Acoustic assessment and distribution of the main pelagic fish species in ICES Subdivision 9a South during the *ECOCADIZ 2017-07* Spanish survey (July-August 2017).

By

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ABSTRACT

The present working document summarises the main results obtained from the Spanish (pelagic ecosystem-) acoustic survey conducted by IEO between 31st July and 13rd August 2017 in the Portuguese and Spanish shelf waters (20-200 m isobaths) off the Gulf of Cadiz onboard the R/V *Miguel Oliver*. The 21 foreseen acoustic transects were sampled. A total of 22 valid fishing hauls were carried out for echo-trace ground-truthing purposes. The survey did not make use of *CUFES* sampler, as usual, since such sampling was carried out during the *BOCADEVA* DEPM survey, conducted almost at the same time. A census of top predator species was also carried out along the sampled acoustic transects. The distribution of all the mid-sized and small pelagic fish species susceptible of being acoustically assessed is also shown from the mapping of their back-scattering energies. Chub mackerel was the most frequent species in the fishing hauls, followed by anchovy, mackerel, sardine and bogue. *Trachurus* spp. showed a medium relative frequency of occurrence. Chub mackerel was also the most abundant species in these hauls, followed at quite a distance by anchovy, sardine and blue jack mackerel, with the remaining species showing negligible relative contributions. The bulk of the anchovy population was almost exclusively restricted to the central part of the surveyed area, with the smallest anchovies mainly occurring in the surroundings of the Guadalquivir river mouth and Bay of Cadiz, and larger/older anchovies occurring in the westernmost waters. The total biomass estimated for anchovy, 12.2 kt (1 504 million fish), was well below its historical average (ca, 23 kt) and such a level represents a strong and abrupt decreasing trend in relation to the most recent levels. This decreased biomass level is corroborated by its *PELAGO* spring survey counterpart (13.8 kt) and by the preliminary *BOCADEVA* DEPM survey estimate (12.4 kt). Sardine recorded weak acoustic echo-integration in summer 2017, with somewhat higher detections being recorded in the western and central zones in the Gulf. This pattern is quite similar to the one provided by *PELAGO* survey in spring. *ECOCADIZ* survey sardine estimates suggest in relative terms similar strong decreasing trends in abundance and biomass levels than the exhibited ones by its spring counterpart *PELAGO*. However, in absolute terms, *ECOCADIZ* provides a worst scenario, with a biomass estimate of only 11 kt (against the 39 kt estimated by *PELAGO* in spring). Age structured estimates of the whole population denote a not very age-structured population, which is still maintained by relatively small/young sardines.

INTRODUCTION

The *ECOCADIZ* surveys constitute a series of yearly acoustic surveys conducted by IEO in the Subdivision 9a South (Algarve and Gulf of Cadiz, between 20 – 200 m depth) under the "pelagic ecosystem survey" approach onboard R/V *Cornide de Saavedra* (until 2013, since 2014 on onboard R/V *Miguel Oliver*). This series started in 2004 with the *BOCADEVA 0604* pilot acoustic - anchovy DEPM survey. The following surveys within this new series (named *ECOCADIZ* since 2006 onwards) are planned to be routinely performed on a yearly basis, although the series, because of the available ship time, has shown some gaps in those years coinciding with the conduction of the triennial anchovy DEPM survey (the true *BOCADEVA* series, which first survey started in 2005).

Results from the *ECOCADIZ* series are routinely reported to ICES Expert Groups on both stock assessment (formerly in WGMHSA, WGANC, WGANSA, at present in WGHANSA) and acoustic and egg surveys on anchovy and sardine (WGACEGG).

The present Working Document reports the main results from the *ECOCADIZ 2017-07* survey. These results will refer to the acoustic estimates (age-structured for anchovy and sardine) and spatial distribution of the assessed species.

MATERIAL AND METHODS

The *ECOCADIZ 2017-07* survey was carried out between 31st July and 13rd August 2017 onboard the Spanish R/V *Miguel Oliver* covering a survey area comprising 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 *Simrad™ EK60* echo sounder working in the multi-frequency fashion (18, 38, 70, 120, 200 kHz). 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 *Echoview™* software package. Acoustic equipment was previously calibrated during the *MEDIAS 2017* acoustic survey, a survey conducted in the Spanish Mediterranean waters just before the *ECOCADIZ* one, following the standard procedures (Demer *et al*., 2015).

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 by the *Working Group on Acoustic and Egg Surveys for Sardine and Anchovy in ICES areas 7, 8 and 9* (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 ca. 20 m-mean vertical opening pelagic trawl (*Gran Hermano* gear) at an average speed of 4 knots. Gear performance and geometry during the effective fishing was monitored with *Simrad™ Mesotech FS20/25* trawl sonar and a *Marport^{TM} combi TE/TS* (Trawl Eye/Trawl Speed) sensor. Trawl sonar and sensors 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). Additional fishing hauls were conducted by night aimed at the collection of anchovy females with hydrated eggs (DEPM adult parameters' sampling).

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 and with additional preservation of gonads in anchovy mature females), mackerel and horse-mackerel species, and bogue. Specific DEPM adult parameters' biological sampling protocols, involving an extra sampling, were applied to all the anchovy positive samples (see Jiménez *et al*., 2017).

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 (*Sardina pilchardus*)	-72.6
Round sardinella (*Sardinella aurita*)	-72.6
Anchovy (*Engraulis encrasicolus*)	-72.6
Chub mackerel (*Scomber japonicus*)	-68.7
Mackerel (*S. scombrus*)	-84.9
Horse mackerel (*Trachurus trachurus*)	-68.7
Mediterranean horse-mackerel (*T. mediterraneus*)	-68.7
Blue jack mackerel (*T. picturatus*)	-68.7
Bogue (*Boops boops*)	-67.0
Blue whiting (*Micromesistius poutassou*)	-67.5
Boarfish (*Capros aper*)	-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 2010* software (J. Miquel, unpublished) has got implemented the needed procedures and routines for the acoustic assessment following the above approach.

The survey did not make use of *CUFES* sampler, as usual, since such sampling was carried out during the *BOCADEVA* DEPM survey, conducted almost at the same time. 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 monitor some hydrographical variables (sub-surface sea temperature, salinity, and *in vivo* fluorescence. Vertical profiles of hydrographical variables were also recorded by night from 178 CTD casts by using *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) and *LADCP T-RDI WHS* 300 kHz profilers (**Figure 2**)*. VMADCP RDI 150 kHz* records were also continuously recorded by night between CTD stations.

Twenty five (25) *Manta trawl* hauls were also carried out to characterize the distribution pattern of micro-plastics over the shelf (**Figure 3**). These hauls did not follow a pre-established sampling scheme although the main goal was to have samples well distributed both in the coastal and oceanic areas of the shelf. Consequently, the hauls were opportunistically carried out taking the advantage of the conduction of fishing hauls, the start or end of an acoustic transect or whatever discrete station devoted to the sampling of either hydrographical or biological variables which were close to the preferred depths.

Information on presence and abundance of sea birds, turtles and mammals was also recorded during the acoustic sampling by one onboard observer.

RESULTS

Acoustic sampling

The acoustic sampling started on 01st August in the coastal end of the transect RA01 and finalized on 11th August in the oceanic end of the transect RA21 (**Table 1, Figure 1**). Transects were acoustically sampled in the E-W direction. The whole 21-transect sampling grid was sampled. The acoustic sampling usually started at 06:00 UTC although this time might vary depending on the duration of the works related with the hydrographic sampling. The foreseen start of transects RA14 and RA15 by the coastal end had to be displaced into deeper waters in order to avoid the occurrence of open-sea fish farming/fattening cages.

Groundtruthing hauls

Twenty two (22) fishing operations, all of them being considered as valid ones according to a correct gear performance and resulting catches, were carried out (**Table 2**, **Figure 4**). Three (3) additional fishing hauls were conducted by night aimed at the collection of anchovy females with hydrated eggs (for DEPM adults parameters' sampling).

As usual in previous surveys, some fishing hauls were attempted by fishing over an isobath crossing the acoustic transect as close as possible to the depths where the fishing situation of interest was detected over that transect. In this way the mixing of different size compositions (*i.e.*, bi-, multi-modality of length frequency distributions) was avoided as well as a direct interaction with fixed gears. The mixing of sizes is more probable close to nursery-recruitment areas and in regions with a very narrow continental shelf. Given that all of these situations were not very uncommon in the sampled area, 36% of valid hauls (8 hauls) were conducted over isobath.

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 43-170 m.

During the survey were captured 1 Chondrichthyan, 27 Osteichthyes, 3 Cephalopod and 2 Echinoderm species. The percentage of occurrence of the more frequent species in the trawl hauls is shown in the enclosed text table below (see also **Figure 5**). The pelagic ichthyofauna was 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 was the most frequent captured species in the valid hauls (21 hauls, 95% presence index) followed by anchovy, mackerel, sardine and bogue (with relative occurrences between 59-86%). *Trachurus* spp. showed a medium relative frequency of occurrence (ca. 30-40%), whereas round sardinella showed a low occurrence in the whole surveyed area (9%).

For the purposes of the acoustic assessment, anchovy, sardine, round sardinella, mackerel species, horse & jack mackerel species, and bogue were initially considered as the survey target species. All of the invertebrates, and both bentho-pelagic (*e.g.*, manta rays) and benthic fish species (*e.g.*, flatfish, gurnards, etc.) 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 15.2 tonnes and 367 thousand fish (**Table 3**). 84% of this fished biomass corresponded to chub mackerel, 7% to anchovy, sardine and Mediterranean horse mackerel 2% each, 3% to Mediterranean horse mackerel, and contributions lower than 2% by the remaining species. The most abundant species in ground-truthing trawl hauls was also chub mackerel (66%) followed by a long distance by anchovy (27%), sardine (4%) and blue jack mackerel (2%), with the remaining species showing lower contributions than 0.5%.

Species	# of fishing stations	Occurrence (%)	Total weight (kg)	Total number
Scomber colias	21	95	12769,62	242415
Engraulis encrasicolus	19	86	1084,63	98912
Merluccius merluccius	18	82	13,537	153
Scomber scombrus	17	77	72,627	674
Sardina pilchardus	15	68	285,119	12714
Boops boops	13	59	72,191	586
Spondyliosoma cantharus	9	41	55,085	589
Trachurus trachurus	9	41	63,862	764
Pagellus erythrinus	8	36	95,934	604
Diplodus annularis	6	27	1,433	26
Trachurus picturatus	6	27	207,895	6896
Trachurus mediterraneus	6	27	288,781	1497
Diplodus vulgaris	6	27	137,684	910
Loligo media	5	23	1,322	297
Pagellus bellottii	4	18	18,72	123
Pomatomus saltatrix	3	14	5,43	16
Diplodus bellottii	3	14	3,251	56
Spicara flexuosa	3	14	8,404	162
Sardinella aurita	2	9	8,396	27

The species composition, in terms of percentages in number, in each valid fish station is shown in **Figure 5**. A first impression of the distribution pattern of the main species may be derived from the above figure. Thus, anchovy showed a relatively wide distribution over the surveyed area, although the highest yields were recorded in the Spanish waters. The size composition of anchovy catches confirms the usual pattern exhibited by the species in the area during the spawning season, with the largest fish being distributed in the westernmost waters and the smallest ones concentrated in the surroundings of the Guadalquivir river mouth and adjacent shallow waters, including those ones in front of the Bay of Cadiz (**Figure 6**). Although sardine was widely distributed, it was less frequent than anchovy and showed relatively low yields in the surveyed area. Juvenile sardines were almost exclusively captured in the shallowest hauls conducted in the coastal fringe between Tinto-Odiel river mouth and the Bay of Cadiz (**Figure 7**). Chub mackerel, horse mackerel, blue jack mackerel and bogue, although they occurred in a great part of the study area, only showed relatively high yields in the Portuguese waters. Mediterranean horse mackerel was restricted to the easternmost Spanish waters. The size composition of these last species in fishing hauls is shown in **Figures 8** to **14**.

