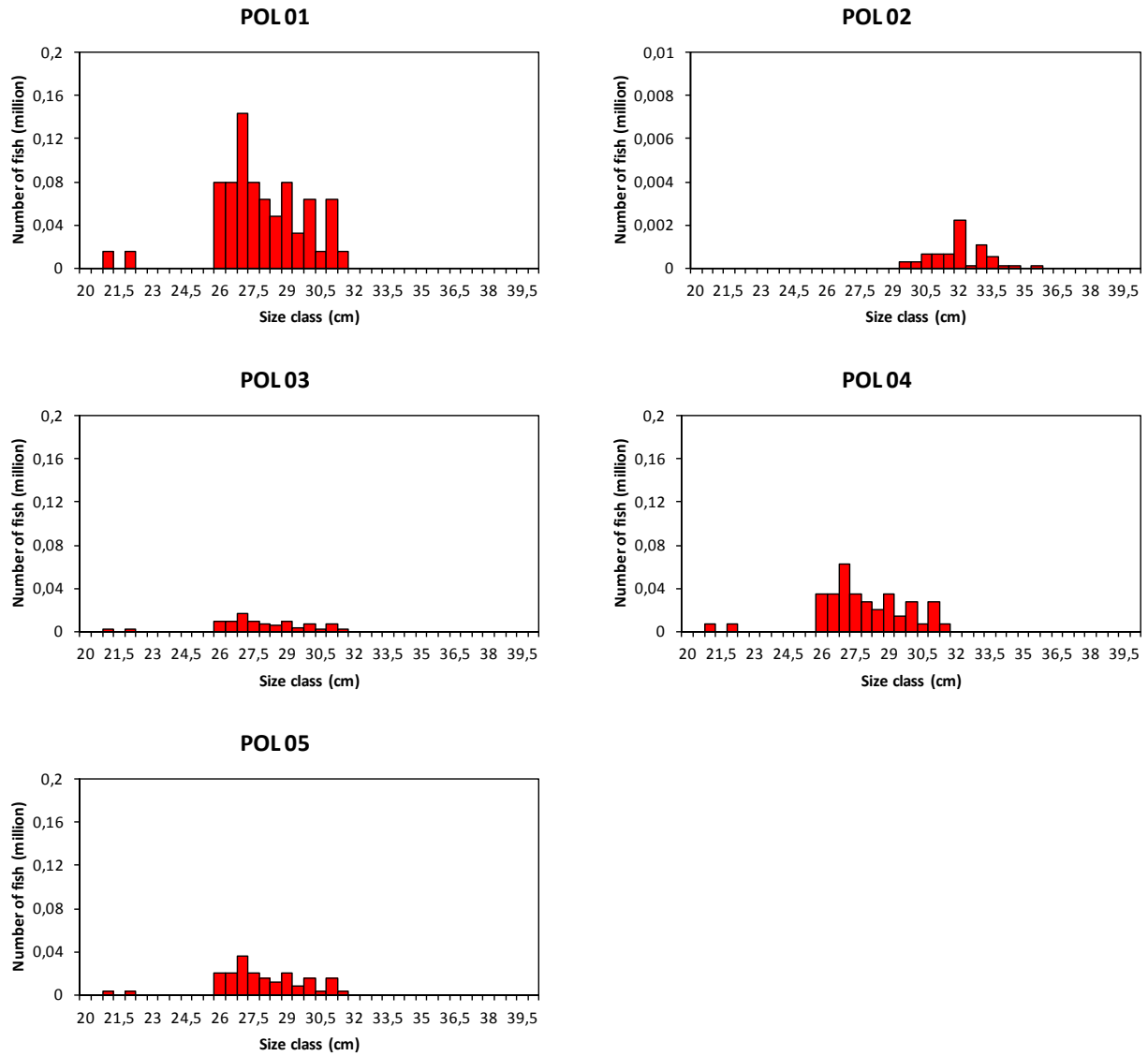


Figure 16. ECOCADIZ-RECLUTAS 2018-10 survey. Atlantic mackerel (*Scomber scombrus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 15**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Atlantic mackerel (*S. scombrus*)

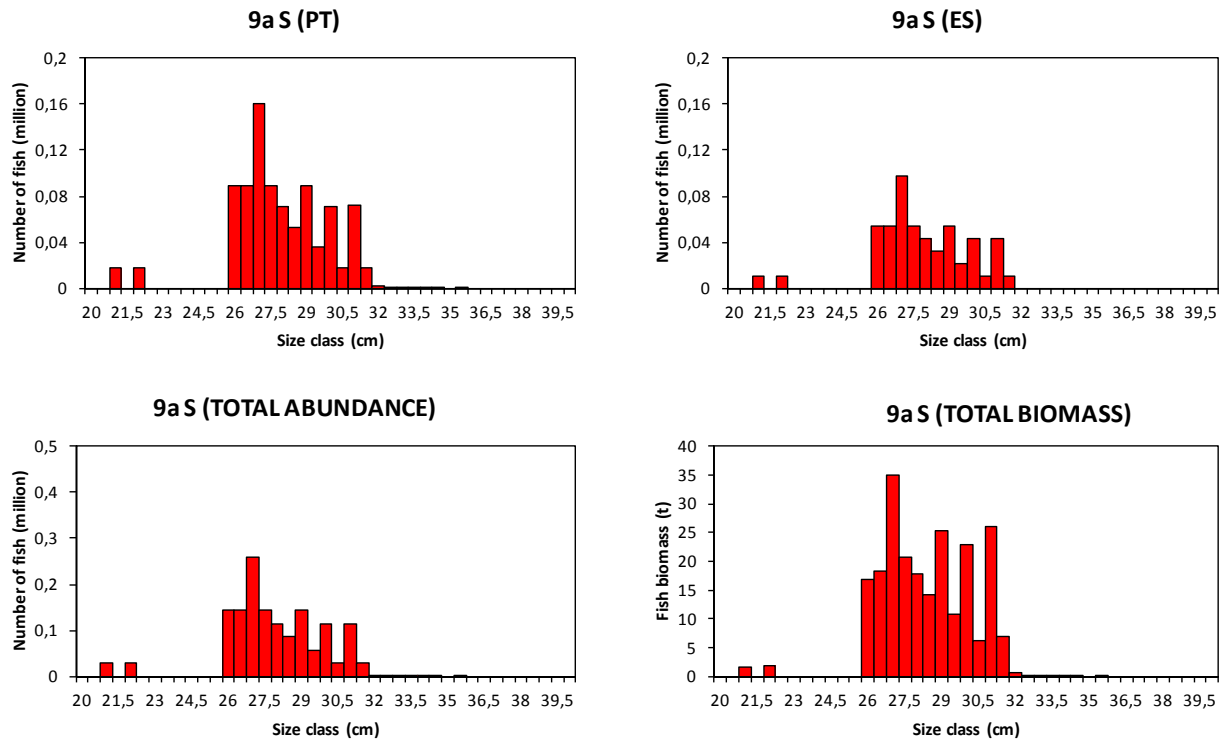


Figure 16. ECOCADIZ-RECLUTAS 2018-10 survey. Atlantic mackerel (*Scomber scombrus*). Cont'd.

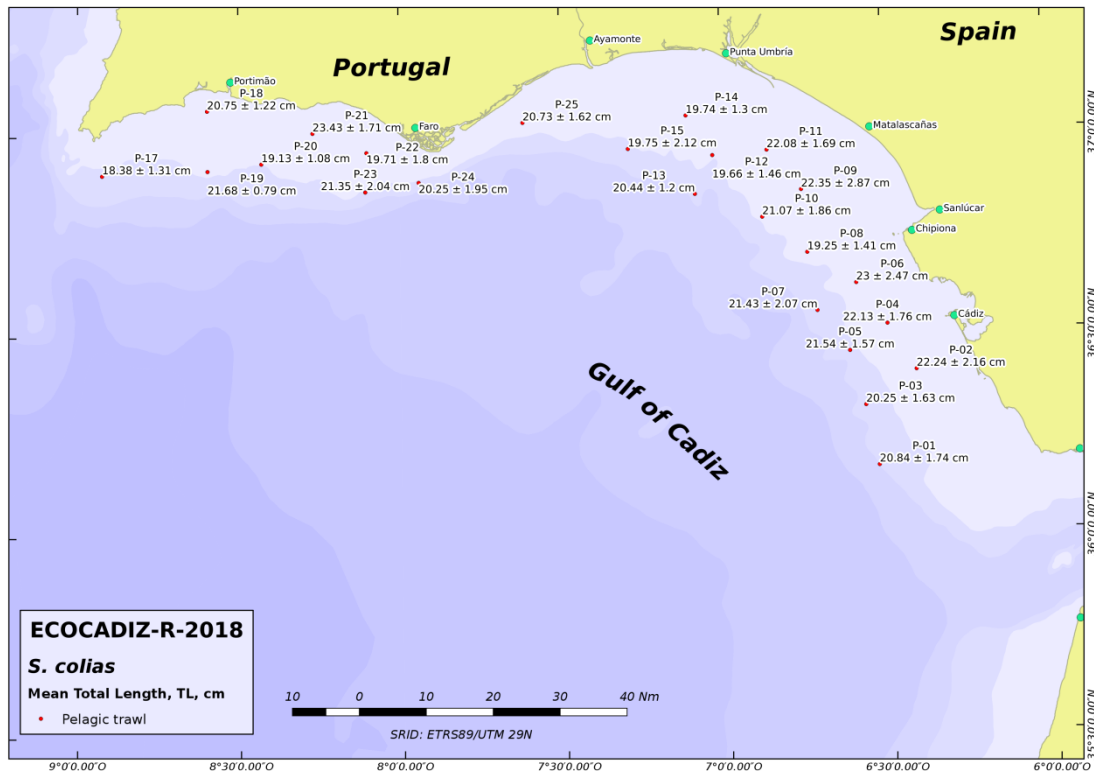
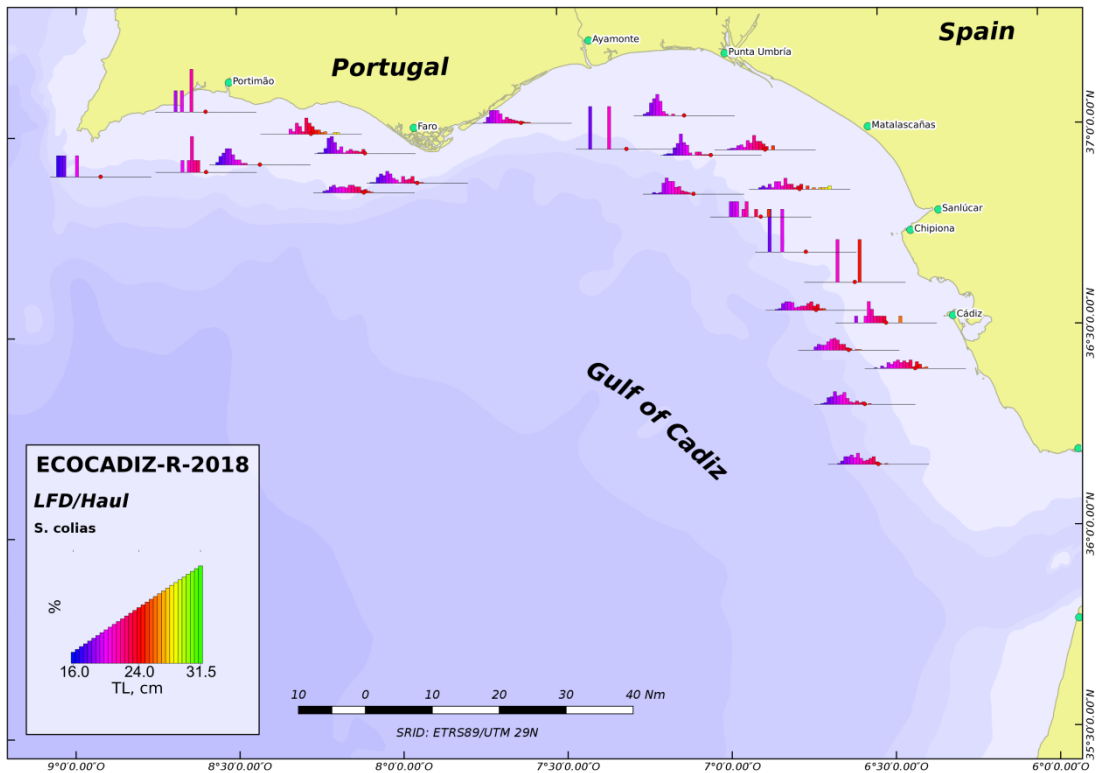


Figure 17. ECOCADIZ-RECLUTAS 2018-10 survey. Chub mackerel (*Scomber colias*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

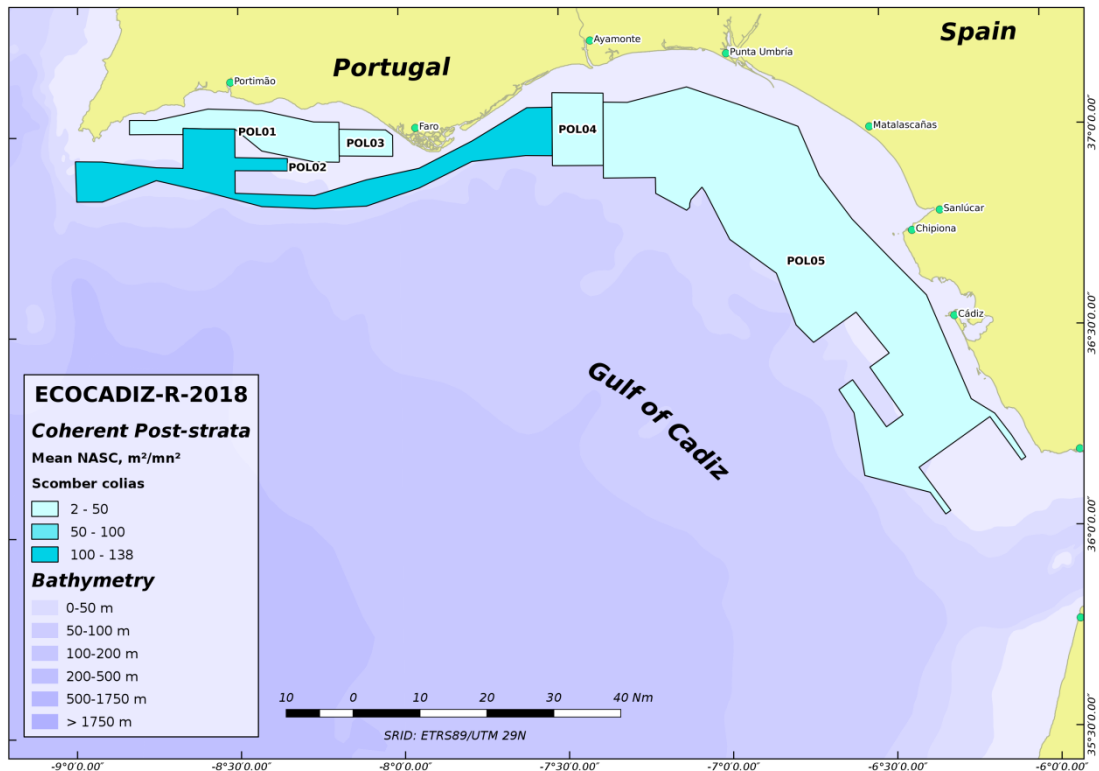
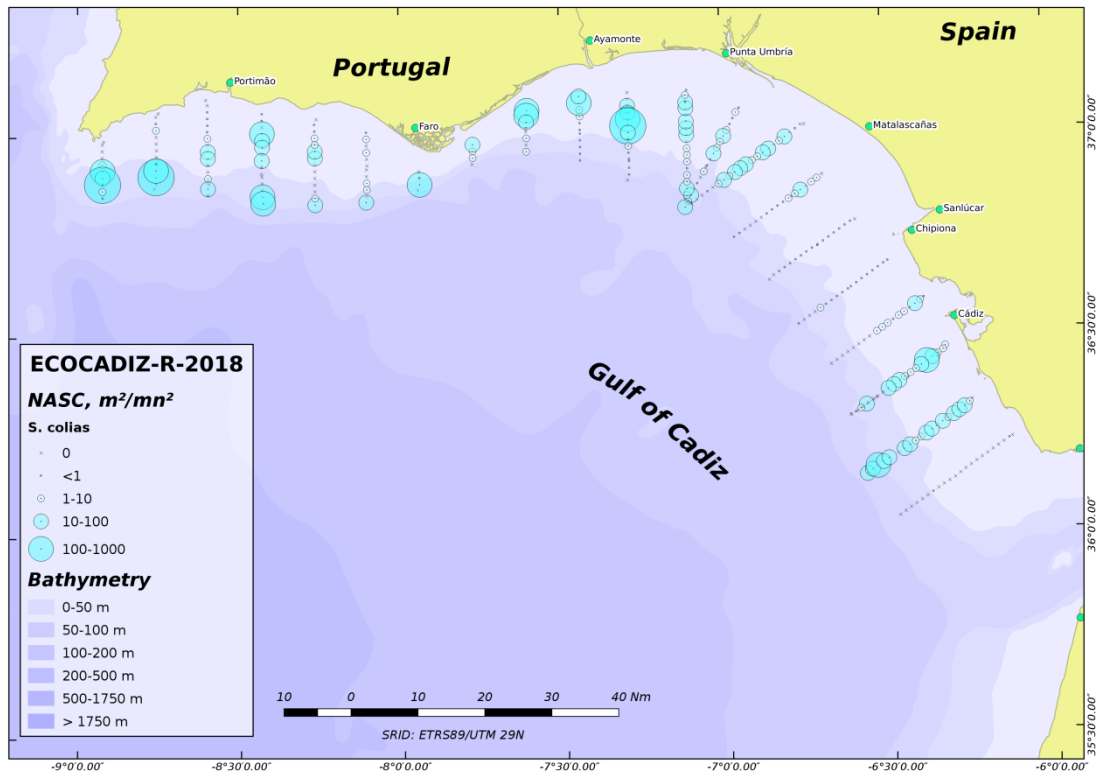


Figure 18. ECOCADIZ-RECLUTAS 2017-10 survey. Chub mackerel (*Scomber colias*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Chub mackerel (*S. colias*)

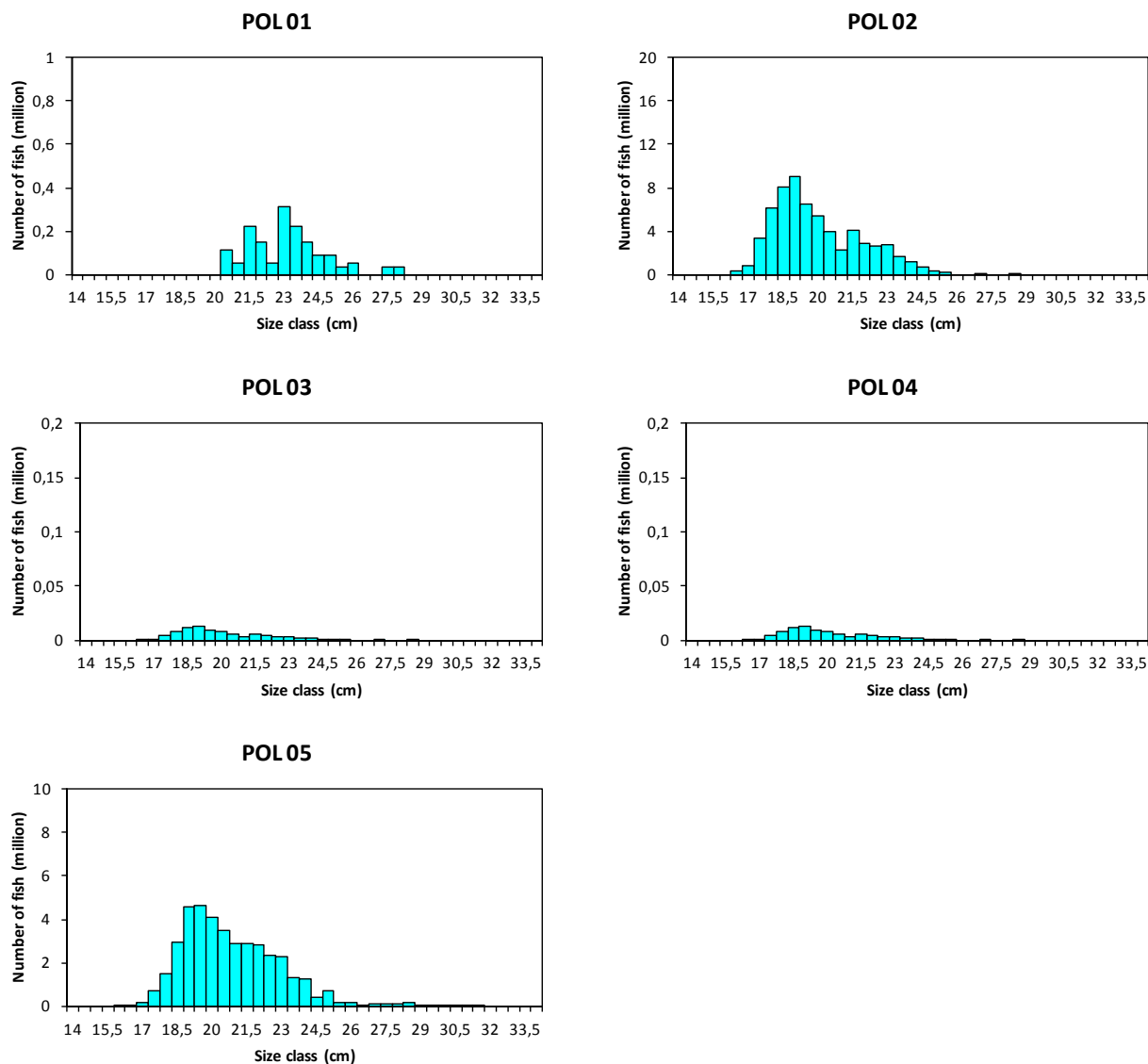


Figure 19. ECOCADIZ-RECLUTAS 2018-10 survey. Chub mackerel (*Scomber colias*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 18**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Chub mackerel (*S. colias*)

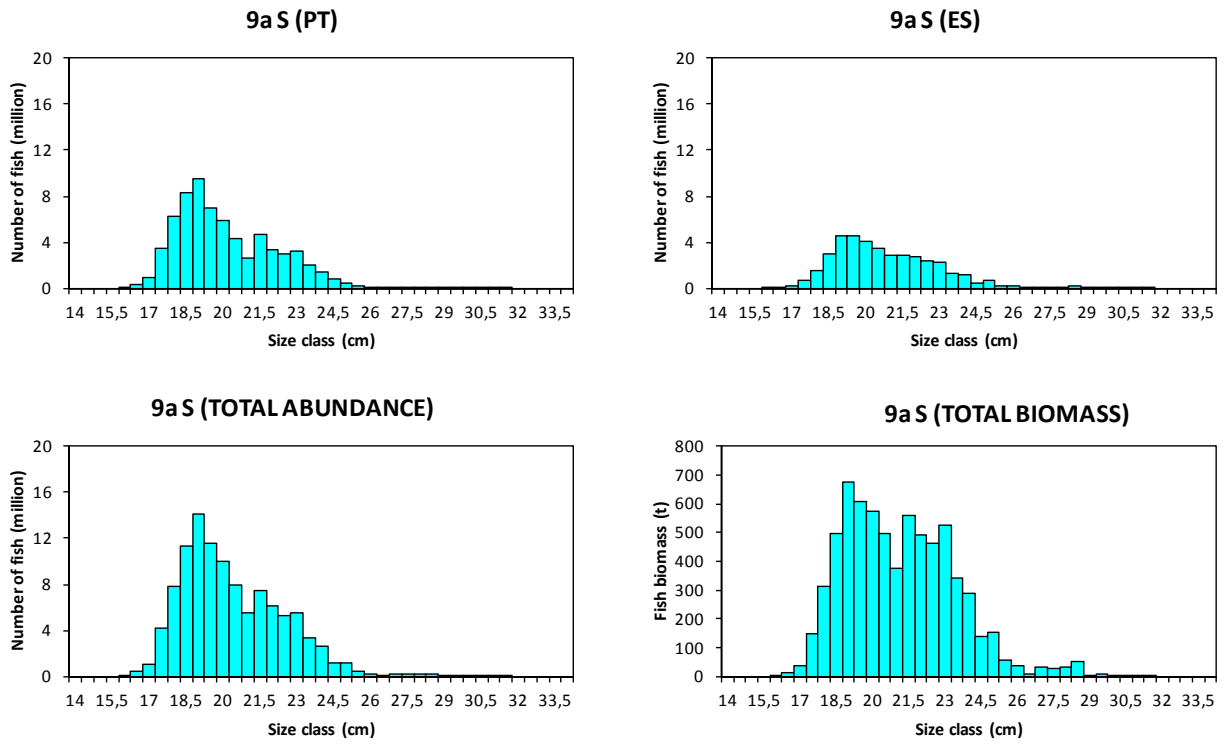


Figure 19. ECOCADIZ-RECLUTAS 2018-10 survey. Chub mackerel (*Scomber colias*). Cont'd.