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

A total of 322 nmi (ESDU) from 21 transects has been acoustically sampled by echo-integration for assessment purposes. From this total, 210 nmi (11 transects) were sampled in Spanish waters, and 112 nmi (10 transects) in the Portuguese waters. 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 (m^2 nmi^{-2})	Total spp.	PIL	ANE	MAC	MAS	HOM	HMM	JAA	BOG	SAA
Total Area (%)	83284 (100.0)	9369 (11.2)	19044 (22.9)	34 (0.04)	32262 (38.7)	3078 (3.7)	15086 (18.1)	149 (0.2)	4189 (5.0)	73 (0.1)
Portugal (%)	35511 (42.6)	5121 (54.7)	2782 (14.6)	5 (14.7)	24022 (74.5)	3018 (98.1)	0 (0.0)	149 (100.0)	414 (9.9)	0 (0.0)
Spain (%)	47773 (57.4)	4248 (45.3)	16262 (85.4)	30 (88.2)	8240 (25.5)	61 (2.0)	15086 (100.0)	0 (0.0)	3775 (90.1)	73 (100.0)

For this "pelagic fish assemblage" has been estimated a total of 83 284 m^2 nmi^{-2}. Portuguese waters accounted for 43% of this total back-scattering energy and the Spanish waters the remaining 57%. However, given that the Portuguese sampled ESDUs were almost the half of the Spanish ones, the (weighted-) relative importance of the Portuguese area (*i.e.*, its density of "pelagic fish") is actually much higher. The mapping of the total back-scattering energy is shown in **Figure 15**. By species, chub mackerel (39%), anchovy (23%), Mediterranean horse mackerel (18%) and sardine (11%) were the most important species in terms of their contributions to the total back-scattering energy. Bogue (5%) and horse mackerel (4%) were the following species in importance. The remaining species contributed with less than 0.5% only.

Some inferences on the species' distribution may be carried out from regional contributions to the total energy attributed to each species: Mediterranean horse mackerel, round sardinella, mackerel and anchovy seemed to show greater densities in the Spanish waters, whereas chub mackerel, blue jack mackerel and horse mackerel could be considered as typically "Portuguese species" in this survey. Regional acoustic contributions attributed to sardine were relatively balanced.

According to the resulting values of integrated acoustic energy, the species acoustically assessed in the present survey finally were anchovy, sardine, round sardinella, mackerel, chub mackerel, blue jack mackerel, horse mackerel, Mediterranean horse mackerel and bogue.

Spatial distribution and abundance/biomass estimates

Anchovy

Parameters of the survey's length-weight relationship for anchovy are given in **Table 4**. The back-scattering energy attributed to this species and the coherent strata considered for the acoustic estimation are shown in **Figure 16**. The estimated abundance and biomass by size and age class are given in **Tables 5** and **6**, and **Figures 17** and **18**.

Anchovy concentrated almost exclusively between Eastern Cape Santa Maria and Bay of Cadiz, as previously reported by the *PELAGO* survey in spring (**Figure 16**).

Ten coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing stations (**Figure 16**). The acoustic estimates by homogeneous post-stratum and total area are shown in **Tables 5** and **6** and **Figures 17** and **18**. Overall acoustic estimates in summer 2017 were of 1 504 million fish and 12 229 tonnes. By geographical strata, the Spanish waters yielded 90% (1 354 million) and 78% (9 563 t) of the total estimated abundance and biomass in the Gulf, confirming the importance of these waters in the species' distribution. The estimates for the Portuguese waters were 151 million and 2 666 t.

The size class range of the assessed population varied between the 7.5 and 18.5 cm size classes, with two modal classes at 9.5 and 11.5 cm. The size composition of anchovy by coherent post-strata confirms the

usual pattern exhibited by the species in the area during the spawning season, with the largest (and oldest) fish being distributed in the westernmost waters and the smallest (and youngest) ones concentrated in the surroundings of the Guadalquivir river mouth and adjacent shallow waters, including those ones in front of the Bay of Cadiz (**Table 5**, **Figures 17** and **18**, see also **Figure 6**). As it has been happening in the last years, during the 2017 survey some recruitment (age 0 fish) has also been recorded, probably as a consequence of the delayed survey dates. This fact seems to have been as evident this summer as in 2015, when it was recorded the historical lowest estimates in mean length and weight for the whole estimated population (106 mm, 8.0 g). This year such variables (109 mm, 8.1 g) are very close to the abovementioned ones.

The population was composed by fishes not older than 2 years. Age 0 fish accounted for 60 and 40% of the total estimated abundance and biomass, respectively. Age 1 fish represented 30% and 49% of the total abundance and biomass.

The Gulf of Cadiz anchovy egg distribution from CUFES sampling is shown in **Figure 19**. Anchovy egg distribution in summer 2017 is quite coincident with that of adults, although the high egg densities recorded west Cape Santa Maria do not correspond with the acoustic records. Nevertheless, such acoustic records correspond to the largest fish, supposedly with a higher reproductive potential.

Sardine

Parameters of the survey's size-weight relationship for sardine are shown in **Table 4**. The back-scattering energy attributed to this species and the coherent strata considered for the acoustic estimation are shown in **Figure 20**. Estimated abundance and biomass by size and age class are given in **Tables 7** and **8** and **Figures 21** and **22**.

Sardine recorded weak acoustic echo-integration in summer 2017, with somewhat higher detections being recorded in the western and central zones in the Gulf. This pattern is quite similar to the one provided by the *PELAGO* survey in spring (**Figure 20**).

Eight size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 20**). The estimates of Gulf of Cadiz sardine abundance and biomass in summer 2017 were 472 million fish and 11 053 t. Portuguese waters accounted for 49.1% of abundance (232 million fish) and 65.6% of the total estimated biomass (7 251 t), values from which could be inferred a large body size on average. In contrast, the estimates from the Spanish area (240 million fish – 50.9% of abundance –; 3 802 t – 34.4% of biomass –), denote a dominance of the smallest sardines.

Sizes of the assessed population ranged between 9.5 and 18.0 cm size classes. The length frequency distribution of the population was clearly bimodal, with one main mode at 15.5 cm size class and a secondary one at 11.5 cm (**Table 7**; **Figure 21**). The 2017 summer estimate of mean size (142 mm) is among the lowest estimates within the series. This fact might be explained by the relative importance of the juvenile fraction (age 0) in the estimated population (mode at 11.5 cm), which was mainly located in relatively shallow waters in front of the Guadiana and Guadalquivir river mouths and the Bay of Cadiz (**Tables 7** and **8**, **Figures 21** and **22,** see also **Figure 7**). However, such a decrease in mean size is not coupled with a similar decreasing trend in the mean weight (23.4 g), which was close to the historical average. The contribution in biomass of the adult fraction in the assessed population (around at a main modal size class at 15.5 cm) may be enough to compensate the greater relative contribution of juveniles.

The population was composed by fishes not older than 3 years, mainly by Age 0 (52% and 37% of the total estimated abundance and biomass, respectively) and Age 1 (44% abundance and 57% biomass).

Round sardinella

Parameters of the survey's length-weight relationship for round sardinella are shown in **Table 4**. Back-scattering energy attributed to the species is shown in **Figure 23**. Estimated abundance and biomass by size class are given in **Table 9** and **Figure 24**.

The species showed weak detections restricted to the easternmost waters in the Gulf and it was absent in Portuguese waters (**Figure 23**). Two coherent post-strata were differentiated (**Figure 23**). The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 9** and **Figure 24**. Overall acoustic estimates in summer 2017 were of 0.7 million fish and 224 tonnes. Sizes of the assessed population ranged between 31.0 and 37.0 cm size classes, with a modal size class at 34.0 cm (**Table 9**, **Figure 24**).

Mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. The distribution of the back-scattering energy attributed to this species is shown in **Figure 25**. Estimated abundance and biomass by size class are given in **Table 10** and **Figure 26**.

Atlantic mackerel mainly occurred in the western and central zones of the study area (**Figure 25**). Two coherent post-strata were differentiated (**Figure 25**). The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 10** and **Figure 26**. Overall acoustic estimates in summer 2017 were of 9 million fish and 897 tonnes, with the 85% of the total of both abundance and biomass being recorded in the Spanish waters (8 million, 759 t). Sizes of the assessed population ranged between 29.0 and 39.5 cm size classes, with a modal size class at 24.5 cm (**Table 10**, **Figure 26**).

Chub mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. The distribution of the back-scattering energy attributed to this species is shown in **Figure 27**. Estimated abundance and biomass by size class are given in **Table 11** and **Figure 28**.

Although widely distributed, it was a typically Western Algarve species in summer 2017 (**Figure 27**). A total of twelve coherent post-strata were differentiated, which denotes a relatively complicate distribution pattern of fish densities and sizes (**Figure 25**). The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 11** and **Figure 28**. Overall acoustic estimates were of 355 million fish and 21 918 t. A great part of the population was distributed over the Portuguese shelf, accounting for 84% (300 million) and 65% (14 271 t) of the total estimated abundance and biomass, respectively. The size range of the estimated population was comprised between the 15.5 and 37 cm size classes and showed two clear modal classes at 18.5, the dominant one, and 29 cm. The smallest modal component was the only one occurring in Portuguese waters (**Table 11** and **Figure 28**).

Blue jack-mackerel

The survey's length-weight relationship for this species is given in **Table 4**. The distribution of the back-scattering energy attributed to this species is illustrated in **Figure 29**. Estimated abundance and biomass by size class are given in **Table 12** and **Figure 30**.

The species showed during the survey very weak acoustic detections. It was restricted almost exclusively to the Algarve outer shelf waters (**Figure 29**). Three coherent post-strata were delimited for the acoustic assessment. The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 12** and **Figure 30**. Overall acoustic estimates in summer 2017 were of 3 million fish and 75 t. More than 98% of both the total estimated abundance and biomass was recorded in the Portuguese waters. Sizes of the assessed population ranged between 13.0 and 21.0 cm size classes, which were grouped around two modal

components, the smallest and dominant one with modal class at 14.5 cm and the secondary component with the modal class at around 20.0-21.0 cm (**Table 12**, **Figure 30**).

Horse mackerel

The survey's length-weight relationship for horse mackerel is shown in **Table 4**. The back-scattering energy attributed to this species is shown in **Figure 31**. Estimated abundance and biomass by size class are shown in **Table 13** and **Figure 32**.

Horse mackerel was a typically Algarve species in summer 2017, especially in the eastern Algarve, and it was quite scarce in the Spanish waters (**Figure 31**). Seven coherent post-strata have been delimitated for the acoustic assessment purposes. The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 13** and **Figure 32**. Overall acoustic estimates were of 42 million fish and 2 033 t. The bulk of the estimated population was located in the Portuguese shelf waters (99% of the total abundance, 42 million; 98% of the total biomass, 1 984 t). The size range of the estimated population was comprised between the 13.0 and 27.5 cm size classes and showed a relatively mixed distribution, outstanding a main modal class at 16.5 cm (**Table 13** and **Figure 32**). This modal class of juvenile fish was almost exclusive of the Portuguese waters.

Mediterranean horse-mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Back-scattering energy attributed to the species is represented in **Figure 33**. Estimated abundance and biomass by size class are shown in **Table 14** and **Figure 34**.

Mediterranean horse-mackerel was only present all over the Spanish inner-mid shelf waters, extending this year its distribution a little further west in relation to its usual distribution, reaching to the Guadiana river mouth coastal waters (**Figure 33**). Three coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing stations. The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 14** and **Figure 34**. Overall acoustic estimates in summer 2017 were of 79 million fish and 14 790 t. Sizes in the population ranged between 18.5 and 40.0 cm size classes, with two well differentiated modes, the smallest and secondary one at 22.0 cm, and the dominant one at 29.5 cm (**Table 14**, **Figure 34**).

Bogue

Parameters of the survey's length-weight relationship for bogue are shown in **Table 4**. Back-scattering energy attributed to bogue is shown in **Figure 35**. Estimated abundance and biomass by size class are shown in **Table 15** and **Figure 36**.

Although widely distributed, the species showed relatively low acoustic detections, somewhat higher in the Spanish waters (**Figure 35**). Two post-strata have been delimited for the acoustic assessment. The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 15** and **Figure 35**. Overall acoustic estimates in summer 2017 were of 22 million fish and 2 499 t. Eighty nine per cent (89%) of both the total abundance and biomass (20 million, 2 224 t) was located in the Spanish waters. The size range of the estimated population was comprised between the 19.5 and 31.0 cm size classes, with a mode at 22.5 cm (**Table 15**, **Figure 35**).

(SHORT) DISCUSSION

The historical series of anchovy biomass estimates is shown in **Figure 37**. The summer 2017 abundance estimate (1504 million)denotes a sudden and strong decreasing trend leading to the population levels well below to those ones corresponding to the historical average (ca. 2000 million fish). This decreasing trend in abundance is completely coupled to the trend exhibited by the biomass, which also showed a strong decrease in relation to the previous year estimate. The 2017 biomass estimate (12.2 kt) also situates well below its historical average (ca. 23 kt). The above decreasing trend is also corroborated by the *BOCADEVA* DEPM provisional estimate (12.4 kt; Jiménez *et al*., WD 2017).