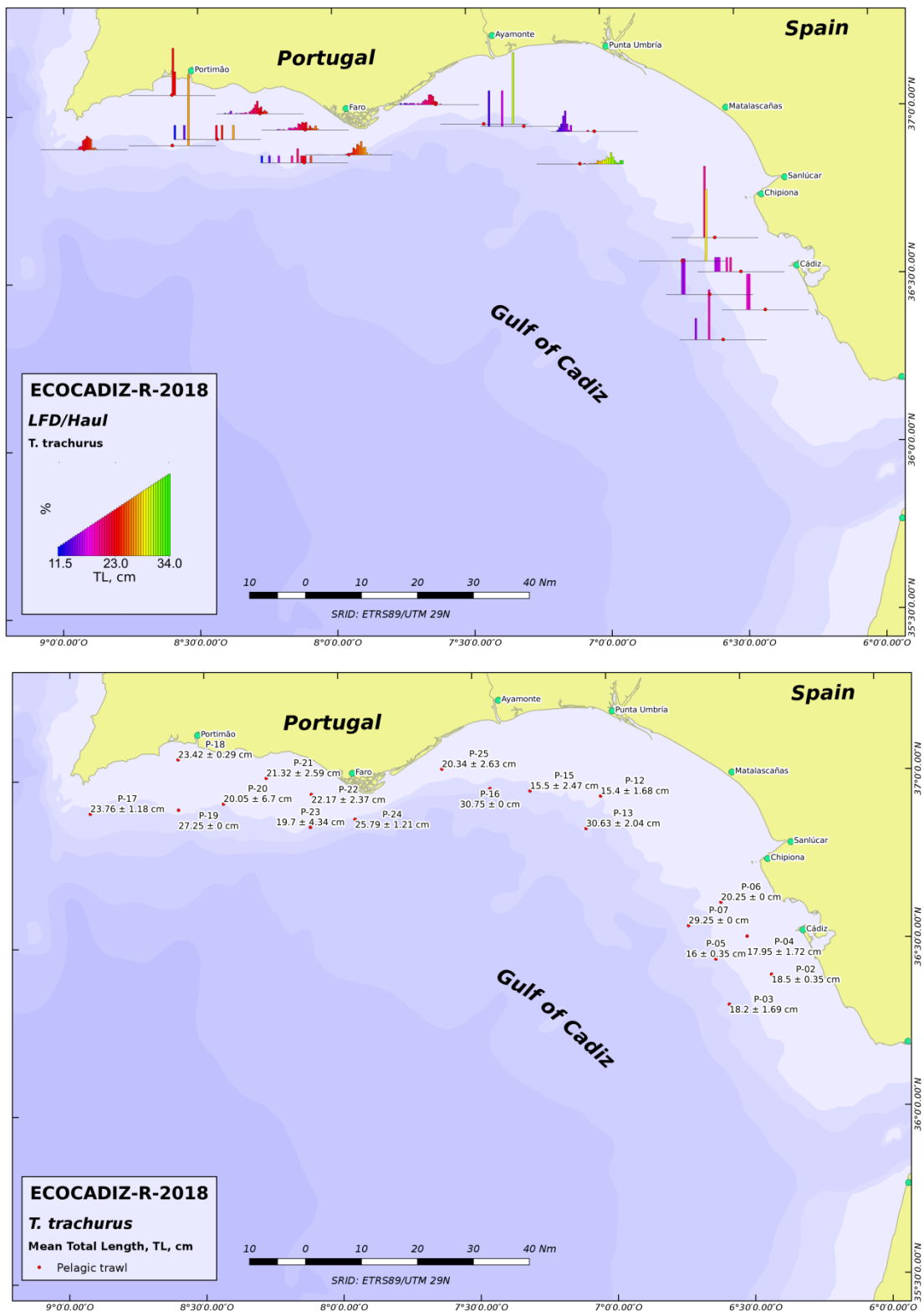


Figure 20. ECOCADIZ-RECLUTAS 2018-10 survey. Horse mackerel (*Trachurus trachurus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

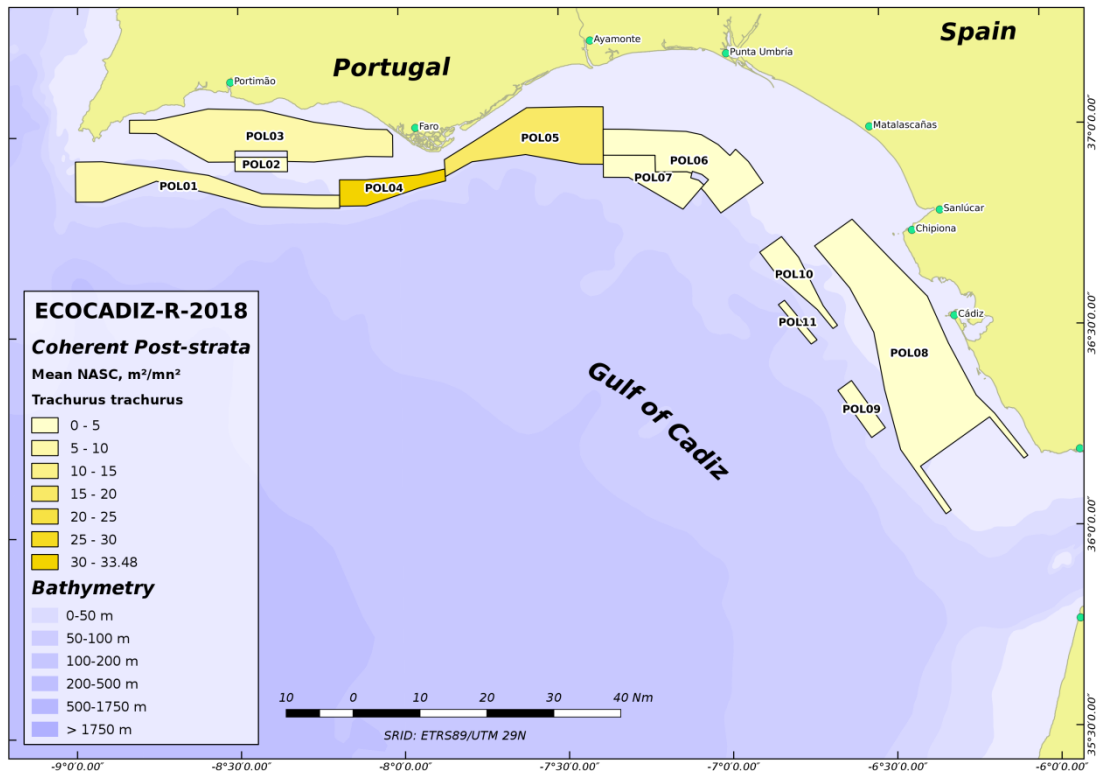
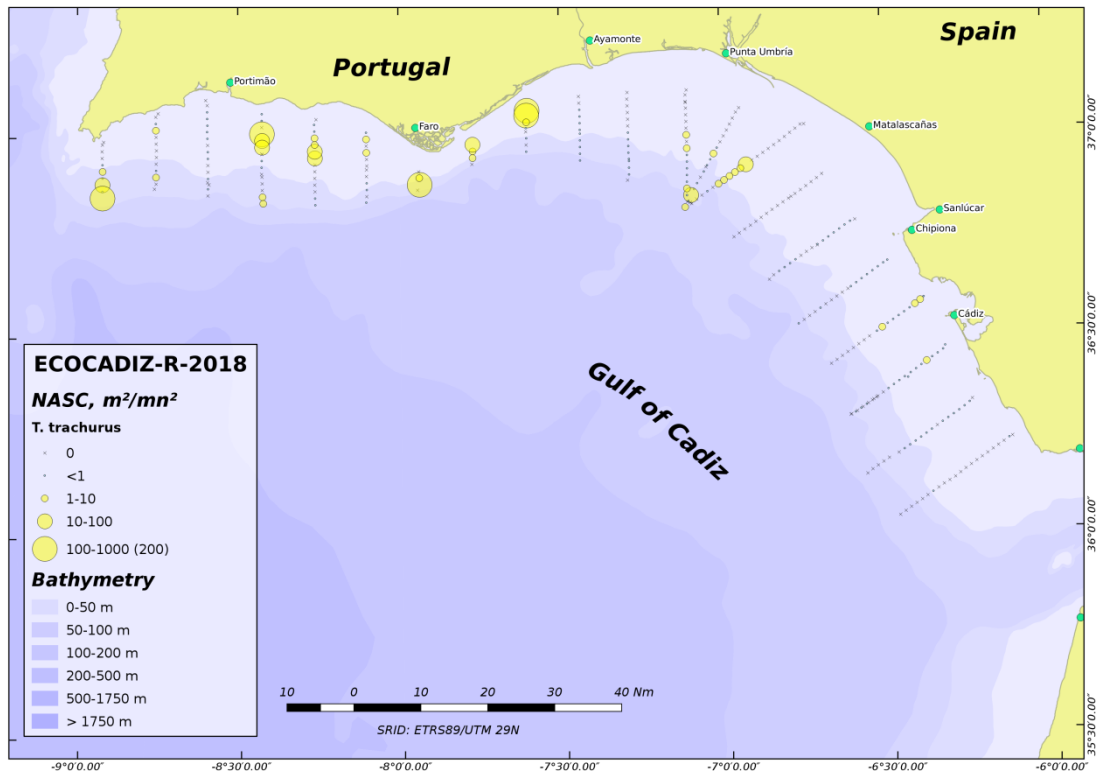


Figure 21. ECOCADIZ-RECLUTAS 2018-10 survey. Horse mackerel (*Trachurus trachurus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Horse mackerel (*T. trachurus*)

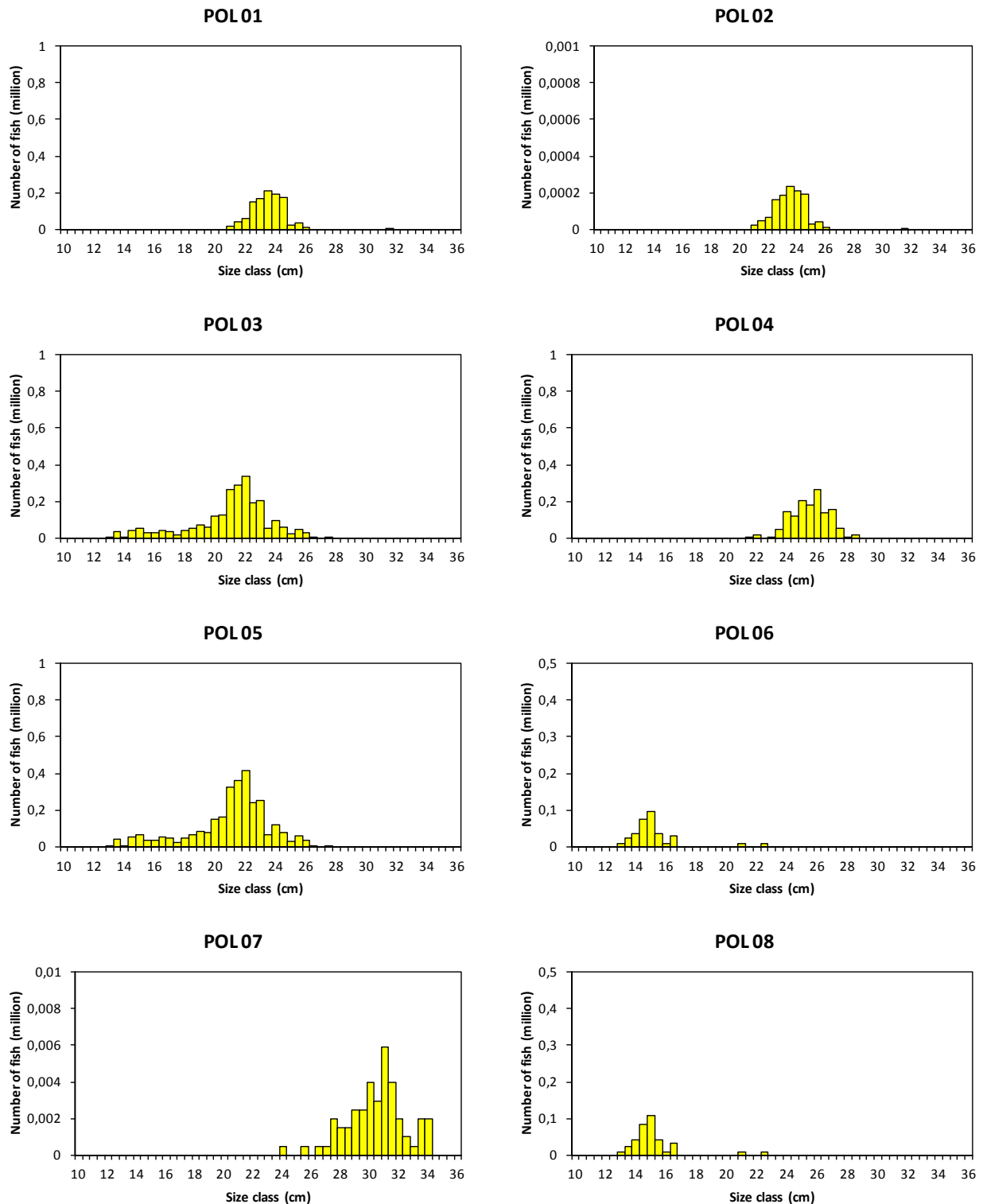


Figure 22. ECOCADIZ-RECLUTAS 2018-10 survey. Horse mackerel (*Trachurus trachurus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 21**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Horse mackerel (*T. trachurus*)

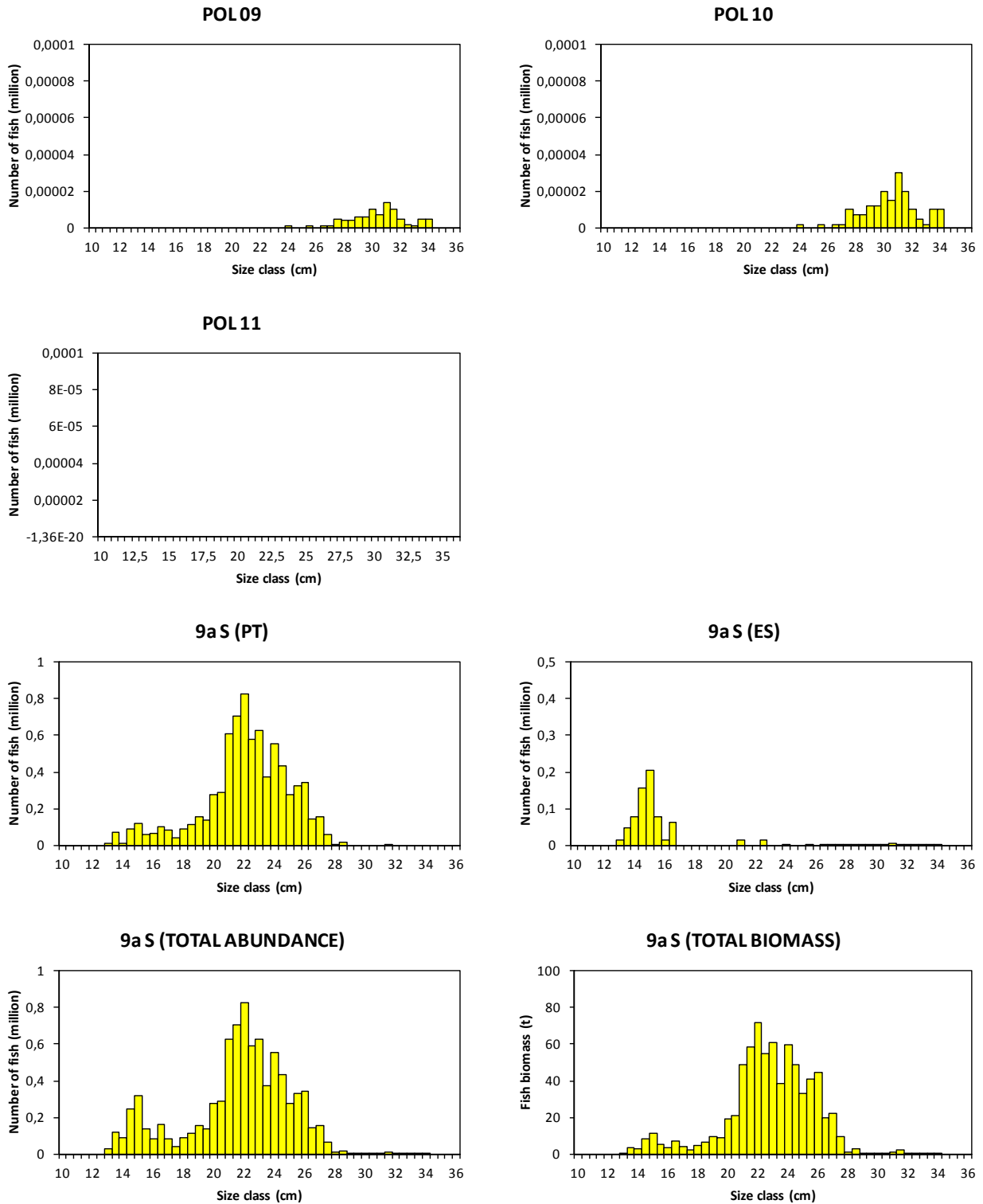


Figure 22. ECOCADIZ-RECLUTAS 2018-10 survey. Horse mackerel (*Trachurus trachurus*). Cont'd.

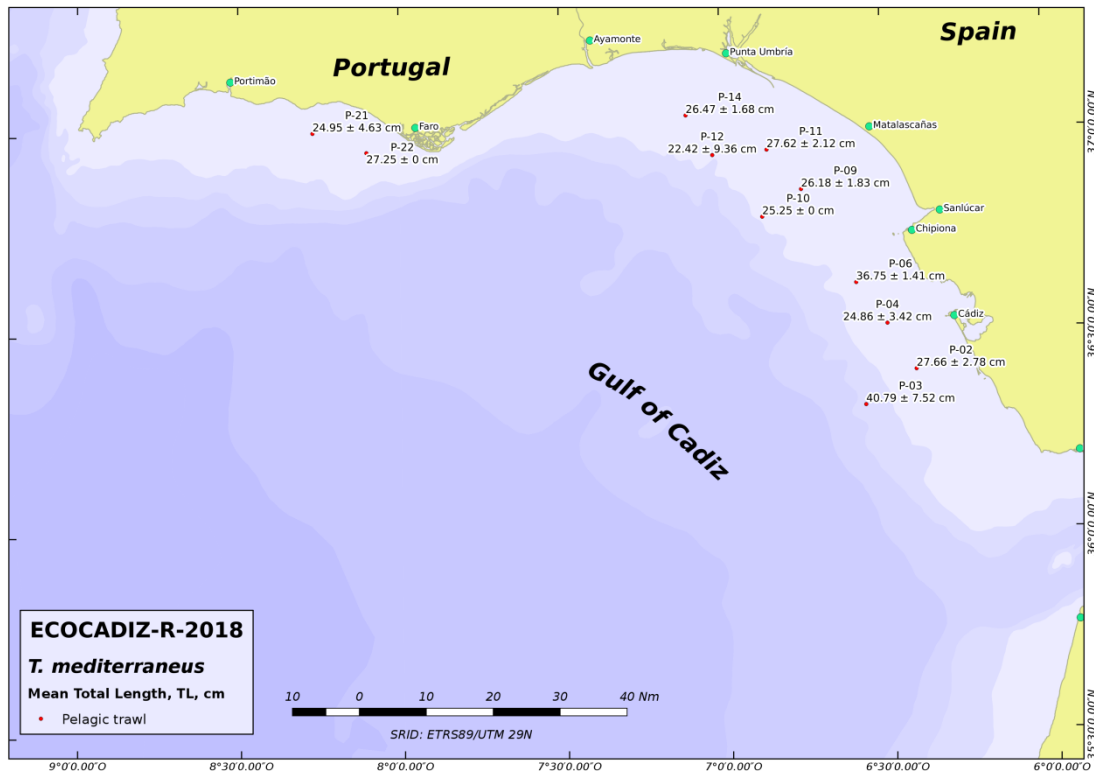
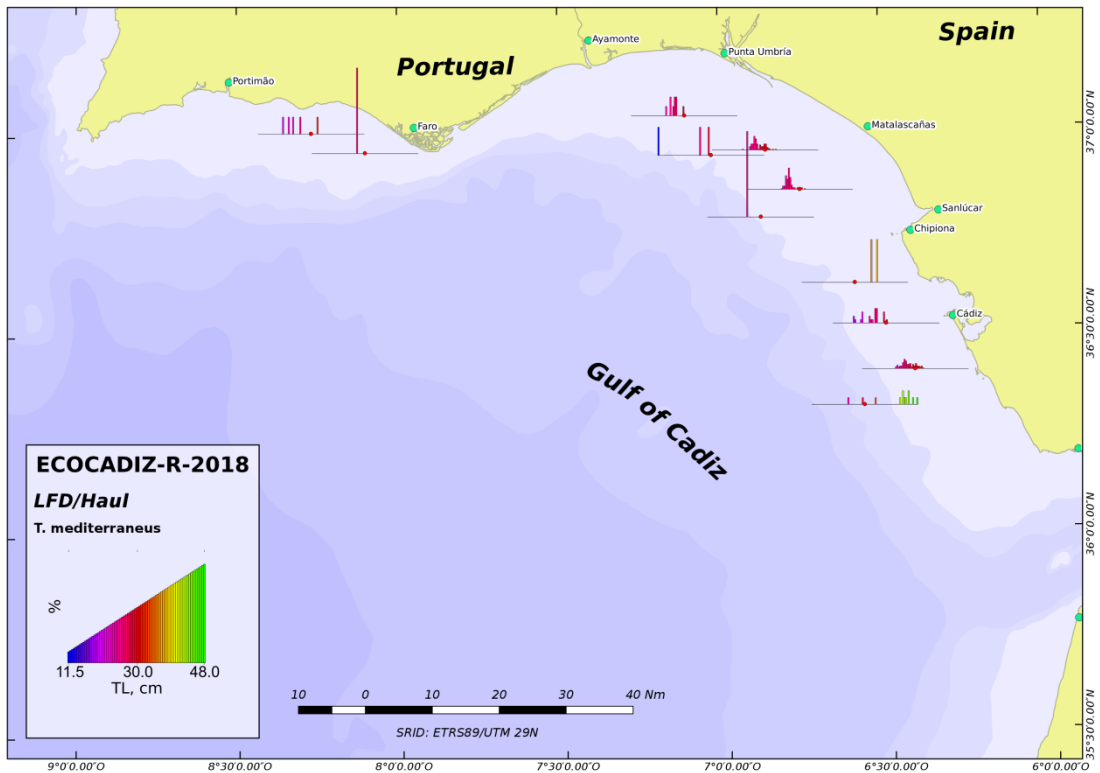


Figure 23. ECOCADIZ-RECLUTAS 2018-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

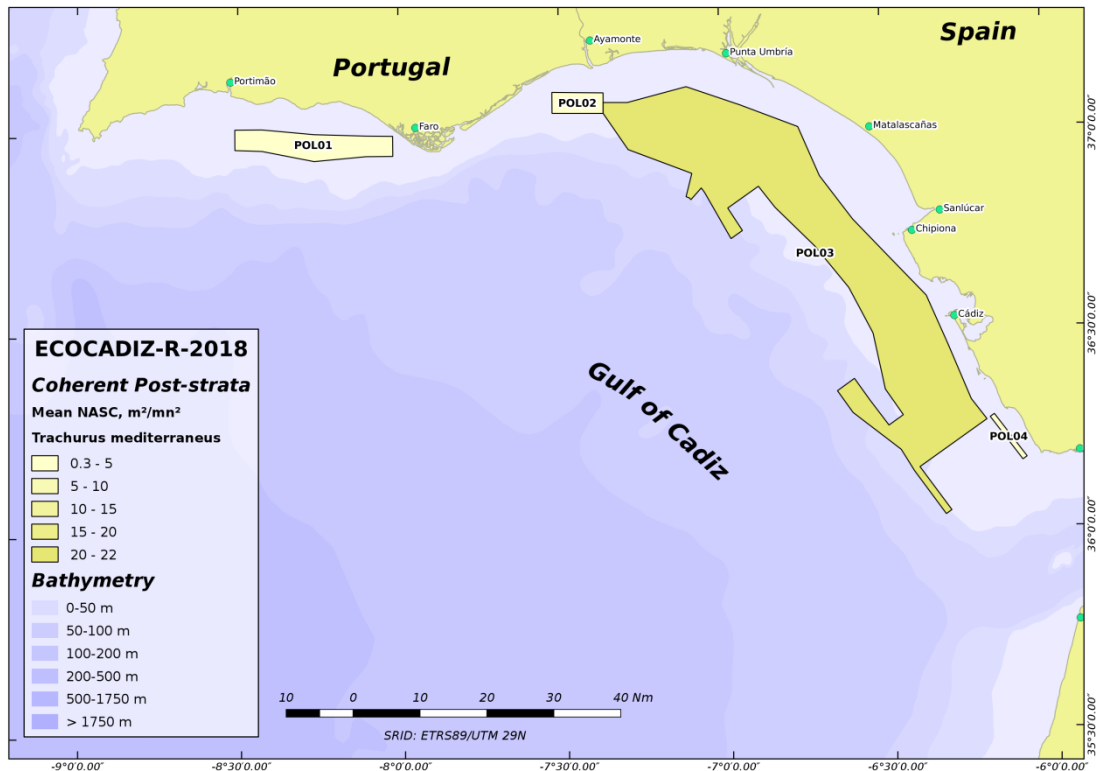
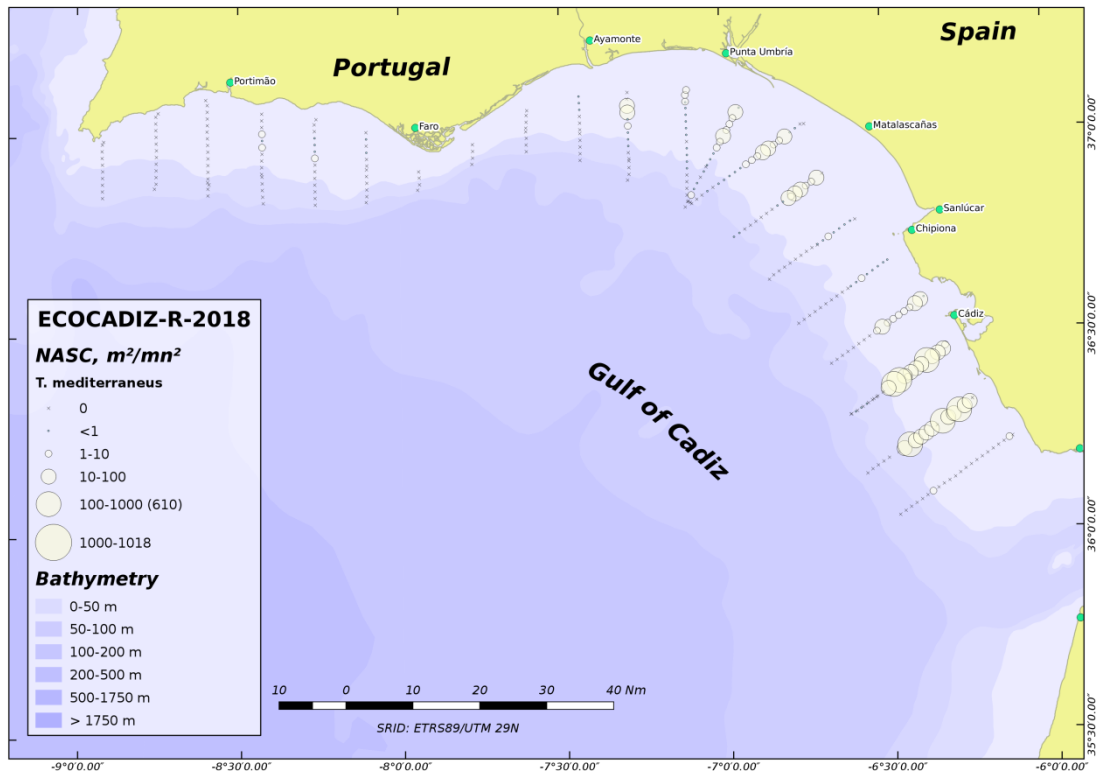