For this same surveyed area, the Portuguese spring survey *PELAGO 17* estimated two months before 1 855 million fish and 13 797 t (137 million and 1 208 t in Portuguese waters, 1 718 million and 12 589 t in Spanish ones; see Marques *et al*., 2017, WD). Both overall and regional estimates are very close to those provided by the *ECOCADIZ* summer survey. It should be recalled that *PELAGO 16* estimated the last year 65 345 t and 9 811 million (all the anchovy in Spanish waters), its historical maximum, suggesting an even more abrupt fall that the one showed by its summer counterpart.

Regarding sardine, *ECOCADIZ* survey estimates suggest in relative terms similar strong decreasing trends in abundance and biomass levels than the exhibited ones by its spring counterpart *PELAGO*. However, in absolute terms, *ECOCADIZ* provides a worst scenario, with a biomass estimate of only 11 kt (against the 39 kt estimated by *PELAGO* in spring). Although *ECOCADIZ* age structured estimates are not still available, the length frequency distribution of the whole population denotes a not very age-structured population, which is still maintained by relatively small sardines.

ACKNOWLEDGMENTS

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Table 1. *ECOCADIZ 2017-07 s*urvey. 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	01/08/17	36º 13,100 N	6º 08,716 W	06:09	20	36º 02,154 N	6º 28,756 W	08:04	243
R02	Sancti-Petri	01/08/17	36º 08,995N	6º 34,016W	08:58	30	36º 19,390N	6º 14,469W	16:23	30
R03	Cádiz	02/08/17	36º 27,250N	6º 19,180W	06:03	28	36º 16,621N	6º 37,809W	10:59	246
R04	Rota	02/08/17	36º 24,500N	6º 40,750W	11:58	182	36º 34,46N	6º 23,128W	17:33	22
R05	Chipiona	03/08/17	36º 40,237N	6º 29,799 W	06:00	24	36º 31,150N	6º 46,250W	09:07	214
R06	Doñana	03/08/17	36º 37,927N	6º 51,406 W	10:08	182	36º 46,500N	6º 35,946 W	15:30	23
R07	Matalascañas	04/08/17	36º 53,681N	6º 40,848W	06:04	22	36º 43,933N	6º 58,323W	07:50	236
R08	Mazagón	05/08/17	37º 09,710 N	6º 44,530W	08:09	22	36º 49,449N	7º 06,172W	10:19	196
R09	Punta Umbría	05/08/17	36º 49,639N	7º 06,304 W	10:23	184	37º 03,927N	6º 56,374W	16:50	30
R10	El Rompido	06/08/17	37º 07,076N	7º 06,952W	06:02	23	36º 49,809N	7º 06,802W	07:47	224
R11	Isla Cristina	06/08/17	36º 53,546N	7º 16,804W	08:47	147	37º 07,414N	7º 16,940W	10:11	24
R12	V.R. do Sto. Antonio	07/08/17	37º 06,250N	7º 26,570W	08:04	26	36º 56,190N	7º 26,500W	09:49	249
R13	Tavira	07/08/17	36º 57,063N	7º 36,110W	10:41	144	37º 05,095N	7º 33,066W	13:27	23
R14	Fuzeta	07/08/17	36º 59,123N	7º 45,919W	16:19	76	36º 55,825N	7º 45,999W	16:39	200
R15	Cabo Sta. María	08/08/17	36º 55,255N	7º 55,955W	05:56	73	36º 52,077N	7º 55,999W	06:15	200
R16	Cuarteira	08/08/17	36º 50,165N	8º 05,968W	07:23	136	37º 00,554N	8º 05,828W	10:05	27
R17	Albufeira	09/08/17	37º 02,246N	8º 13,375W	07:57	30	36º 49,257N	8º 15,499W	11:01	219
R18	Alfanzinha	09/08/17	36º 50,414N	8º 25, 282W	11:55	134	37º 04,146N	8º 25,276W	15:11	30
R19	Portimao	10/08/17	37º 05,641N	8º 35,419W	06:11	35	36º 51,378N	8º 35,398W	09:18	209
R20	Burgau	10/08/17	36º 52,515N	8º 45,002W	10:12	105	37º 04,063N	8º 44,976W	11:22	29
R21	Punta de Sagres	11/08/17	37º 00,454N	8º 55,041N	06:03	38	36º 50,767N	8º 55,000W	07:01	156

Table 2. *ECOCADIZ 2017-07* survey. Descriptive characteristics of the fishing stations. Fishing hauls aimed at the capture of anchovy females with hydrated ovaries in light grey.

FISHING STATION	DATE	POSITION						TIMING				TRAWLED DISTANCE (nmi)	ACOUSTIC TRANSECT	ZONE/LANDMARK
		START			END			START	END	EFFECTIVE TRAWLING	TOTAL MANEOUVRE			
		LAT.	LON.	PROF.	LAT.	LON.	PROF.	UTC	UTC					
PE01	01-08-2017	36º 10.3669 N	6º 31.2384 W	119,6	36º 09.0152 N	6º 34.1601 W	195,12	11:15	11:55	00:39	1:16	2,724	R02	Sancti-Petri
PE02	01-08-2017	36º 16.3730 N	6º 19.7194 W	43,92	36º 14.5677 N	6º 23.2865 W	52,59	14:16	15:05	00:49	1:09	3,402	R02	Sancti-Petri
PE03	02-08-2017	36º 23.1710 N	6º 26.2867 W	58,18	36º 24.3241 N	6º 23.8825 W	50,75	07:09	07:41	00:32	0:58	2,257	R03	Cádiz
PE04	02-08-2017	36º 19.8503 N	6º 32.2985 W	104,68	36º 21.1833 N	6º 29.7711 W	80,89	09:08	09:45	00:36	1:00	2,437	R03	Cádiz
PE05	02-08-2017	36º 23.3908 N	6º 38.9507 W	168,27	36º 24.6127 N	6º 39.6182 W	170,81	13:29	13:50	00:20	0:48	1,334	R04	Rota
PE06	02-08-2017	36º 32.0561 N	6º 27.2176 W	42,86	36º 30.1972 N	6º 30.6510 W	58,18	15:41	16:28	00:46	1:06	3,333	R04	Rota
PE07	03-08-2017	36º 35.3611 N	6º 38.8370 W	73,53	36º 36.6198 N	6º 36.2689 W	56,03	07:09	07:45	00:35	0:58	2,42	R05	Chipiona
PE08	03-08-2017	36º 42.1664 N	6º 43.6876 W	67,64	36º 40.4116 N	6º 46.3035 W	96,21	11:10	11:50	0:40	1:02	2,738	R06	Doñana
PE09	03-08-2017	36º 40.1447 N	6º 38.8498 W	49,52	36º 42.3910 N	6º 41.2103 W	49,42	13:34	14:18	0:44	1:05	2,939	R06	Doñana
PE10	04-08-2017	36º 44.4201 N	6º 57.4351 W	143,36	36º 45.6747 N	6º 55.1296 W	113,67	08:11	08:45	00:33	1:05	2,237	R07	Matalascañas
PE11	04-08-2017	36º 48.5670 N	6º 53.3578 W	92,1	36º 47.0828 N	6º 51.5927 W	90,14	19:24	19:55	00:31	0:54	2,051	R07	Matalascañas
PE12	05-08-2017	36º 51.9792 N	7º 06.5428 W	128,78	36º 50.4769 N	7º 03.7150 W	127,2	12:00	12:42	00:41	1:07	2,721	R09	Punta Umbría
PE13	05-08-2017	36º 57.9699 N	6º 55.8524 W	50,62	36º 59.9630 N	6º 58.4898 W	46,96	15:20	16:04	00:44	1:03	2,903	R09	Punta Umbría
PE14	06-08-2017	36º 57.4392 N	7º 16.7068 W	102,39	36º 54.2563 N	7º 16.7733 W	142,89	11:35	12:23	00:48	1:14	3,179	R10	El Rompido
PE15	06-08-2017	36º 50.1417 N	7º 02.8766 W	123,23	36º 52.2860 N	7º 06.9959 W	125,74	20:09	21:09	01:00	1:28	3,939	R09	Punta Umbría
PE16	07-08-2017	37º 00.4756 N	7º 35.9474 W	96,85	36º 57.5050 N	7º 36.0468 W	150,19	11:31	12:17	00:46	1:15	2,968	R13	Tavira
PE17	07-08-2017	37º 03.1962 N	7º 35.6677 W	44,89	37º 02.2413 N	7º 38.1066 W	57,81	14:36	15:09	00:33	1:00	2,173	R13	Tavira
PE18	08-08-2017	36º 52.9192 N	8º 06.0394 W	99,14	36º 51.3055 N	8º 05.9827 W	109,84	07:58	08:20	00:22	0:50	1,612	R16	Cuarteira
PE19	08-08-2017	36º 57.3261 N	8º 03.9639 W	44,11	36º 57.4865 N	8º 05.8284 W	44,77	11:14	11:36	00:21	0:45	1,503	R16	Cuarteira
PE20	08-08-2017	37º 00.0629 N	7º 36.6649 W	97,65	36º 57.4813 N	7º 35.7400 W	149,26	19:43	20:23	00:39	1:07	2,683	R13	Tavira
PE21	09-08-2017	36º 53.0852 N	8º 15.3606 W	104,73	36º 55.1995 N	8º 15.4387 W	86,89	09:11	09:41	00:30	0:55	2,112	R17	Albufeira
PE22	09-08-2017	36º 55.1362 N	8º 25.1307 W	105,57	36º 52.6055 N	8º 25.1294 W	127,16	12:52	13:28	00:36	1:05	2,527	R18	Alfanzina
PE23	10-08-2017	36º 55.1111 N	8º 36.1719 W	97,68	36º 54.9748 N	8º 34.1472 W	95,27	07:54	08:18	00:23	0:47	1,629	R19	Portimao
PE24	10-08-2017	36º 52.8391 N	8º 42.1778 W	109,06	36º 53.5526 N	8º 45.4317 W	107,83	13:17	13:56	00:38	1:03	2,706	R20	Burgau
PE25	11-08-2017	36º 56.9753 N	7º 10.4668 W	99,82	36º 56.7254 N	7º 06.5153 W	92,33	19:08	19:54	00:45	1:09	3,177	R10	El Rompido

Table 3. *ECOCADIZ 2017-07* survey. Catches by species in number (upper panel) and weight (in kg, lower panel) from valid fishing stations.

ABUNDANCE (nº)													
Fishing station	ANE	PIL	MAS	MAC	HOM	JAA	HMM	BOG	WHB	BOC	SAA	OTHERS SPP	TOTAL
01	4	688	3894	1	0	3	1	0	0	0	0	0	**4591**
02	0	2127	212	0	0	0	479	0	0	0	26	772	**3616**
03	8	601	4	0	7	0	301	229	0	0	1	119	**1270**
04	6237	21	179	12	0	0	0	1	0	0	0	9	**6459**
05	20	932	6648	32	16	0	0	0	0	0	0	1	**7649**
06	4626	434	4	1	0	0	401	12	0	0	0	124	**5602**
07	12549	3548	0	151	0	0	0	0	0	0	0	8	**16256**
08	4618	756	44	81	0	0	0	0	0	0	0	1	**5500**
09	8582	79	1	0	0	0	175	5	0	0	0	29	**8871**
10	12995	0	23139	22	1	0	0	0	0	0	0	15	**36172**
11	13630	16	17	139	0	0	0	0	0	0	0	1	**13803**
12	3021	0	55	34	0	0	0	0	0	0	0	13	**3123**
13	1645	848	93	6	0	0	140	11	0	0	0	53	**2796**
14	9152	0	4180	61	0	0	0	0	0	0	0	8	**13401**
16	17739	0	4373	103	0	3	0	1	0	0	0	18	**22237**
17	659	753	13	1	272	0	0	13	0	0	0	325	**2036**
18	1314	0	114399	0	34	4812	0	4	0	0	0	4	**120567**
19	0	1635	1153	6	118	0	0	7	0	0	0	1173	**4092**
21	1079	0	17688	14	12	20	0	11	0	0	0	23	**18847**
22	461	273	40266	9	303	2035	0	288	0	0	0	33	**43668**
23	573	3	21052	1	0	0	0	3	0	0	0	13	**21645**
24	0	0	5001	0	1	23	0	1	0	0	0	1	**5027**
TOTAL	98912	12714	242415	674	764	6896	1497	586	0	0	27	2743	367228

Table 3. *ECOCADIZ 2017-07* survey. Cont'd.

Fishing station	ANE	PIL	MAS	MAC	HOM	JAA	HMM	BOG	WHB	BOC	SAA	OTHERS SPP	TOTAL
							BIOMASS (kg)						
01	0,108	7,620	238,750	0,105	0	0,074	0,381	0	0	0	0	0	**247,038**
02	0	49,000	50,100	0	0	0	88,350	0	0	0	8,150	107,209	**302,809**
03	0,084	8,450	0,912	0	0,505	0	51,750	26,850	0	0	0,246	19,161	**107,958**
04	71,000	0,348	9,100	1,161	0	0	0	0,073	0	0	0	5,157	**86,839**
05	0,335	31,45	351,050	2,922	1,229	0	0	0	0	0	0	0,047	**387,033**
06	33,195	5,042	0,850	0,105	0	0	83,450	2,868	0	0	0	15,275	**140,785**
07	74,250	60,850	0	15,750	0	0	0	0	0	0	0	1,101	**151,951**
08	28,200	17,100	2,634	8,500	0	0	0	0	0	0	0	0,098	**56,532**
09	36,700	0,954	0,298	0	0	0	38,200	1,160	0	0	0	6,753	**84,065**
10	137,103	0	1226,350	2,215	0,149	0	0	0	0	0	0	1,556	**1367,373**
11	105,300	0,246	1,079	13,150	0	0	0	0	0	0	0	0,086	**119,861**
12	37,600	0	2,315	3,125	0	0	0	0	0	0	0	0,742	**43,782**
13	15,800	11,250	18,100	1,633	0	0	26,650	2,325	0	0	0	4,729	**80,487**
14	114,575	0	185,850	6,730	0	0	0	0	0	0	0	0,583	**307,738**
16	302,39	0	179,200	10,984	0	0,167	0	0,130	0	0	0	2,157	**495,028**
17	10,050	24,750	0,625	0,286	11,900	0	0	1,652	0	0	0	33,934	**83,197**
18	43,399	0	6144,227	0	3,579	155,476	0	0,442	0	0	0	0,168	**6347,291**
19	0	56,950	54,400	1,479	6,850	0	0	0,624	0	0	0	156,470	**276,773**
21	34,320	0	875,250	1,456	1,156	0,539	0	1,245	0	0	0	1,644	**915,610**
22	20,271	10,997	2009,530	2,931	38,342	50,231	0	34,478	0	0	0	3,356	**2170,136**
23	19,950	0,112	1094,400	0,095	0	0	0	0,250	0	0	0	11,178	**1125,985**
24	0	0	324,600	0	0,152	1,408	0	0,094	0	0	0	0,360	**326,614**
TOTAL	**1084,630**	**285,119**	**12769,620**	**72,627**	**63,862**	**207,895**	**288,781**	**72,191**	**0**	**0**	**8,396**	**371,764**	**15224,885**

Table 4. *ECOCADIZ 2017-07* survey. Parameters of the size-weight relationships for survey's target species. FAO codes for the species: ANE: *Engraulis encrasicolus*; PIL: *Sardina pilchardus*; SAA: *Sardinella aurita*; MAS: *Scomber colias*; MAC: *Scomber scombrus*; HOM: *Trachurus trachurus*; JAA: *Trachurus picturatus;* HMM: *Trachurus mediterraneus*; BOG: *Boops boops*.

PARAMETER	ANE	PIL	SAA	MAS	MAC	HOM	JAA	HMM	BOG
Size range (mm)	76-185	97-223	312-372	159-349	221-359	136-282	136-242	203-393	182-308
n	1122	667	27	830	383	188	149	244	165
a	0,001963	0,003658	0,352569	0,002041	0,000905	0,012523	0,006008	0,030710	0,003606
b	3,447472	3,276988	1,910583	3,422904	3,606129	2,846218	3,092380	2,582981	3,285272
r^2	0,99	0,94	0,86	0,98	0,95	0,99	0,98	0,95	0,95

Table 5. *ECOCADIZ 2017-07* 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 16**.

											ECOCADIZ 2017-07. Engraulis encrasicolus. ABUNDANCE (in numbers and million fish)					
												n			Millions		
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL 10	PORTUGAL	SPAIN	TOTAL	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	0	0	0	625897	14901807	642705	0	0	0	0	16170409	16170409	0	16	16
8	0	0	0	0	3778354	42199809	3879819	0	0	0	0	49857982	49857982	0	50	50
8,5	0	0	0	0	6256906	99257466	6424930	0	828904	0	0	112768206	112768206	0	113	113
9	0	0	0	0	27229680	106730349	27960910	0	3315618	0	0	165236557	165236557	0	165	165
9,5	0	0	0	0	56165925	59563271	57674213	0	13290101	0	0	186693510	186693510	0	187	187
10	0	0	0	0	57125540	39694195	58659598	0	27381477	0	0	182860810	182860810	0	183	183
10,5	0	0	19306695	0	44083912	4967269	45267748	60541	23236955	0	0	136923120	136923120	0	137	137
11	0	0	68496797	0	20152779	4967269	20693965	424340	32382534	0	0	147117684	147117684	0	147	147
11,5	0	0	109124798	1956123	9482408	2461655	9737050	1757903	16605719	2994318	0	154119974	154119974	0	154	154
12	0	6593424	47175490	12880057	1226758	2461655	1259701	2484951	8289045	6394842	6593424	82172499	88765923	7	82	89
12,5	0	15208331	21489191	23650401	2551596	0	2620117	1939528	828904	6122103	15208331	59201840	74410171	15	59	74
13	0	34009722	10744596	20490312	2551596	0	2620117	424340	0	1769897	34009722	38600858	72610580	34	39	73
13,5	0	33434313	0	13569385	0	0	0	60541	1657809	678944	33434313	15966679	49400992	33	16	49
14	0	24362787	0	3706885	0	0	0	0	0	136369	24362787	3843254	28206041	24	4	28
14,5	29957	14239055	0	1076397	0	0	0	0	0	0	14269012	1076397	15345409	14	1	15
15	117110	10478527	0	752157	0	0	0	0	0	0	10595637	752157	11347794	11	1	11
15,5	415873	7596631	0	246396	0	0	0	0	0	0	8012504	246396	8258900	8	0,2	8
16	783953	762735	0	0	0	0	0	0	0	0	1546688	0	1546688	2	0	2
16,5	1014514	381367	0	0	0	0	0	0	0	0	1395881	0	1395881	1	0	1
17	945907	0	0	0	0	0	0	0	0	0	945907	0	945907	1	0	1
17,5	304980	0	0	0	0	0	0	0	0	0	304980	0	304980	0,3	0	0,3
18	57102	0	0	0	0	0	0	0	0	0	57102	0	57102	0,1	0	0,1
18,5	5966	0	0	0	0	0	0	0	0	0	5966	0	5966	0,01	0	0,01
TOTAL *n*	3675362	147066892	276337567	78328113	231231351	377204745	237440873	7152144	127817066	18096473	150742254	1353608332	1504350586	151	1354	1504
Millions	4	147	276	78	231	377	237	7	128	18						

Table 5. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Cont'd.

				ECOCADIZ 2017-07. *Engraulis encrasicolus*. BIOMASS (t)									
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	PT	ES	TOTAL
6	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
7	0	0	0	0	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	1,430	34,040	1,468	0	0	0	0	36,938	36,938
8	0	0	0	0	10,707	119,581	10,994	0	0	0	0	141,282	141,282
8,5	0	0	0	0	21,717	344,518	22,301	0	2,877	0	0	391,413	391,413
9	0	0	0	0	114,470	448,680	117,544	0	13,938	0	0	694,632	694,632
9,5	0	0	0	0	283,101	300,225	290,703	0	66,988	0	0	941,017	941,017
10	0	0	0	0	342,117	237,723	351,304	0	163,984	0	0	1095,128	1095,128
10,5	0	0	136,258	0	311,125	35,057	319,479	0,427	163,996	0	0	966,342	966,342
11	0	0	565,446	0	166,363	41,005	170,830	3,503	267,320	0	0	1214,467	1214,467
11,5	0	0	1046,529	18,76	90,938	23,608	93,380	16,859	159,252	28,716	0	1478,042	1478,042
12	0	73,002	522,321	142,606	13,583	27,255	13,947	27,513	91,775	70,803	73,002	909,803	982,805
12,5	0	193,285	273,110	300,577	32,429	0	33,300	24,650	10,535	77,807	193,285	752,408	945,693
13	0	493,53	155,919	297,344	37,027	0	38,022	6,158	0	25,684	493,530	560,154	1053,684
13,5	0	551,266	0	223,733	0	0	0	0,998	27,334	11,194	551,266	263,259	814,525
14	0	454,332	0	69,128	0	0	0	0	0	2,543	454,332	71,671	526,003
14,5	0,629	299,062	0	22,607	0	0	0	0	0	0	299,691	22,607	322,298
15	2,759	246,884	0	17,721	0	0	0	0	0	0	249,643	17,721	267,364
15,5	10,951	200,039	0	6,488	0	0	0	0	0	0	210,990	6,488	217,478
16	22,992	22,370	0	0	0	0	0	0	0	0	45,362	0	45,362
16,5	33,031	12,417	0	0	0	0	0	0	0	0	45,448	0	45,448
17	34,084	0	0	0	0	0	0	0	0	0	34,084	0	34,084
17,5	12,127	0	0	0	0	0	0	0	0	0	12,127	0	12,127
18	2,499	0	0	0	0	0	0	0	0	0	2,499	0	2,499
18,5	0,287	0	0	0	0	0	0	0	0	0	0,287	0	0,287
TOTAL	119,359	2546,187	2699,583	1098,964	1425,007	1611,692	1463,272	80,108	967,999	216,747	2665,546	9563,372	12228,918

Table 6. *ECOCADIZ 2017-07* 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 16** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	PT	ES	TOTAL
	N	N	N	N	N	N	Nr	N	N	N	N	N	N
0	3	8385	132058	10805	196671	359693	201952	2251	92824	4473	6412	885749	892161
I	1237	111313	143426	62643	34422	17511	35346	4831	34712	13291	138854	307718	446572
II	2436	27369	853	4881	139	0	143	70	281	332	5413	143971	149384
III	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3675	147067	276338	78328	231231	377205	237441	7152	127817	18096	150679	1337438	1488117

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	PT	ES	TOTAL
	B	B	B	B	B	B	B	B	B	B	B	B	B
0	0,1	116	1196	133	1141	1502	1172	23	650	50	103	5001	5104
I	39	1850	1492	881	282	109	289	56	314	162	2419	3495	5914
II	80	580	11	85	2	0	2	1	5	5	141	1031	1172
III	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	119	2546	2700	1099	1425	1612	1463	80	968	217	2663	9527	12190

Table 7. *ECOCADIZ 2017-07* survey. Sardine (*S. 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 20**.

									n			Millions		
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	PORTUGAL	SPAIN	TOTAL	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	691060	0	0	0	0	0	0	691060	691060	0	1	1
10	0	0	1390714	0	0	0	0	0	0	1390714	1390714	0	1	1
10,5	0	0	7861485	0	0	0	0	0	0	7861485	7861485	0	8	8
11	0	0	20728046	0	129942	0	0	0	0	20857988	20857988	0	21	21
11,5	0	0	59408342	82649	2138172	351638	0	744356	0	62725157	62725157	0	63	63
12	0	0	47183836	297681	6976176	1266521	0	2680999	0	58405213	58405213	0	58	58
12,5	0	0	15938314	377980	2966086	1608163	0	3404193	0	24294736	24294736	0	24	24
13	0	0	4794377	424361	854137	1805494	0	3821909	0	11700278	11700278	0	12	12
13,5	2477108	0	1525099	256528	699220	1091430	0	2310363	2477108	5882640	8359748	2	6	8
14	1696393	0	1712991	458764	531393	1951865	0	4131751	1696393	8786764	10483157	2	9	10
14,5	5962764	0	699653	594044	266790	2527431	0	5350121	5962764	9438039	15400803	6	9	15
15	59962127	5313	966832	830081	743513	3531681	0	7475938	59967440	13548045	73515485	60	14	74
15,5	81663765	45455	0	384723	159637	1636851	1423874	3464922	81709220	7070007	88779227	82	7	89
16	59816592	68477	880545	144697	52483	615631	2092334	1303180	59885069	5088870	64973939	60	5	65
16,5	9149612	36600	0	28582	0	121604	1086927	257414	9186212	1494527	10680739	9	1	11
17	8018369	5313	0	32257	0	137242	336947	290518	8023682	796964	8820646	8	1	9
17,5	3196475	0	0	8295	0	35291	81519	74705	3196475	199810	3396285	3	0,2	3
18	0	0	0	0	0	0	43477	0	0	43477	43477	0	0,04	0,04
18,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	231943205	161158	163781294	3920642	15517549	16680842	5065078	35310369	232104363	240275774	472380137	232	240	472
Millions	232	0,2	164	4	16	17	5	35						