Figure 24. ECOCADIZ-RECLUTAS 2018-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in $m^2\ nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Mediterranean horse mackerel (*T. mediterraneus*)

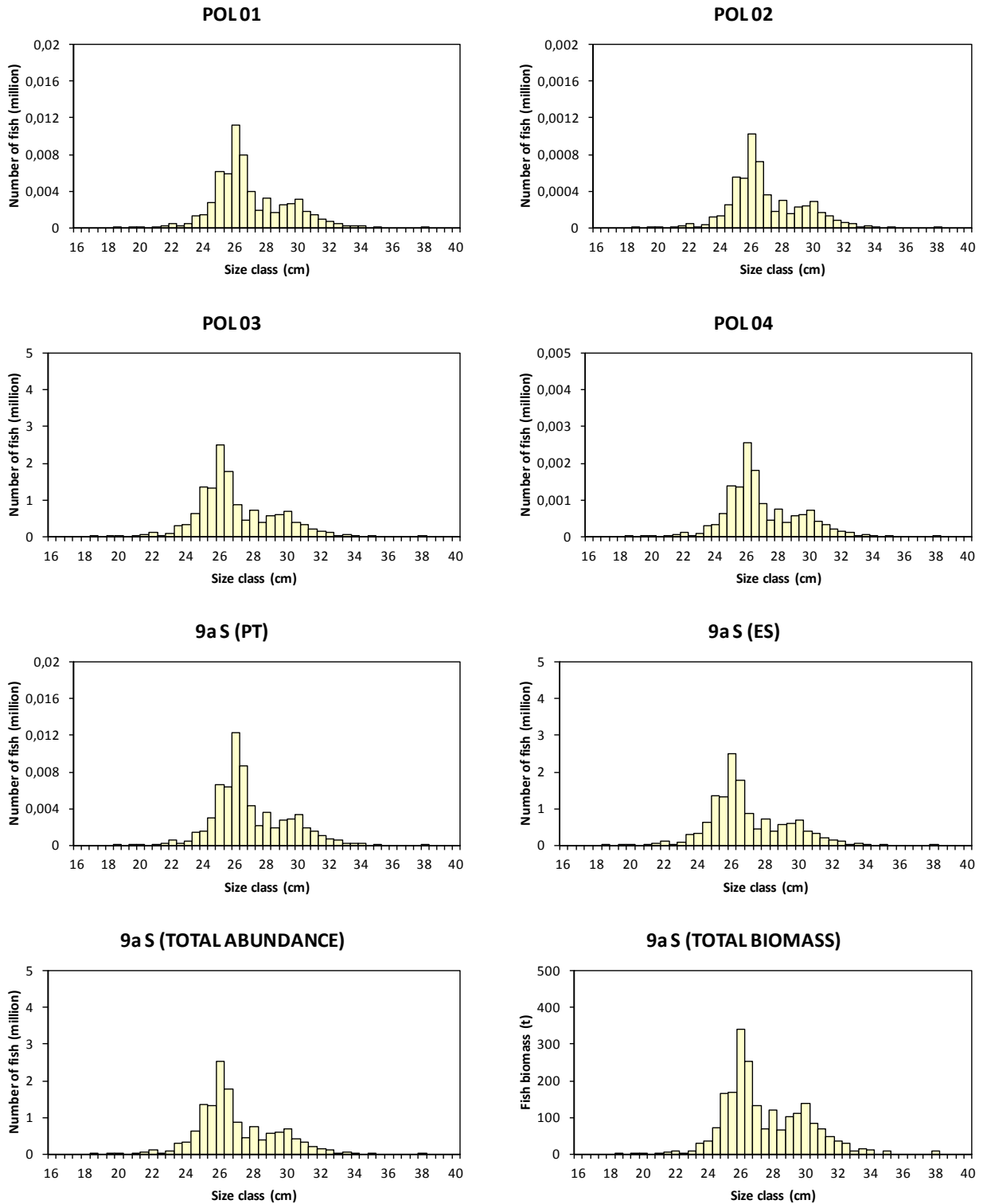


Figure 25. ECOCADIZ-RECLUTAS 2018-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 24**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

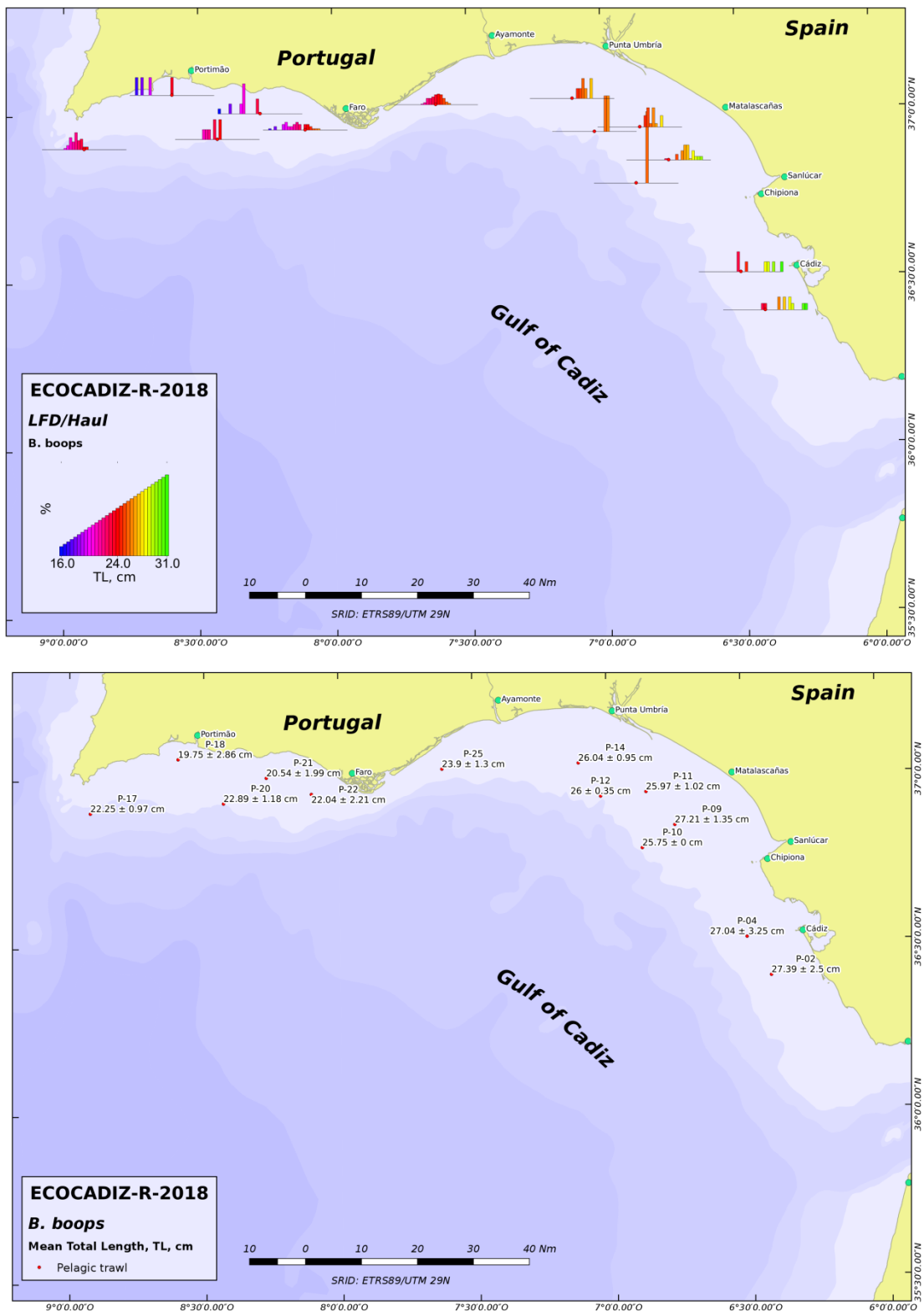


Figure 26. ECOCADIZ-RECLUTAS 2018-10 survey. Bogue (*Boops boops*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

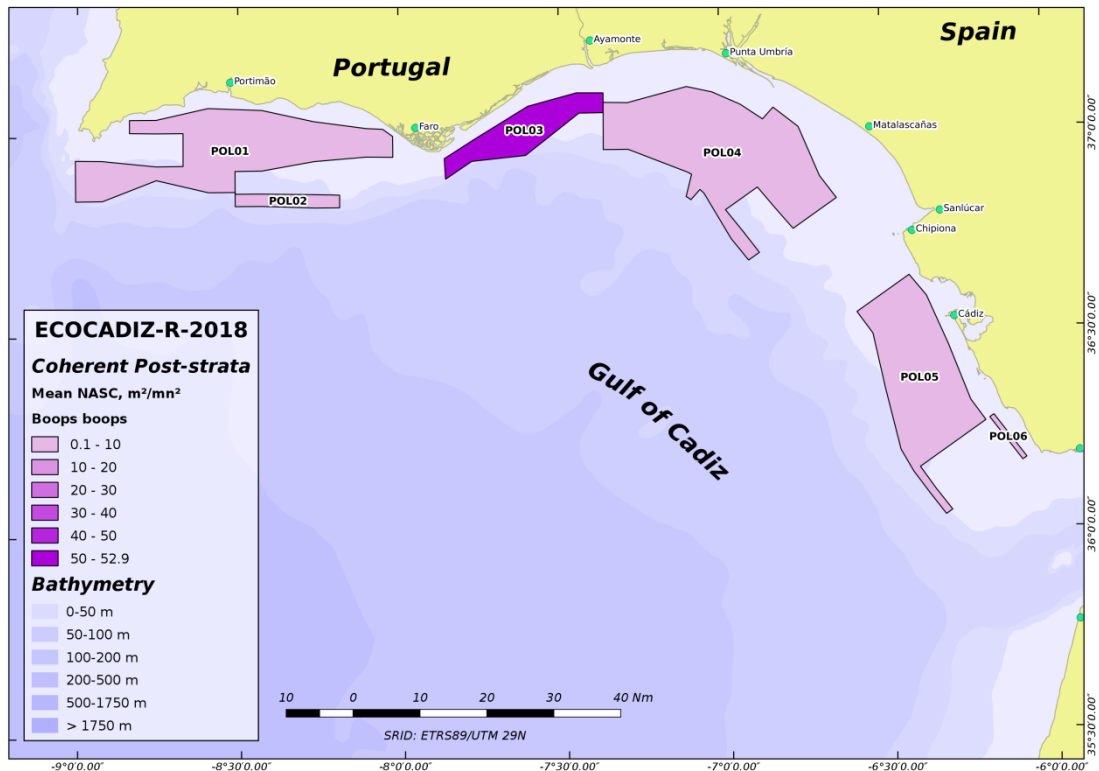
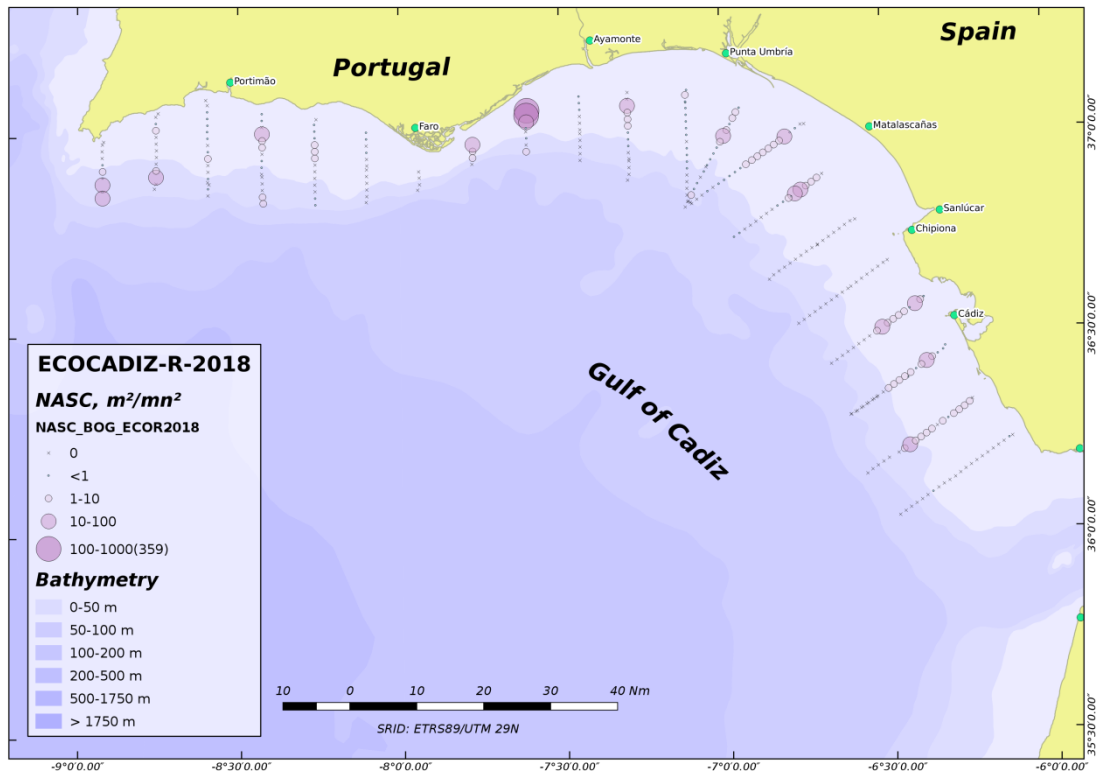