Table 7. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Cont'd

Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	PT	ES	TOTAL
6	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
9,5	0	0	4,403	0	0	0	0	0	0	4,403	4,403
10	0	0	10,438	0	0	0	0	0	0	10,438	10,438
10,5	0	0	68,971	0	0	0	0	0	0	68,971	68,971
11	0	0	211,069	0	1,323	0	0	0	0	212,392	212,392
11,5	0	0	697,589	0,970	25,107	4,129	0	8,740	0	736,535	736,535
12	0	0	635,116	4,007	93,903	17,048	0	36,087	0	786,161	786,161
12,5	0	0	244,589	5,800	45,518	24,679	0	52,241	0	372,827	372,827
13	0	0	83,459	7,387	14,868	31,429	0	66,53	0	203,673	203,673
13,5	48,686	0	29,975	5,042	13,743	21,451	0	45,408	48,686	115,619	164,305
14	37,481	0	37,848	10,136	11,741	43,126	0	91,290	37,481	194,141	231,622
14,5	147,508	0	17,308	14,696	6,600	62,524	0	132,353	147,508	233,481	380,989
15	1654,586	0,147	26,679	22,905	20,516	97,453	0	206,290	1654,733	373,843	2028,576
15,5	2504,694	1,394	0	11,800	4,896	50,204	43,671	106,272	2506,088	216,843	2722,931
16	2032,473	2,327	29,920	4,917	1,783	20,918	71,094	44,280	2034,800	172,912	2207,712
16,5	343,349	1,373	0	1,073	0	4,563	40,788	9,660	344,722	56,084	400,806
17	331,345	0,220	0	1,333	0	5,671	13,924	12,005	331,565	32,933	364,498
17,5	145,054	0	0	0,376	0	1,601	3,699	3,390	145,054	9,066	154,120
18	0	0	0	0	0	0	2,161	0	0	2,161	2,161
18,5	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7245,176	5,461	2097,364	90,442	239,998	384,796	175,337	814,546	7250,637	3802,483	11053,120

Table 8. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Estimated abundance (thousands of individuals) and biomass (tonnes) by age group. Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 20** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	PT	ES	TOTAL
	N	N	N	N	N	N	Nr	N	N	N	N
0	46873	22	156708	1962	13499	8349	641	17674	46895	198142	245037
I	167682	120	6776	1826	1934	7767	3750	16442	167801	38495	206296
II	16632	19	298	129	82	549	662	1163	16651	2882	19534
III	756	0,4	0	4	1	15	13	32	757	65	822
IV	0	0	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	0	0	0
VI	0	0	0	0	0	0	0	0	0	0	0
VII	0	0	0	0	0	0	0	0	0	0	0
VIII	0	0	0	0	0	0	0	0	0	0	0
IX	0	0	0	0	0	0	0	0	0	0	0
X	0	0	0	0	0	0	0	0	0	0	0
TOTAL	231943	161	163781	3921	15518	16681	5065	35310	232104	239585	471689

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	PT	ES	TOTAL
	B	B	B	B	B	B	B	B	B	B	B
0	1381	1	1954	38	195	163	21	344	1382	2711	4093
I	5265	4	135	48	43	206	130	436	5269	999	6268
II	576	1	8	4	2	16	24	33	576	86	663
III	23	0,01	0	0,1	0,05	0,5	0,4	1	23	2	25
IV	0	0	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	0	0	0
VI	0	0	0	0	0	0	0	0	0	0	0
VII	0	0	0	0	0	0	0	0	0	0	0
VIII	0	0	0	0	0	0	0	0	0	0	0
IX	0	0	0	0	0	0	0	0	0	0	0
X	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7245	5	2097	90	240	385	175	815	7251	3798	11049

Table 9. *ECOCADIZ 2017-07* survey. Round sardinella (*S. aurita*). 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 23**.

ECOCADIZ 2017-07 . Sardinella aurita . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	n			Millions		
			PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
25	0	0	0	0	0	0	0	0
25,5	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
26,5	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
27,5	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
28,5	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0
31	10276	17918	0	28194	28194	0	0,03	0,03
31,5	0	0	0	0	0	0	0	0
32	10276	17918	0	28194	28194	0	0,03	0,03
32,5	0	0	0	0	0	0	0	0
33	10276	17918	0	28194	28194	0	0,03	0,03
33,5	41102	71670	0	112772	112772	0	0,1	0,1
34	71929	125423	0	197352	197352	0	0,2	0,2
34,5	51378	89588	0	140966	140966	0	0,1	0,1
35	30827	53753	0	84580	84580	0	0,1	0,1
35,5	20551	35835	0	56386	56386	0	0,1	0,1
36	10276	17918	0	28194	28194	0	0,03	0,03
36,5	0	0	0	0	0	0	0	0
37	10276	17918	0	28194	28194	0	0,03	0,03
37,5	0	0	0	0	0	0	0	0
TOTAL *n*	267167	465859	0	733026	733026	0	1	1
Millions	0,3	0,5						

Table 9. *ECOCADIZ 2017-07* survey. Round sardinella (*S. aurita*). Cont'd.

ECOCADIZ 2017-07 . Sardinella aurita . BIOMASS (t)					
Size class	POL01	POL02	n		
			PORTUGAL	SPAIN	TOTAL
25	0	0	0	0	0
25,5	0	0	0	0	0
26	0	0	0	0	0
26,5	0	0	0	0	0
27	0	0	0	0	0
27,5	0	0	0	0	0
28	0	0	0	0	0
28,5	0	0	0	0	0
29	0	0	0	0	0
29,5	0	0	0	0	0
30	0	0	0	0	0
30,5	0	0	0	0	0
31	2,601	4,535	0	7,136	7,136
31,5	0	0	0	0	0
32	2,762	4,816	0	7,578	7,578
32,5	0	0	0	0	0
33	2,928	5,106	0	8,034	8,034
33,5	12,05	21,012	0	33,062	33,062
34	21,689	37,82	0	59,509	59,509
34,5	15,927	27,773	0	43,700	43,700
35	9,821	17,125	0	26,946	26,946
35,5	6,726	11,728	0	18,454	18,454
36	3,453	6,022	0	9,475	9,475
36,5	0	0	0	0	0
37	3,638	6,343	0	9,981	9,981
37,5	0	0	0	0	0
TOTAL	81,595	142,28	0	223,875	223,875

Table 10. *ECOCADIZ 2017-07* survey. Mackerel (*S. 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 25**.

ECOCADIZ 2017-07. *Scomber scombrus*. ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	*n*			Millions		
			PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
18	0	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0	0
20	3766	20675	3766	20675	24441	0,004	0,02	0,02
20,5	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
21,5	0	0	0	0	0	0	0	0
22	14358	78822	14358	78822	93180	0,01	0,1	0,1
22,5	28294	155326	28294	155326	183620	0,03	0,2	0,2
23	43039	236273	43039	236273	279312	0,04	0,2	0,3
23,5	136307	748289	136307	748289	884596	0,1	0,7	0,9
24	253188	1389931	253188	1389931	1643119	0,3	1,4	1,6
24,5	317502	1742995	317502	1742995	2060497	0,3	1,7	2,1
25	262365	1440312	262365	1440312	1702677	0,3	1,4	1,7
25,5	134171	736561	134171	736561	870732	0,1	0,7	0,9
26	67922	372875	67922	372875	440797	0,1	0,4	0,4
26,5	47131	258736	47131	258736	305867	0,05	0,3	0,3
27	26366	144743	26366	144743	171109	0,03	0,1	0,2
27,5	17059	93652	17059	93652	110711	0,02	0,1	0,1
28	5287	29027	5287	29027	34314	0,01	0,03	0,03
28,5	10354	56841	10354	56841	67195	0,01	0,1	0,1
29	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
30,5	5287	29027	5287	29027	34314	0,01	0,03	0,03
31	0	0	0	0	0	0	0	0
31,5	2230	12244	2230	12244	14474	0,002	0,01	0,01
32	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0
33	2230	12244	2230	12244	14474	0,002	0,01	0,01
33,5	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
34,5	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0	0
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	1521	8352	1521	8352	9873	0,002	0,01	0,01
40	0	0	0	0	0	0	0	0
40,5	0	0	0	0	0	0	0	0
TOTAL *n*	1378377	7566925	1378377	7566925	8945302	1	8	9
Millions	1	8						

Table 10. *ECOCADIZ 2017-07* survey. Mackerel (*S. scombrus*). Cont'd.

Size class	POL01	POL02	*n* PORTUGAL	*n* SPAIN	*n* TOTAL
18	0	0	0	0	0
18,5	0	0	0	0	0
19	0	0	0	0	0
19,5	0	0	0	0	0
20	0,175	0,962	0,175	0,962	1,137
20,5	0	0	0	0	0
21	0	0	0	0	0
21,5	0	0	0	0	0
22	0,938	5,149	0,938	5,149	6,087
22,5	2,003	10,994	2,003	10,994	12,997
23	3,295	18,087	3,295	18,087	21,382
23,5	11,266	61,850	11,266	61,850	73,116
24	22,560	123,849	22,560	123,849	146,409
24,5	30,451	167,170	30,451	167,170	197,621
25	27,045	148,471	27,045	148,471	175,516
25,5	14,844	81,490	14,844	81,490	96,334
26	8,054	44,216	8,054	44,216	52,270
26,5	5,982	32,841	5,982	32,841	38,823
27	3,578	19,641	3,578	19,641	23,219
27,5	2,472	13,569	2,472	13,569	16,041
28	0,817	4,486	0,817	4,486	5,303
28,5	1,704	9,357	1,704	9,357	11,061
29	0	0	0	0	0
29,5	0	0	0	0	0
30	0	0	0	0	0
30,5	1,109	6,090	1,109	6,090	7,199
31	0	0	0	0	0
31,5	0,525	2,883	0,525	2,883	3,408
32	0	0	0	0	0
32,5	0	0	0	0	0
33	0,620	3,405	0,620	3,405	4,025
33,5	0	0	0	0	0
34	0	0	0	0	0
34,5	0	0	0	0	0
35	0	0	0	0	0
35,5	0	0	0	0	0
36	0	0	0	0	0
36,5	0	0	0	0	0
37	0	0	0	0	0
37,5	0	0	0	0	0
38	0	0	0	0	0
38,5	0	0	0	0	0
39	0	0	0	0	0
39,5	0,805	4,422	0,805	4,422	5,227
40	0	0	0	0	0
40,5	0	0	0	0	0
TOTAL	138,243	758,932	138,243	758,932	897,175

ECOCADIZ 2017-07 . Scomber scombrus . BIOMASS (t)

Table 11. *ECOCADIZ 2017-07* survey. Chub mackerel (*S. 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 27**.

Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL 10	POL11	POL12	n PORTUGAL	n SPAIN	n TOTAL	Millions PORTUGAL	Millions SPAIN	Millions TOTAL
14	0	0	0	0	0	0	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	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15,5	0	224684	0	0	0	0	0	0	0	0	0	0	224684	0	224684	0,2	0	0,2
16	0	1065452	0	0	0	0	0	0	0	0	0	0	1065452	0	1065452	1	0	1
16,5	857540	1157202	580034	0	89135	0	0	25075	18390	0	0	0	2594776	132600	2727376	3	0	3
17	3344406	5861302	3906167	0	117366	0	0	107904	79140	0	0	0	13111875	304410	13416285	13	0	13
17,5	11834051	15235490	7377308	0	477408	0	0	239527	175676	0	122488	0	34446849	1015099	35461948	34	1	35
18	21095482	28494739	2891107	0	1124179	0	0	978310	717521	0	427633	0	52481328	3247643	55728971	52	3	56
18,5	38846559	36614458	3326133	0	1255413	5377	9099	1536049	1126583	0	792947	0	78787150	4725468	83512618	79	5	84
19	15178457	38863482	870051	0	613109	37638	63695	1571685	1152719	0	672608	0	54911990	4111454	59023444	55	4	59
19,5	3344406	27760665	725043	0	346173	59146	100092	1000849	734052	94528	792947	33025	31830114	3160812	34990926	32	3	35
20	1715080	15200882	0	0	89135	75276	127390	588829	431865	94528	1343067	33025	16915962	2783115	19699077	17	3	20
20,5	1715080	7279485	0	0	27736	32261	54596	292481	214514	94528	1343067	33025	8994565	2092208	11086773	9	2	11
21	857540	2305193	145009	0	0	10754	18199	197114	144569	236320	1770700	82562	3307742	2460218	5767960	3	2	6
21,5	0	198969	0	0	0	5377	9099	94910	69610	0	672608	0	198969	851604	1050573	0,2	1	1
22	0	443146	0	0	0	0	0	111314	81641	0	182657	0	443146	375612	818758	0,4	0,4	1
22,5	0	233258	0	0	0	5377	9099	57657	42287	94528	244976	33025	233258	486949	720207	0,2	0,5	1
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23,5	0	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	38069	27921	0	0	0	0	65990	65990	0	0,1	0,1
24,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	5377	9099	0	0	0	0	0	0	14476	14476	0	0,01	0,01
25,5	0	0	0	174262	0	0	0	12690	9307	141792	0	49537	0	387588	387588	0	0,4	0,4
26	0	0	0	1394100	0	0	0	0	0	94528	0	33025	0	1521653	1521653	0	2	2
26,5	0	0	0	522787	0	0	0	0	0	94528	0	33025	0	650340	650340	0	1	1
27	0	0	0	2265412	0	0	0	0	0	236320	0	82562	0	2584294	2584294	0	3	3
27,5	0	0	0	2439674	0	0	0	0	0	94528	0	33025	0	2567227	2567227	0	3	3
28	0	0	0	2962462	0	0	0	0	0	141792	0	49537	0	3153791	3153791	0	3	3
28,5	0	0	0	2091149	0	0	0	0	0	898018	0	313737	0	3302904	3302904	0	3	3
29	0	0	0	2265412	0	0	0	0	0	1512451	0	528400	0	4306263	4306263	0	4	4
29,5	0	0	0	871312	0	0	0	0	0	2174149	0	759575	0	3805036	3805036	0	4	4
30	0	0	0	871312	0	0	0	0	0	1134338	0	396300	0	2401950	2401950	0	2	2
30,5	0	0	0	174262	0	0	0	0	0	756226	0	264200	0	1194688	1194688	0	1	1
31	0	0	0	0	0	0	0	0	0	898018	0	313737	0	1211755	1211755	0	1	1
31,5	0	0	0	0	0	0	0	0	0	378113	0	132100	0	510213	510213	0	1	1
32	0	0	0	0	0	0	0	0	0	378113	0	132100	0	510213	510213	0	1	1
32,5	0	0	0	0	0	0	0	0	0	141792	0	49537	0	191329	191329	0	0,2	0,2
33	0	0	0	174262	0	0	0	0	0	0	0	0	0	174262	174262	0	0,2	0,2
33,5	0	0	0	0	0	0	0	0	0	236320	0	82562	0	318882	318882	0	0,3	0,3
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34,5	0	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	94528	0	33025	0	127553	127553	0	0,1	0,1
35,5	0	0	0	0	0	0	0	0	0	141792	0	49537	0	191329	191329	0	0,2	0,2
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	94528	0	33025	0	127553	127553	0	0,1	0,1
37,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	98788601	180938407	19820852	16206406	4139654	236583	400368	6852463	5025795	10256306	8365698	3583208	299547860	55066481	354614341	300	55	355
Millions	99	181	20	16	4	0,2	0,4	7	5	10	8	4						

Table 11. *ECOCADIZ 2017-07* survey. Chub mackerel (*S. colias*). Cont'd.

Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL 10	POL11	POL12	PORTUGAL	SPAIN	TOTAL
							ECOCADIZ 2017-07 . Scomber colias . BIOMASS (t)								
14	0	0	0	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	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15,5	0	5,749	0	0	0	0	0	0	0	0	0	0	5,749	0	5,749
16	0	30,339	0	0	0	0	0	0	0	0	0	0	30,339	0	30,339
16,5	27,088	36,553	18,322	0	2,816	0	0	0,792	0,581	0	0	0	81,963	4,189	86,152
17	116,831	204,755	136,456	0	4,100	0	0	3,769	2,765	0	0	0	458,042	10,634	468,676
17,5	455,879	586,911	284,193	0	18,391	0	0	9,227	6,768	0	4,719	0	1326,983	39,105	1366,088
18	893,720	1207,193	122,483	0	47,626	0	0	41,447	30,398	0	18,117	0	2223,396	137,588	2360,984
18,5	1805,277	1701,547	154,572	0	58,342	0,250	0,423	71,383	52,355	0	36,850	0	3661,396	219,603	3880,999
19	771,864	1976,309	44,244	0	31,178	1,914	3,239	79,924	58,619	0	34,204	0	2792,417	209,078	3001,495
19,5	185,674	1541,21	40,253	0	19,219	3,284	5,557	55,565	40,753	5,248	44,023	1,833	1767,137	175,482	1942,619
20	103,725	919,319	0	0	5,391	4,553	7,704	35,611	26,118	5,717	81,226	1,997	1023,044	168,317	1191,361
20,5	112,756	478,583	0	0	1,823	2,121	3,589	19,229	14,103	6,215	88,299	2,171	591,339	137,550	728,889
21	61,166	164,422	10,343	0	0	0,767	1,298	14,059	10,312	16,856	126,298	5,889	235,931	175,479	411,410
21,5	0	15,368	0	0	0	0,415	0,703	7,331	5,376	0	51,950	0	15,368	65,775	81,143
22	0	36,996	0	0	0	0	0	9,293	6,816	0	15,249	0	36,996	31,358	68,354
22,5	0	21,013	0	0	0	0,484	0,820	5,194	3,809	8,515	22,068	2,975	21,013	43,865	64,878
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	4,267	3,130	0	0	0	0	7,397	7,397
24,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0,692	1,171	0	0	0	0	0	0	1,863	1,863
25,5	0	0	0	23,988	0	0	0	1,747	1,281	19,518	0	6,819	0	53,353	53,353
26	0	0	0	204,959	0	0	0	0	0	13,897	0	4,855	0	223,711	223,711
26,5	0	0	0	81,987	0	0	0	0	0	14,825	0	5,179	0	101,991	101,991
27	0	0	0	378,529	0	0	0	0	0	39,487	0	13,795	0	431,811	431,811
27,5	0	0	0	433,823	0	0	0	0	0	16,809	0	5,873	0	456,505	456,505
28	0	0	0	559,989	0	0	0	0	0	26,803	0	9,364	0	596,156	596,156
28,5	0	0	0	419,752	0	0	0	0	0	180,257	0	62,976	0	662,985	662,985
29	0	0	0	482,376	0	0	0	0	0	322,047	0	112,513	0	916,936	916,936
29,5	0	0	0	196,611	0	0	0	0	0	490,596	0	171,398	0	858,605	858,605
30	0	0	0	208,154	0	0	0	0	0	270,990	0	94,675	0	573,819	573,819
30,5	0	0	0	44,034	0	0	0	0	0	191,088	0	66,760	0	301,882	301,882
31	0	0	0	0	0	0	0	0	0	239,797	0	83,777	0	323,574	323,574
31,5	0	0	0	0	0	0	0	0	0	106,605	0	37,244	0	143,849	143,849
32	0	0	0	0	0	0	0	0	0	112,462	0	39,290	0	151,752	151,752
32,5	0	0	0	0	0	0	0	0	0	44,453	0	15,530	0	59,983	59,983
33	0	0	0	57,541	0	0	0	0	0	0	0	0	0	57,541	57,541
33,5	0	0	0	0	0	0	0	0	0	82,123	0	28,691	0	110,814	110,814
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34,5	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	38,121	0	13,318	0	51,439	51,439
35,5	0	0	0	0	0	0	0	0	0	60,006	0	20,964	0	80,970	80,970
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	46,047	0	16,087	0	62,134	62,134
37,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4533,980	8926,267	810,866	3091,743	188,886	14,480	24,504	358,838	263,184	2358,482	523,003	823,973	**14271,113**	7647,093	21918,206

Table 12. *ECOCADIZ 2017-07* survey. Blue jack mackerel (*T. picturatus*). 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 29**.

Size class	POL01	POL02	POL03	n PORTUGAL	n SPAIN	n TOTAL	Millions PORTUGAL	Millions SPAIN	Millions TOTAL
10	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0
13	4063	39602	102	43665	102	43767	0,04	0,0001	0,04
13,5	23725	231225	597	254950	597	255547	0,3	0,001	0,3
14	49834	485679	1254	535513	1254	536767	1	0,001	1
14,5	70083	683014	1763	753097	1763	754860	1	0,002	1
15	43054	419598	1083	462652	1083	463735	0,5	0,001	0,5
15,5	22831	222512	574	245343	574	245917	0,2	0,001	0,2
16	10562	102931	266	113493	266	113759	0,1	0,0003	0,1
16,5	4035	39324	102	43359	102	43461	0,04	0,0001	0,04
17	846	8249	21	9095	21	9116	0,01	0,00002	0,01
17,5	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
18,5	846	8249	21	9095	21	9116	0,01	0,00002	0,01
19	846	8249	21	9095	21	9116	0,01	0,00002	0,01
19,5	3249	31665	82	34914	82	34996	0,03	0,0001	0,03
20	3987	38860	100	42847	100	42947	0,04	0,0001	0,04
20,5	3987	38860	100	42847	100	42947	0,04	0,0001	0,04
21	3987	38860	100	42847	100	42947	0,04	0,0001	0,04
21,5	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
22,5	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0
TOTAL *n*	245935	2396877	6186	2642812	6186	2648998	3	0,01	3
Millions	0,2	2	0,01						

Table 12. *ECOCADIZ 2017-07* survey. Blue jack mackerel (*T. picturatus*). Cont'd.

Size class	POL01	POL02	POL03	PORTUGAL	SPAIN	TOTAL
10	0	0	0	0	0	0
10,5	0	0	0	0	0	0
11	0	0	0	0	0	0
11,5	0	0	0	0	0	0
12	0	0	0	0	0	0
12,5	0	0	0	0	0	0
13	0,072	0,703	0,002	0,775	0,002	0,777
13,5	0,472	4,601	0,012	5,073	0,012	5,085
14	1,107	10,793	0,028	11,90	0,028	11,928
14,5	1,733	16,886	0,044	18,619	0,044	18,663
15	1,180	11,50	0,030	12,680	0,030	12,710
15,5	0,691	6,738	0,017	7,429	0,017	7,446
16	0,352	3,433	0,009	3,785	0,009	3,794
16,5	0,148	1,441	0,004	1,589	0,004	1,593
17	0,034	0,331	0,001	0,365	0,001	0,366
17,5	0	0	0	0	0	0
18	0	0	0	0	0	0
18,5	0,044	0,428	0,001	0,472	0,001	0,473
19	0,048	0,465	0,001	0,513	0,001	0,514
19,5	0,198	1,931	0,005	2,129	0,005	2,134
20	0,263	2,560	0,007	2,823	0,007	2,830
20,5	0,283	2,760	0,007	3,043	0,007	3,050
21	0,305	2,971	0,008	3,276	0,008	3,284
21,5	0	0	0	0	0	0
22	0	0	0	0	0	0
22,5	0	0	0	0	0	0
23	0	0	0	0	0	0
TOTAL	6,930	67,541	0,176	74,471	0,176	74,647

Table 13. *ECOCADIZ 2017-07* survey. Horse mackerel (*T. 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 31**.