Figure 27. ECOCADIZ-RECLUTAS 2018-10 survey. Bogue (*Boops boops*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Bogue (*B. boops*)

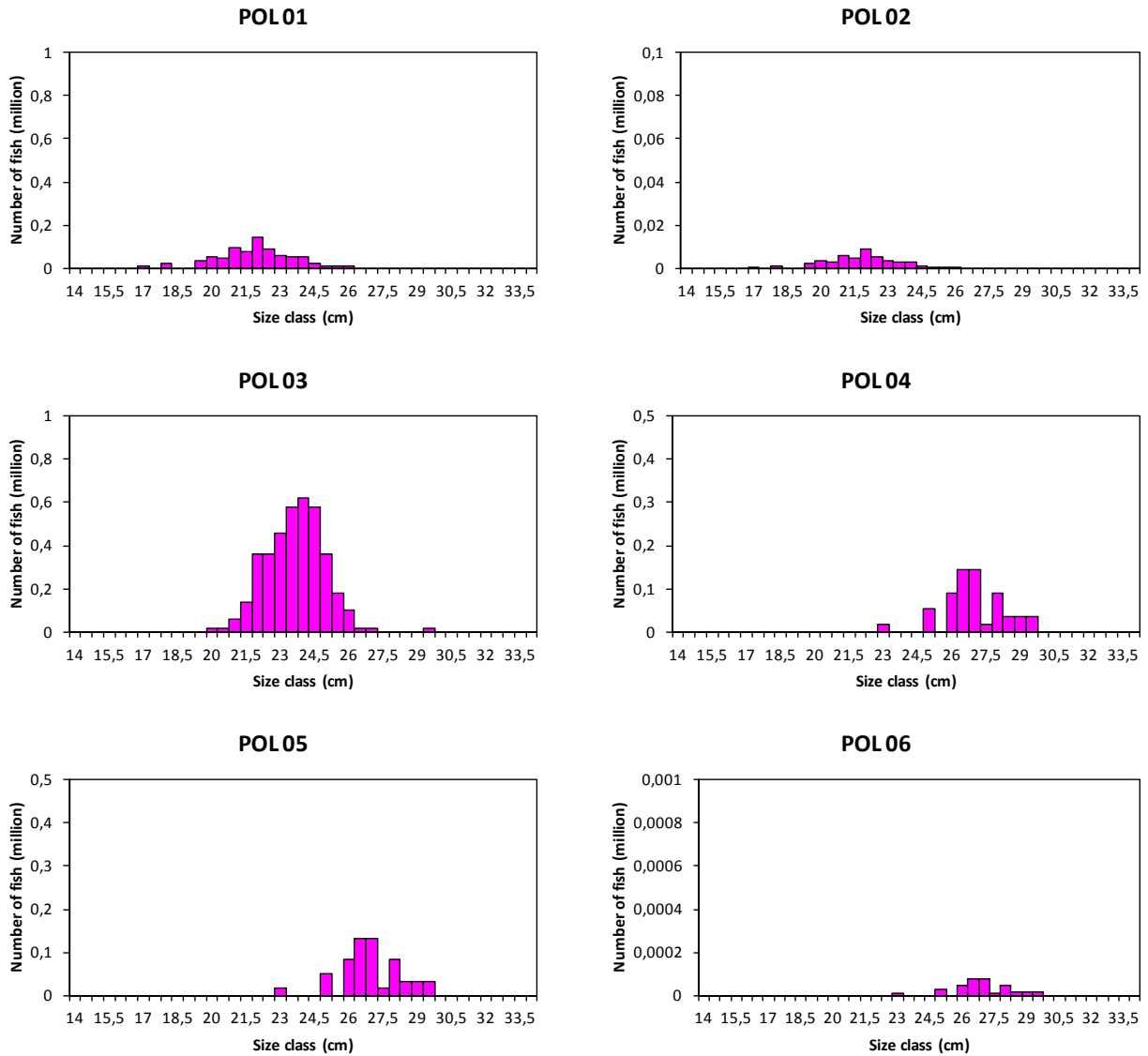


Figure 28. ECOCADIZ-RECLUTAS 2018-10 survey. Bogue (*Boops boops*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 27**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2018-10: Bogue (*B. boops*)

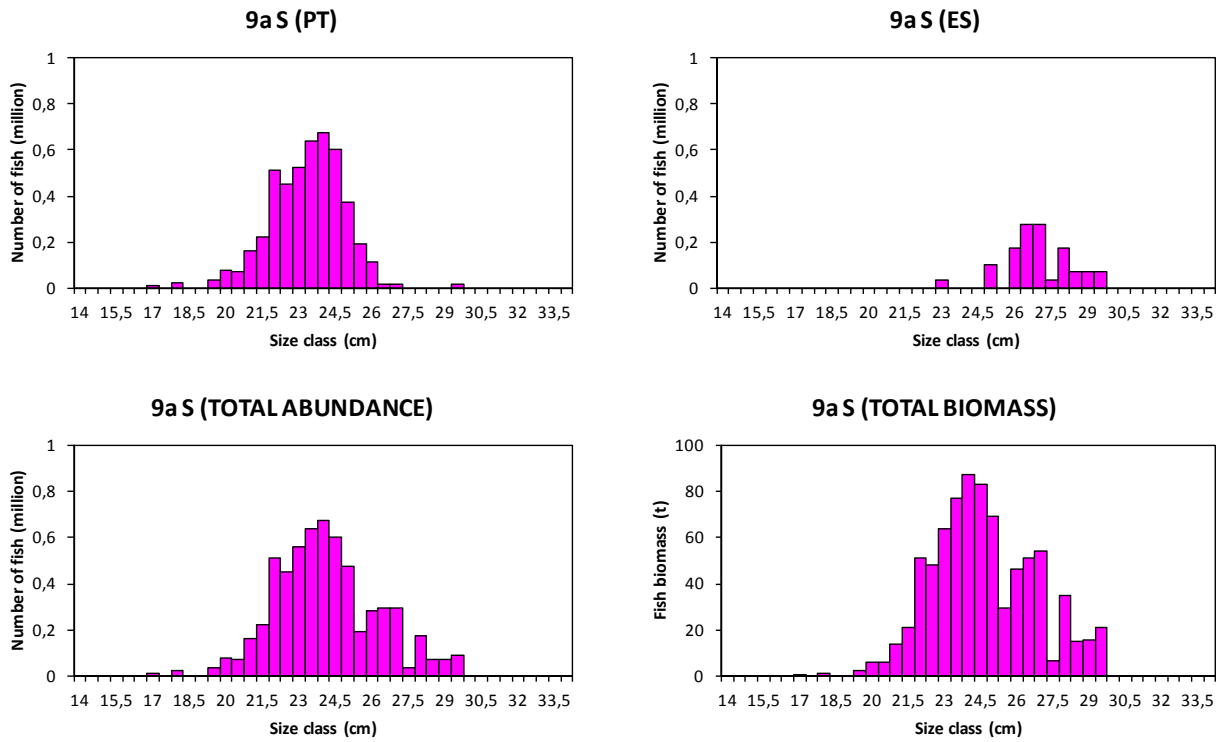


Figure 28. ECOCADIZ-RECLUTAS 2018-10 survey. Bogue (*Boops boops*). Cont'd.

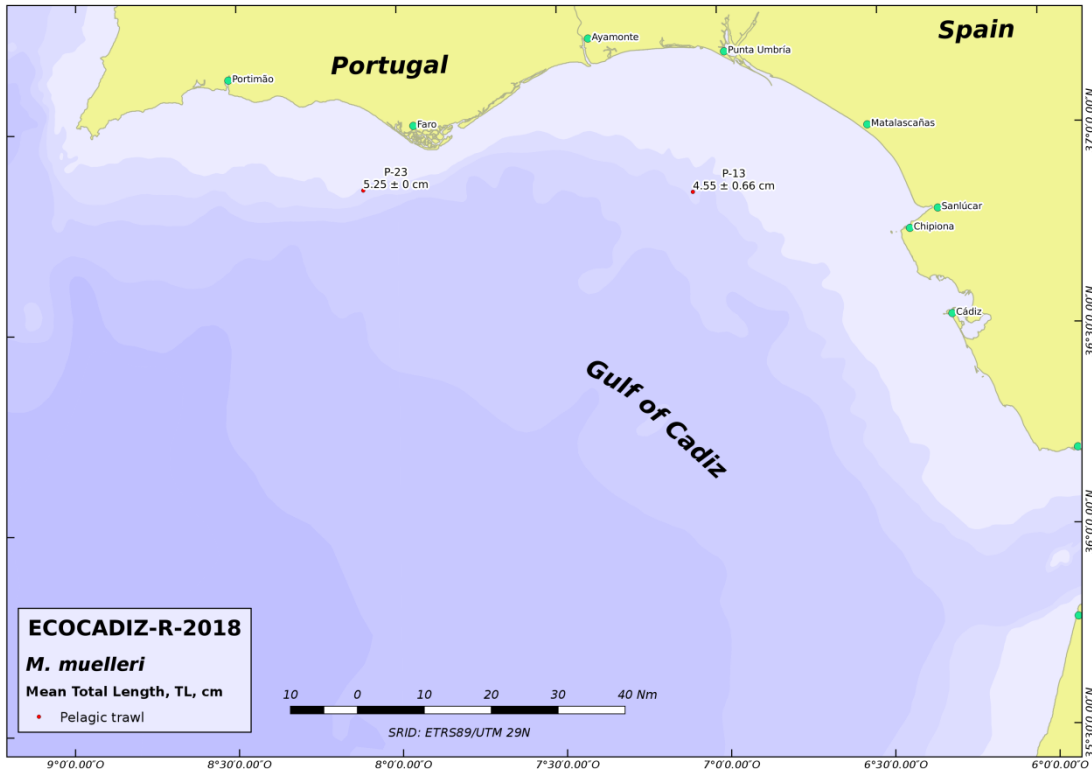
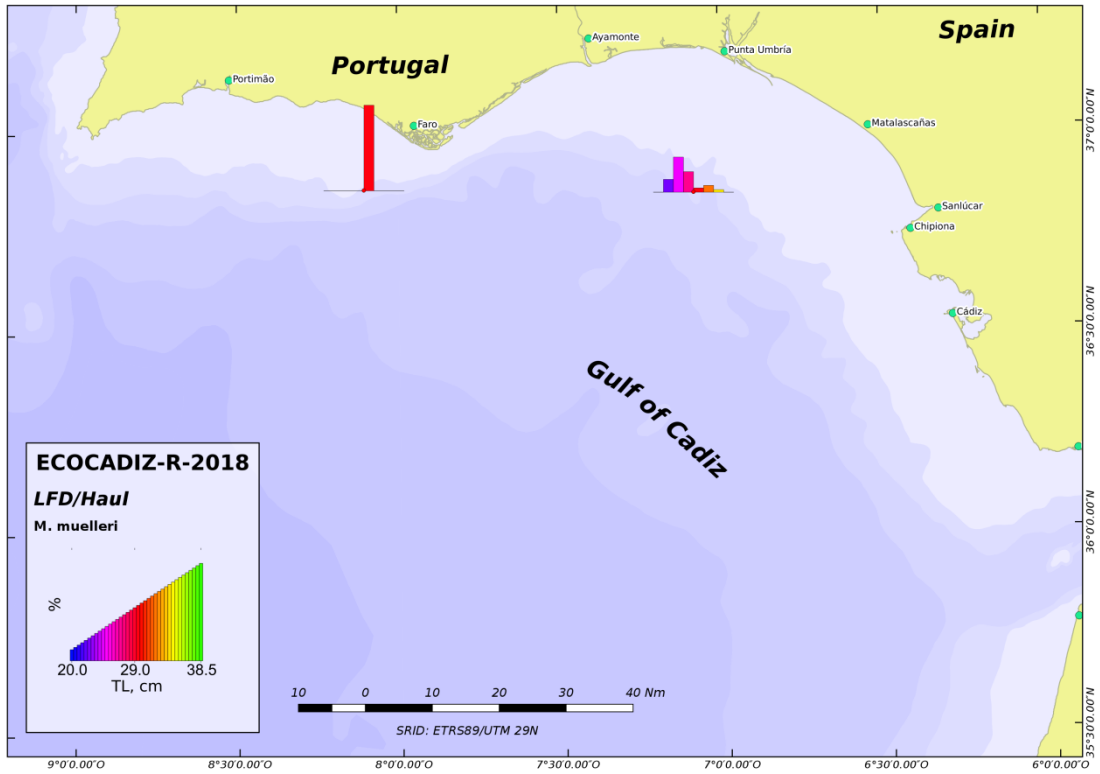