								n			Millions		
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
10	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
11	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
12	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
13	0	0	0	348753	0	0	0	348753	0	348753	0,3	0	0,3
13,5	0	0	0	348753	0	0	0	348753	0	348753	0,3	0	0,3
14	0	0	0	348753	0	0	0	348753	0	348753	0,3	0	0,3
14,5	166594	0	0	930008	0	0	0	1096602	0	1096602	1	0	1
15	0	0	0	1162510	0	0	0	1162510	0	1162510	1	0	1
15,5	0	0	0	930008	0	0	0	930008	0	930008	1	0	1
16	0	0	0	3138776	0	0	0	3138776	0	3138776	3	0	3
16,5	166594	0	0	7905065	0	0	0	8071659	0	8071659	8	0	8
17	666375	0	0	6161301	0	0	0	6827676	0	6827676	7	0	7
17,5	1416046	0	0	3836282	0	0	0	5252328	0	5252328	5	0	5
18	499781	0	0	1627513	0	0	0	2127294	0	2127294	2	0	2
18,5	1915827	43	925	813757	3	2151	231	2730552	2385	2732937	3	0,002	3
19	1749233	0	0	930008	0	0	0	2679241	0	2679241	3	0	3
19,5	1166155	0	0	930008	0	0	0	2096163	0	2096163	2	0	2
20	499781	43	925	348753	3	2151	231	849502	2385	851887	1	0,002	1
20,5	333187	128	2774	465004	8	6453	692	801093	7153	808246	1	0,01	1
21	166594	257	5548	348753	16	12907	1384	521152	14307	535459	1	0,01	0,5
21,5	0	1050	22671	116251	66	52742	5655	139972	58463	198435	0,1	0,1	0,2
22	166594	300	6473	465004	19	15058	1614	638371	16691	655062	1	0,02	1
22,5	333187	782	16883	0	49	39278	4211	350852	43538	394390	0,4	0,04	0,4
23	333187	1453	31369	581255	91	72979	7825	947264	80895	1028159	1	0,1	1
23,5	166594	1807	39006	0	113	90745	9729	207407	100587	307994	0,2	0,1	0,3
24	0	685	14794	116251	43	34418	3690	131730	38151	169881	0,1	0,04	0,2
24,5	0	996	21507	0	62	50033	5364	22503	55459	77962	0,02	0,1	0,1
25	0	1093	23596	0	68	54893	5885	24689	60846	85535	0,02	0,1	0,1
25,5	166594	0	0	0	0	0	0	166594	0	166594	0,2	0	0,2
26	0	0	0	0	0	0	0	0	0	0	0	0	0
26,5	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
27,5	0	43	925	0	3	2151	231	968	2385	3353	0,001	0,002	0,003
28	0	0	0	0	0	0	0	0	0	0	0	0	0
28,5	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	9912323	8680	187396	31852766	544	435959	46742	41961165	483245	42444410	42	0,5	42
Millions	10	0,01	0,2	32	0,001	0,4	0,05						

ECOCADIZ 2017-07 . Trachurus trachurus . ABUNDANCE (in numbers and million fish)

Table 13. *ECOCADIZ 2017-07* survey. Horse mackerel (*T. trachurus*). Cont'd.

Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	PORTUGAL	SPAIN	TOTAL
10	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0	0
13	0	0	0	6,828	0	0	0	6,828	0	6,828
13,5	0	0	0	7,587	0	0	0	7,587	0	7,587
14	0	0	0	8,399	0	0	0	8,399	0	8,399
14,5	4,426	0	0	24,708	0	0	0	29,134	0	29,134
15	0	0	0	33,960	0	0	0	33,96	0	33,960
15,5	0	0	0	29,780	0	0	0	29,78	0	29,780
16	0	0	0	109,859	0	0	0	109,859	0	109,859
16,5	6,356	0	0	301,606	0	0	0	307,962	0	307,962
17	27,645	0	0	255,603	0	0	0	283,248	0	283,248
17,5	63,722	0	0	172,633	0	0	0	236,355	0	236,355
18	24,341	0	0	79,264	0	0	0	103,605	0	103,605
18,5	100,767	0,002	0,049	42,801	0	0,113	0,012	143,619	0,125	143,744
19	99,161	0	0	52,720	0	0	0	151,881	0	151,881
19,5	71,112	0	0	56,712	0	0	0	127,824	0	127,824
20	32,724	0,003	0,061	22,835	0	0,141	0,015	55,623	0,156	55,779
20,5	23,385	0,009	0,195	32,636	0,001	0,453	0,049	56,225	0,503	56,728
21	12,512	0,019	0,417	26,193	0,001	0,969	0,104	39,141	1,074	40,215
21,5	0	0,084	1,819	9,329	0,005	4,232	0,454	11,232	4,691	15,923
22	14,262	0,026	0,554	39,808	0,002	1,289	0,138	54,650	1,429	56,079
22,5	30,386	0,071	1,540	0	0,004	3,582	0,384	31,997	3,970	35,967
23	32,326	0,141	3,043	56,393	0,009	7,080	0,759	91,903	7,848	99,751
23,5	17,172	0,186	4,021	0	0,012	9,354	1,003	21,379	10,369	31,748
24	0	0,075	1,618	12,715	0,005	3,764	0,404	14,408	4,173	18,581
24,5	0	0,115	2,493	0	0,007	5,800	0,622	2,608	6,429	9,037
25	0	0,134	2,895	0	0,008	6,736	0,722	3,029	7,466	10,495
25,5	21,615	0	0	0	0	0	0	21,615	0	21,615
26	0	0	0	0	0	0	0	0	0	0
26,5	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0
27,5	0	0,007	0,148	0	0	0,345	0,037	0,155	0,382	0,537
28								0	0	0
28,5								0	0	0
29								0	0	0
TOTAL	581,912	0,872	18,853	1382,369	0,054	43,858	4,703	**1984,006**	**48,615**	**2032,621**

ECOCADIZ 2017-07 . Trachurus trachurus . BIOMASS (t)

Table 14. *ECOCADIZ 2017-07* survey. Mediterranean horse mackerel (*T. 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 33**.

Size class	POL01	POL02	POL03	n PORTUGAL	n SPAIN	n TOTAL	Millions PORTUGAL	Millions SPAIN	Millions TOTAL
				ECOCADIZ 2017-07. Trachurus mediterraneus. ABUNDANCE (in numbers and million fish)					
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	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
18,5	28014	0	37793	0	65807	65807	0	0,1	0,1
19	35547	0	47955	0	83502	83502	0	0,1	0,1
19,5	28014	0	37793	0	65807	65807	0	0,1	0,1
20	112056	0	151171	0	263227	263227	0	0,3	0,3
20,5	252126	0	340134	0	592260	592260	0	1	1
21	323220	0	436045	0	759265	759265	0	1	1
21,5	371715	0	501467	0	873182	873182	0	1	1
22	748256	0	1009445	0	1757701	1757701	0	2	2
22,5	544625	0	734733	0	1279358	1279358	0	1	1
23	679280	0	916392	0	1595672	1595672	0	2	2
23,5	328046	0	442555	0	770601	770601	0	1	1
24	184845	0	249368	0	434213	434213	0	0,4	0,4
24,5	131524	48720	177435	0	357679	357679	0	0,4	0,4
25	95977	48720	129480	0	274177	274177	0	0,3	0,3
25,5	124415	170521	167844	0	462780	462780	0	0,5	0,5
26	159538	177899	215228	0	552665	552665	0	1	1
26,5	156407	492355	211004	0	859766	859766	0	1	1
27	682505	275340	920743	0	1878588	1878588	0	2	2
27,5	769678	233997	1038345	0	2042020	2042020	0	2	2
28	2042008	1169986	2754798	0	5966792	5966792	0	6	6
28,5	2690826	1218707	3630095	0	7539628	7539628	0	8	8
29	4230512	2064632	5707229	0	12002373	12002373	0	12	12
29,5	4612891	2430035	6223083	0	13266009	13266009	0	13	13
30	2396373	2949673	3232859	0	8578905	8578905	0	9	9
30,5	1673918	1389228	2258222	0	5321368	5321368	0	5	5
31	916010	1823257	1235756	0	3975023	3975023	0	4	4
31,5	264485	1211329	356807	0	1832621	1832621	0	2	2
32	403543	892419	544405	0	1840367	1840367	0	2	2
32,5	56028	570586	75585	0	702199	702199	0	1	1
33	211164	845926	284874	0	1341964	1341964	0	1	1
33,5	71094	451012	95911	0	618017	618017	0	1	1
34	56028	233997	75585	0	365610	365610	0	0,4	0,4
34,5	0	233997	0	0	233997	233997	0	0,2	0,2
35	0	160917	0	0	160917	160917	0	0,2	0,2
35,5	0	121801	0	0	121801	121801	0	0,1	0,1
36	0	104819	0	0	104819	104819	0	0,1	0,1
36,5	0	160917	0	0	160917	160917	0	0,2	0,2
37	0	0	0	0	0	0	0	0	0
37,5	0	56098	0	0	56098	56098	0	0,1	0,1
38	0	48720	0	0	48720	48720	0	0,05	0,05
38,5	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
39,5	0	0	0	0	0	0	0	0	0
40	0	48720	0	0	48720	48720	0	0,05	0,05
40,5	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
TOTAL *n*	25380668	19634328	34240139	0	79255135	79255135	**0**	**79**	**79**
Millions	25	20	34						

Table 14. *ECOCADIZ 2017-07* survey. Mediterranean horse mackerel (*T. mediterraneus*). Cont'd.

ECOCADIZ 2017-07 . Trachurus mediterraneus . BIOMASS (t)						
Size class	POL01	POL02	POL03	PORTUGAL	SPAIN	TOTAL
15	0	0	0	0	0	0
15,5	0	0	0	0	0	0
16	0	0	0	0	0	0
16,5	0	0	0	0	0	0
17	0	0	0	0	0	0
17,5	0	0	0	0	0	0
18	0	0	0	0	0	0
18,5	1,670	0	2,253	0	3,923	3,923
19	2,269	0	3,060	0	5,329	5,329
19,5	1,910	0	2,577	0	4,487	4,487
20	8,151	0	10,996	0	19,147	19,147
20,5	19,531	0	26,349	0	45,880	45,880
21	26,627	0	35,921	0	62,548	62,548
21,5	32,518	0	43,869	0	76,387	76,387
22	69,416	0	93,646	0	163,062	163,062
22,5	53,510	0	72,188	0	125,698	125,698
23	70,595	0	95,237	0	165,832	165,832
23,5	36,019	0	48,591	0	84,610	84,610
24	21,418	0	28,894	0	50,312	50,312
24,5	16,064	5,951	21,672	0	43,687	43,687
25	12,344	6,266	16,653	0	35,263	35,263
25,5	16,833	23,071	22,709	0	62,613	62,613
26	22,684	25,295	30,603	0	78,582	78,582
26,5	23,350	73,503	31,501	0	128,354	128,354
27	106,883	43,119	144,192	0	294,194	294,194
27,5	126,331	38,407	170,428	0	335,166	335,166
28	350,986	201,100	473,502	0	1025,588	1025,588
28,5	483,948	219,186	652,877	0	1356,011	1356,011
29	795,513	388,237	1073,198	0	2256,948	2256,948
29,5	906,236	477,398	1222,57	0	2606,204	2606,204
30	491,495	604,977	663,058	0	1759,530	1759,530
30,5	358,170	297,255	483,194	0	1138,619	1138,619
31	204,338	406,721	275,665	0	886,724	886,724
31,5	61,469	281,525	82,926	0	425,920	425,920
32	97,650	215,949	131,736	0	445,335	445,335
32,5	14,107	143,669	19,032	0	176,808	176,808
33	55,291	221,498	74,592	0	351,381	351,381
33,5	19,347	122,735	26,101	0	168,183	168,183
34	15,837	66,144	21,366	0	103,347	103,347
34,5	0	68,667	0	0	68,667	68,667
35	0	48,996	0	0	48,996	48,996
35,5	0	38,460	0	0	38,460	38,460
36	0	34,307	0	0	34,307	34,307
36,5	0	54,565	0	0	54,565	54,565
37	0	0	0	0	0	0
37,5	0	20,388	0	0	20,388	20,388
38	0	18,319	0	0	18,319	18,319
38,5	0	0	0	0	0	0
39	0	0	0	0	0	0
39,5	0	0	0	0	0	0
40	0	20,896	0	0	20,896	20,896
40,5	0	0	0	0	0	0
41	0	0	0	0	0	0
TOTAL	4522,510	4166,604	6101,156	0	14790,270	14790,270

Table 15. *ECOCADIZ 2017-07* survey. Bogue (*B. 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 35**.