Figure 29. ECOCADIZ-RECLUTAS 2018-10 survey. Pearlside (*Maurolicus muelleri*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

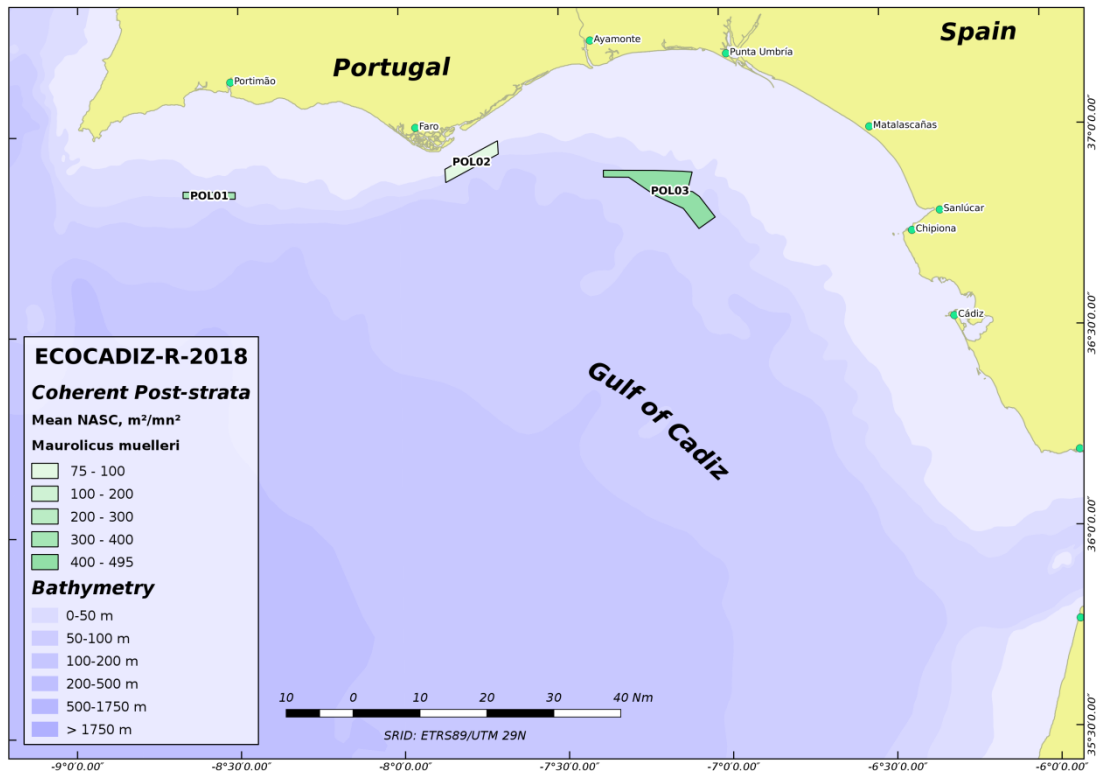
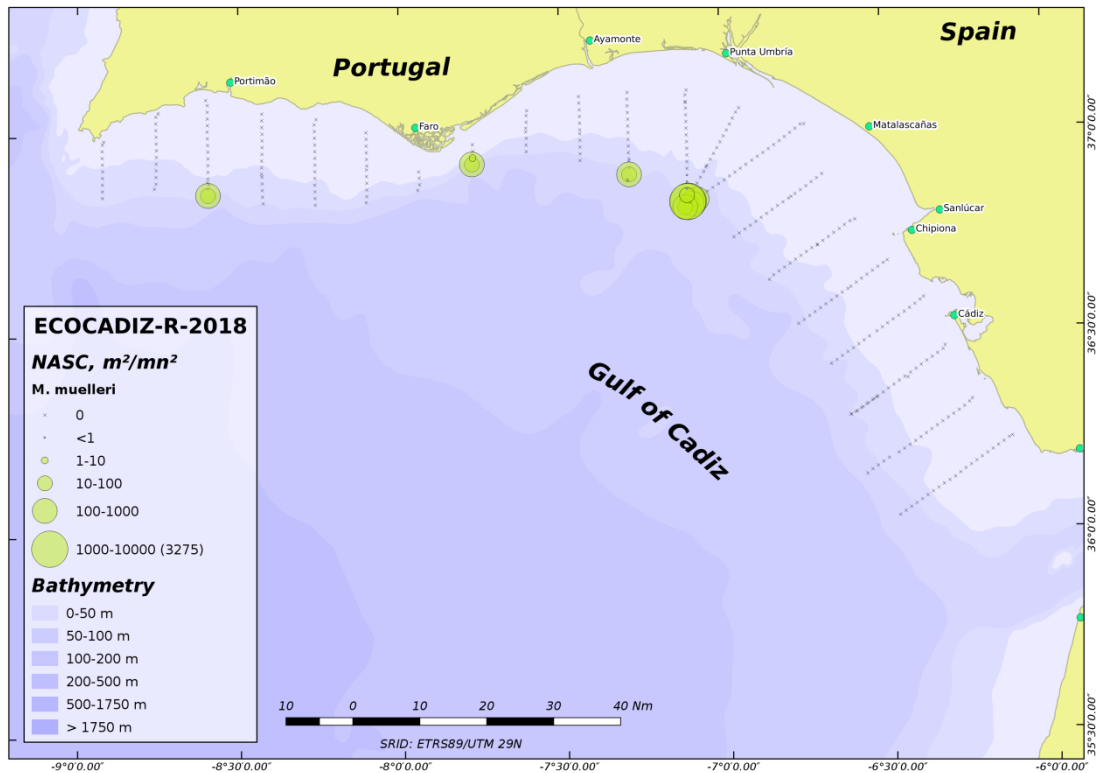


Figure 30. ECOCADIZ-RECLUTAS 2018-10 survey. Pearlside (*Mauroliscus muelleri*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2\ nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2018-10: Pearlside (*M. muelleri*)

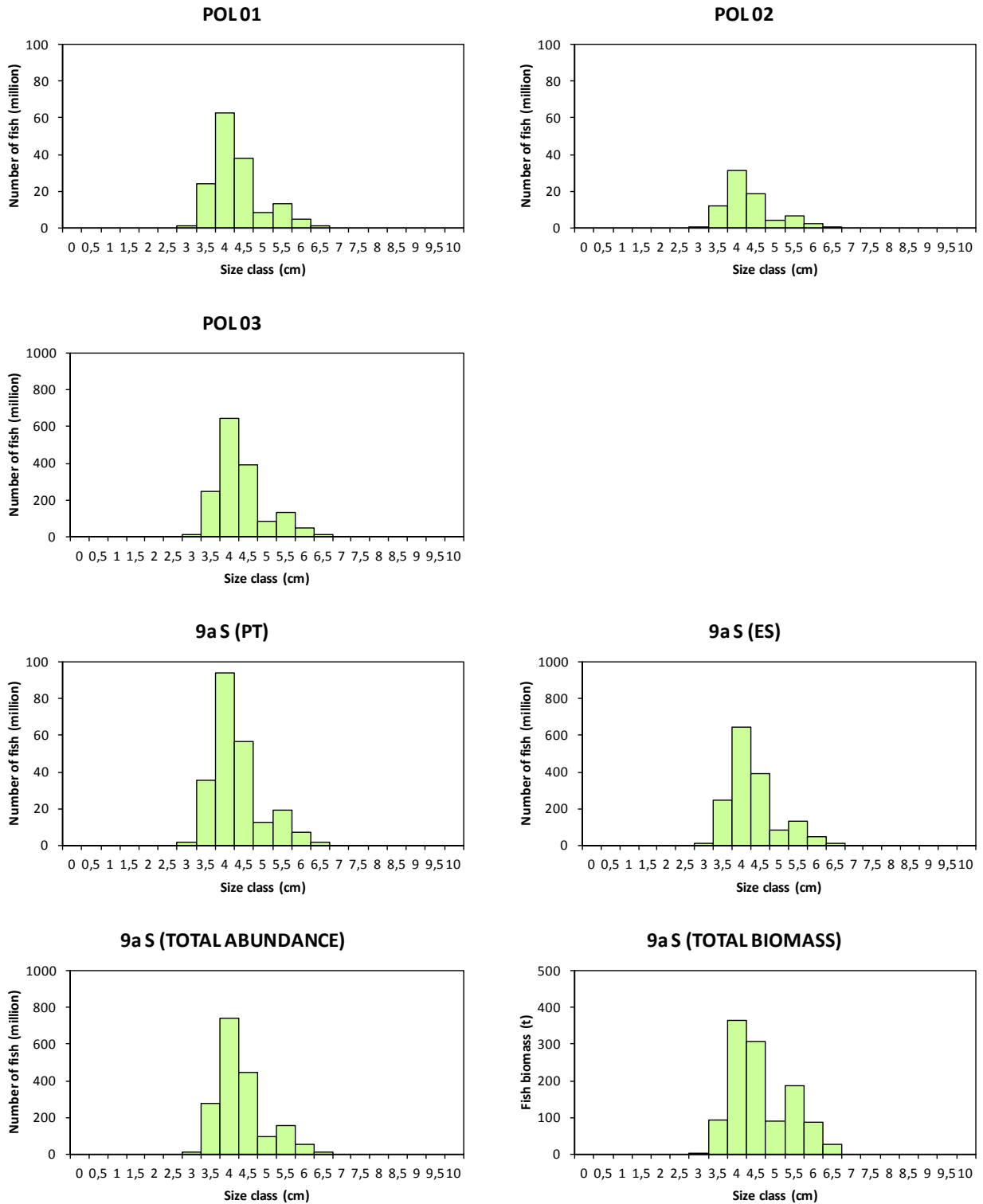


Figure 31. ECOCADIZ-RECLUTAS 2018-10 survey. Pearlside (*Maurolicus muelleri*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 30**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

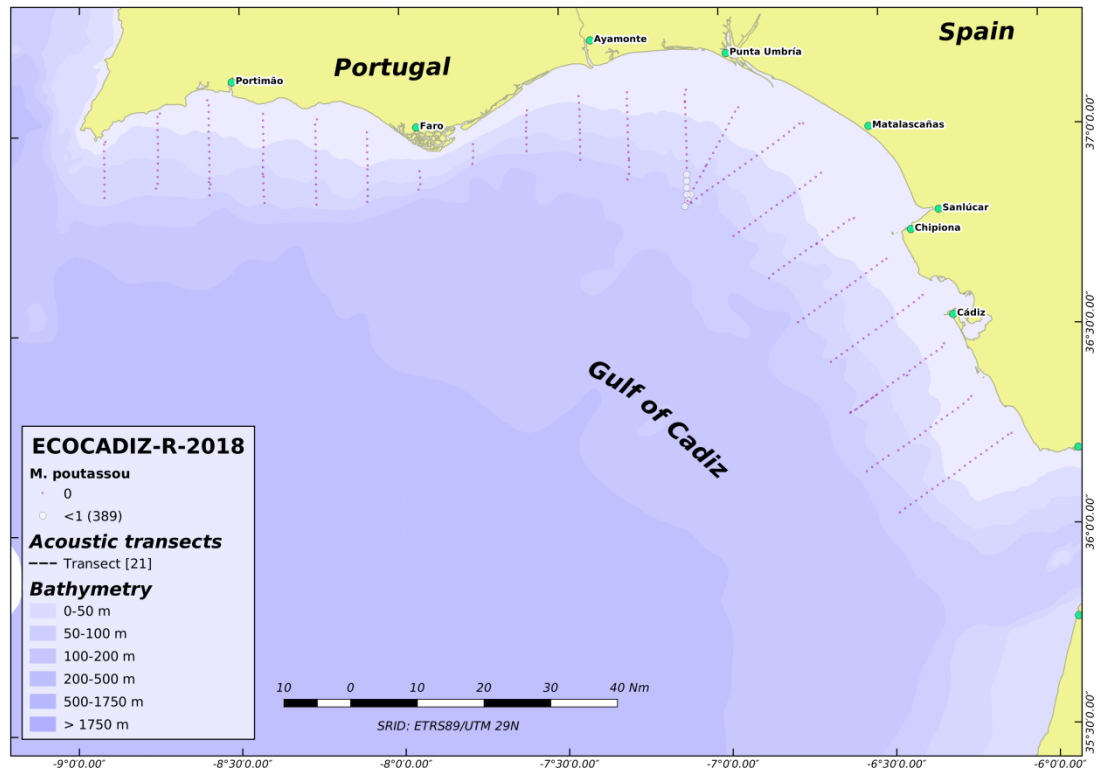
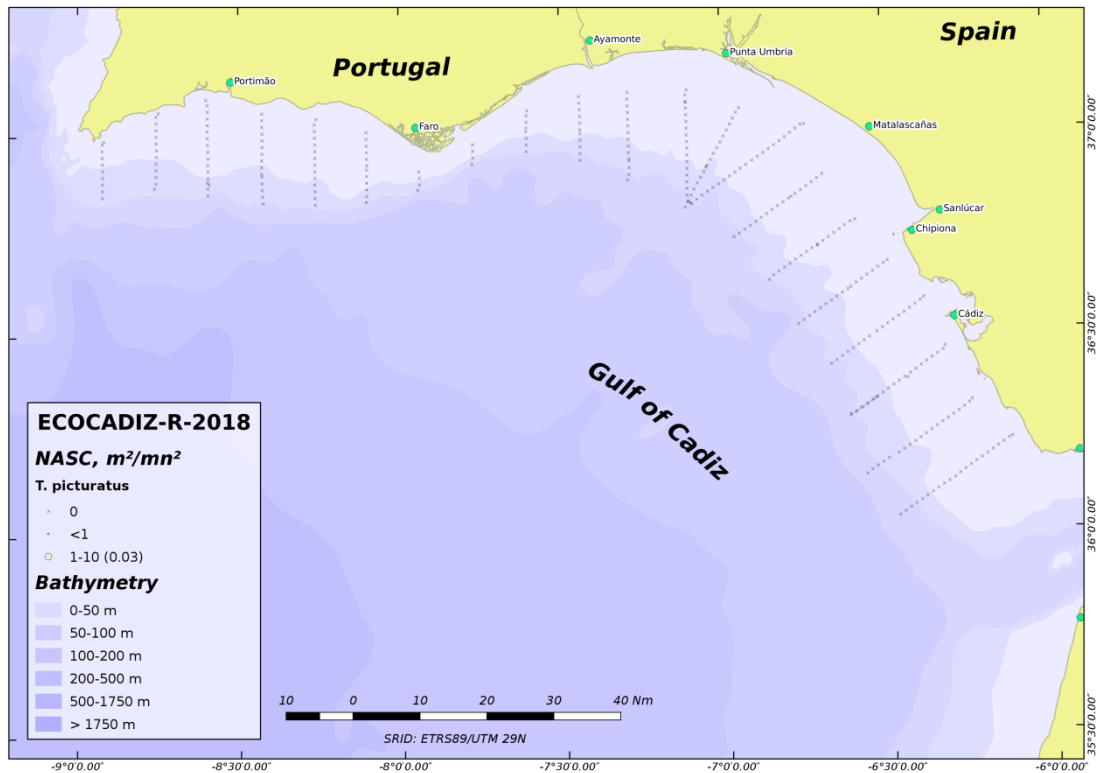


Figure 32. ECOCADIZ-RECLUTAS 2018-10 survey. Distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2\ mn^{-2}$) attributed to incidental species which have not been acoustically assessed. Top: Blue jack mackerel (*Trachurus picturatus*). Bottom: Blue whiting (*Micromesistius poutassou*).

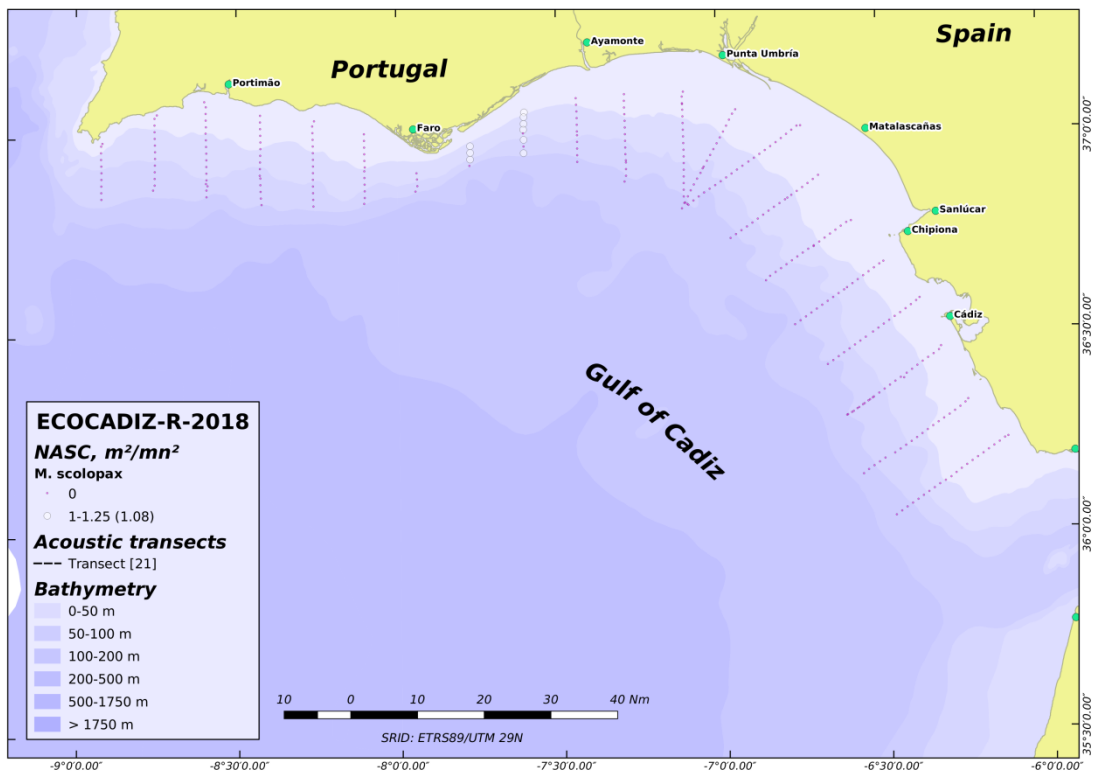
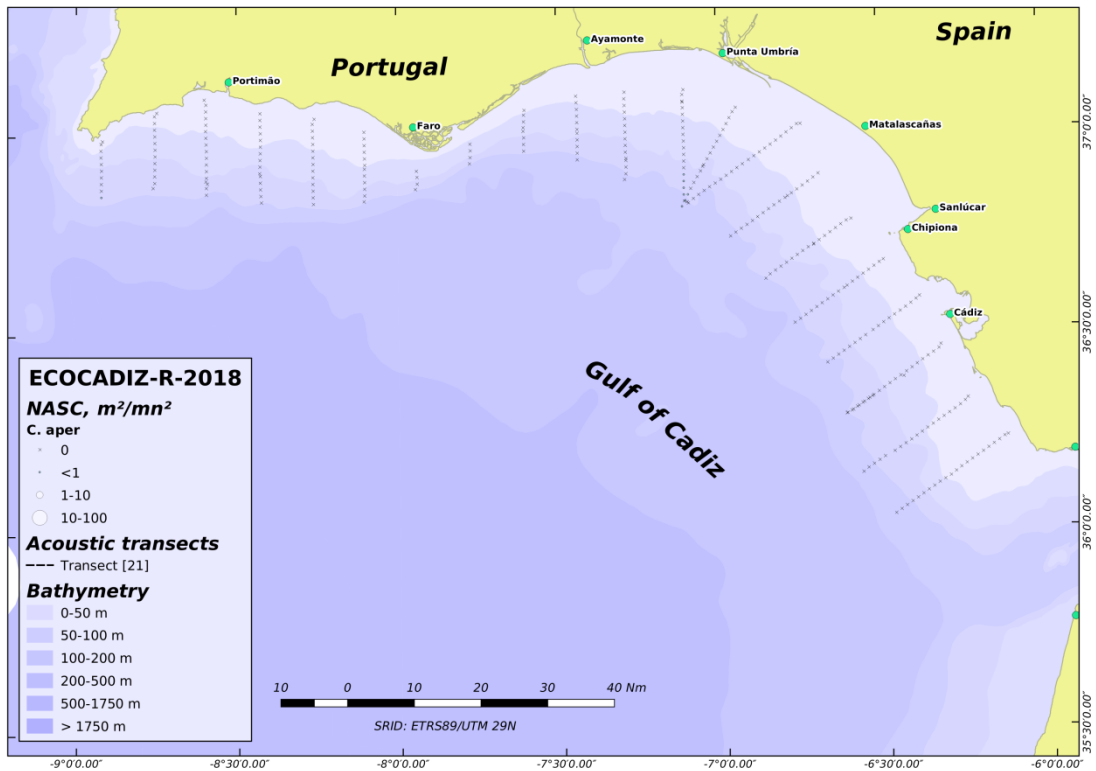


Figure 32. ECOCADIZ-RECLUTAS 2018-10 survey. Cont'd. Top: Boarfish (*Capros aper*). Bottom: Snipefish (*Macrorhamphosus scolopax*).

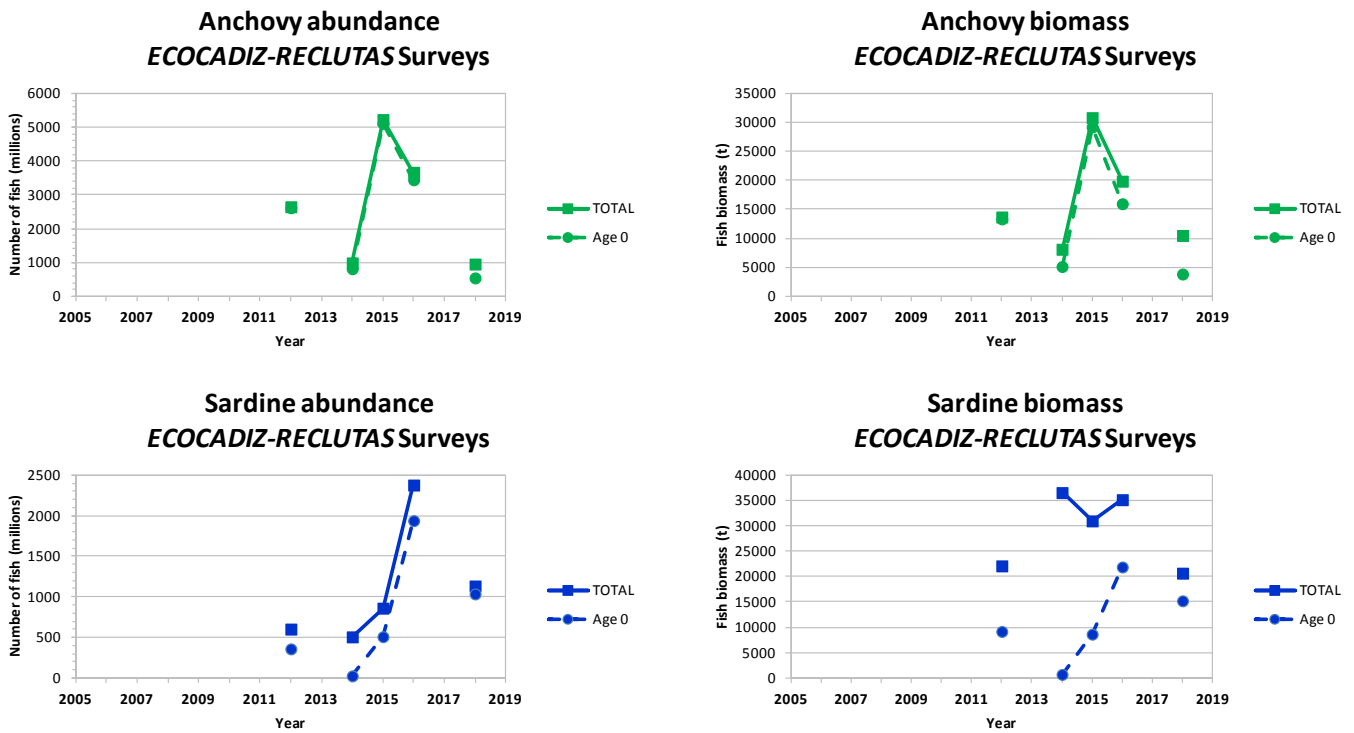


Figure 33. ECOCADIZ-RECLUTAS surveys series. Historical series of autumn acoustic estimates of anchovy and sardine abundance (million) and biomass (t) in Sub-division 9.a South. The estimates correspond to the total population and age 0 fish. The 2012 survey only surveyed the Spanish waters. No survey was conducted in 2013. Although a survey was conducted in 2017, the survey was interrupted for a serious breakdown of the vessel's propulsion system and no estimates were computed. The 2018 estimates should be considered with caution because a possible under-estimation (see text for details).