Size class	POL01	POL02	PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
			\(n\)			Millions		
15	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
19,5	16246	131598	16246	131598	147844	0,02	0,1	0,1
20	34434	278927	34434	278927	313361	0,03	0,3	0,3
20,5	70400	570257	70400	570257	640657	0,1	1	1
21	210079	1701696	210079	1701696	1911775	0,2	2	2
21,5	228678	1852353	228678	1852353	2081031	0,2	2	2
22	277417	2247146	277417	2247146	2524563	0,3	2	3
22,5	460868	3733143	460868	3733143	4194011	0,5	4	4
23	365295	2958984	365295	2958984	3324279	0,4	3	3
23,5	326977	2648595	326977	2648595	2975572	0,3	3	3
24	241862	1959144	241862	1959144	2201006	0,2	2	2
24,5	61511	498257	61511	498257	559768	0,1	0,5	1
25	27077	219330	27077	219330	246407	0,03	0,2	0,2
25,5	30961	250792	30961	250792	281753	0,03	0,3	0,3
26	12773	103463	12773	103463	116236	0,01	0,1	0,1
26,5	5415	43866	5415	43866	49281	0,01	0,04	0,05
27	12773	103463	12773	103463	116236	0,01	0,1	0,1
27,5	16246	131598	16246	131598	147844	0,02	0,1	0,1
28	21662	175464	21662	175464	197126	0,02	0,2	0,2
28,5	0	0	0	0	0	0	0	0
29	16246	131598	16246	131598	147844	0,02	0,1	0,1
29,5	5415	43866	5415	43866	49281	0,01	0,04	0,05
30	16246	131598	16246	131598	147844	0,02	0,1	0,1
30,5	5415	43866	5415	43866	49281	0,01	0,04	0,05
31	5415	43866	5415	43866	49281	0,01	0,04	0,05
31,5	0	0	0	0	0	0	0	0
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
TOTAL *n*	2469411	20002870	2469411	20002870	22472281	**2**	**20**	**22**
Millions	2	20						

ECOCADIZ 2017-07 . *Boops boops* . ABUNDANCE (in numbers and million fish)

Table 15. *ECOCADIZ 2017-07* survey. Bogue (*B. boops*). Cont'd.

Size class	POL01	POL02	*n* PORTUGAL	*n* SPAIN	TOTAL
			ECOCADIZ 2017-07 . Boops boops . BIOMASS (t)		
15	0	0	0	0	0
15,5	0	0	0	0	0
16	0	0	0	0	0
16,5	0	0	0	0	0
17	0	0	0	0	0
17,5	0	0	0	0	0
18	0	0	0	0	0
18,5	0	0	0	0	0
19	0	0	0	0	0
19,5	1,057	8,561	1,057	8,561	9,618
20	2,432	19,698	2,432	19,698	22,130
20,5	5,387	43,633	5,387	43,633	49,020
21	17,382	140,798	17,382	140,798	158,180
21,5	20,423	165,432	20,423	165,432	185,855
22	26,697	216,250	26,697	216,250	242,947
22,5	47,710	386,461	47,710	386,461	434,171
23	40,616	328,997	40,616	328,997	369,613
23,5	38,987	315,808	38,987	315,808	354,795
24	30,882	250,149	30,882	250,149	281,031
24,5	8,399	68,031	8,399	68,031	76,430
25	3,948	31,981	3,948	31,981	35,929
25,5	4,815	39,001	4,815	39,001	43,816
26	2,116	17,139	2,116	17,139	19,255
26,5	0,954	7,731	0,954	7,731	8,685
27	2,392	19,379	2,392	19,379	21,771
27,5	3,230	26,166	3,230	26,166	29,396
28	4,567	36,996	4,567	36,996	41,563
28,5	0	0	0	0	0
29	3,840	31,106	3,840	31,106	34,946
29,5	1,353	10,963	1,353	10,963	12,316
30	4,289	34,739	4,289	34,739	39,028
30,5	1,509	12,220	1,509	12,220	13,729
31	1,591	12,885	1,591	12,885	14,476
31,5	0	0	0	0	0
32	0	0	0	0	0
32,5	0	0	0	0	0
33	0	0	0	0	0
TOTAL	274,576	2224,124	274,576	2224,124	2498,700
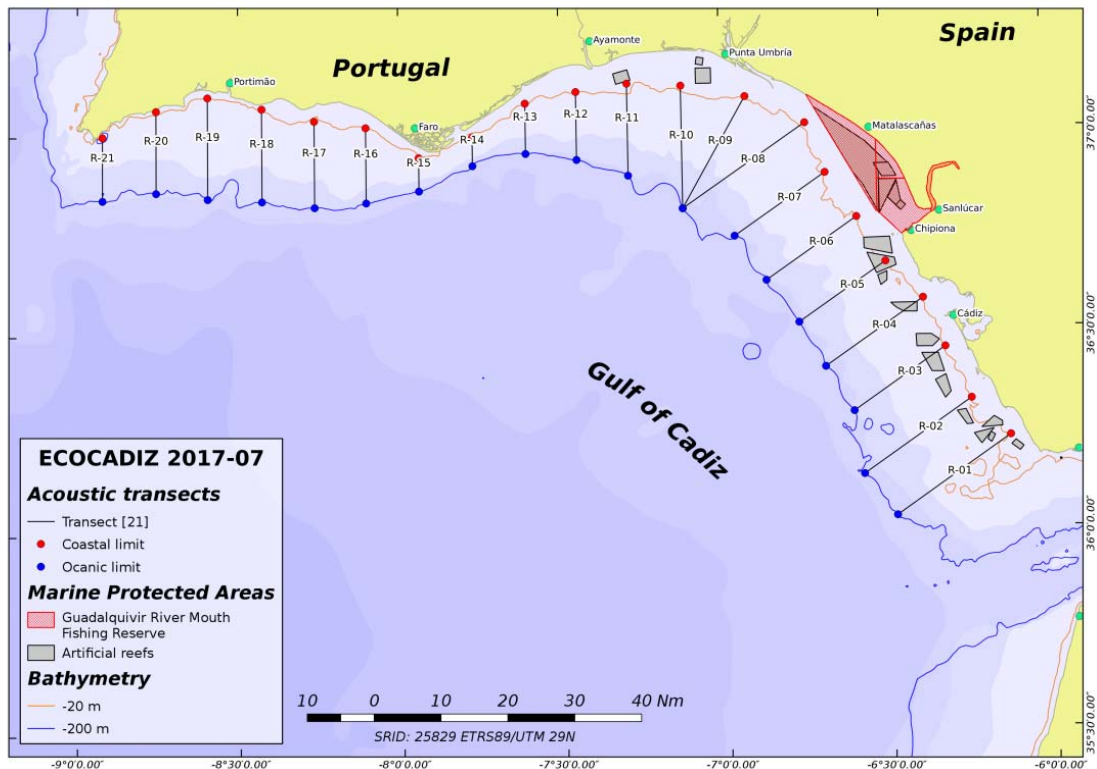
Figure 1. *ECOCADIZ 2017-07* survey. Location of the acoustic transects sampled during the survey. The different protected areas inside the Guadalquivir river mouth Fishing Reserve and artificial reef polygons are also shown.
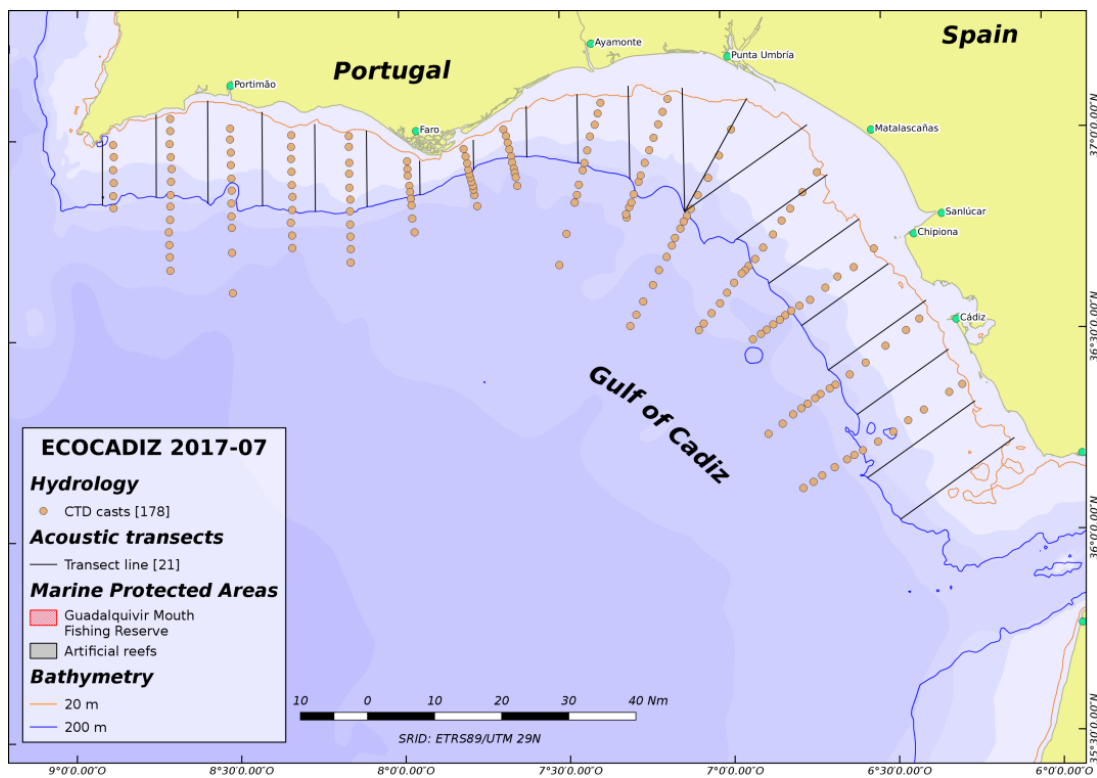
Figure 2. *ECOCADIZ 2017-07* survey. Location of CTD-LADCP stations.
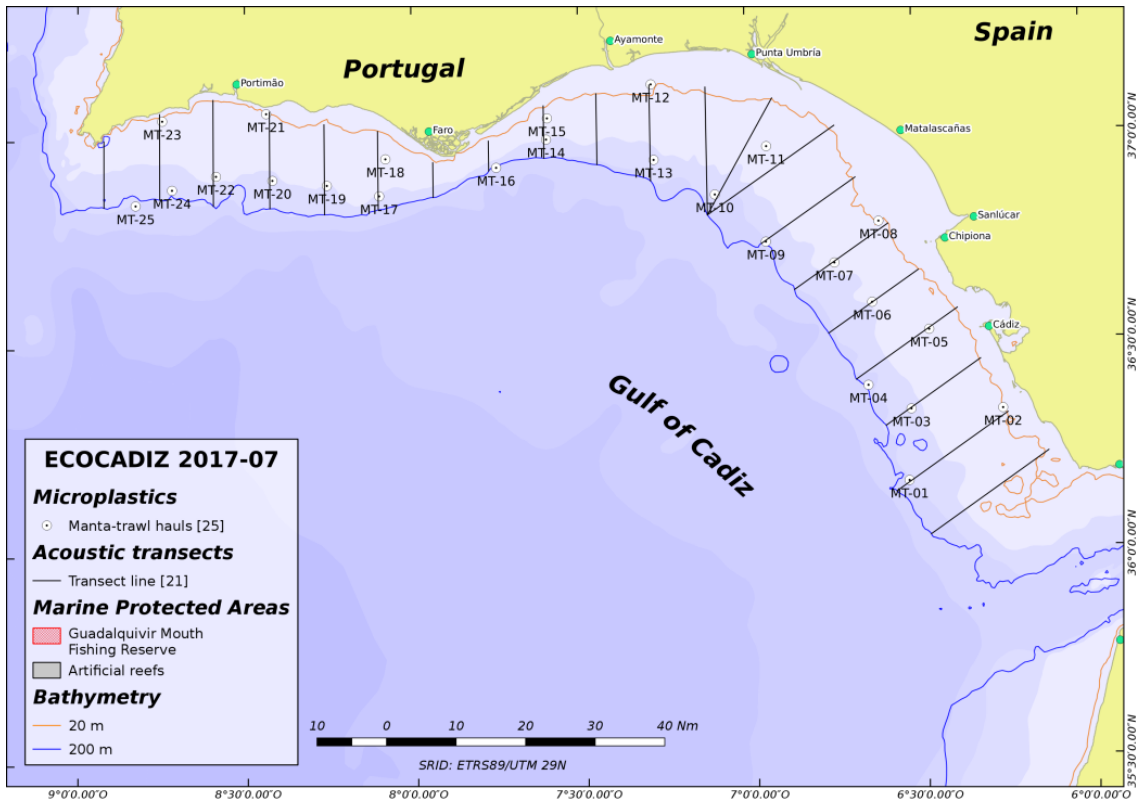
Figure 3. *ECOCADIZ 2017-07* survey. Location of Manta trawl hauls (micro-plastics).
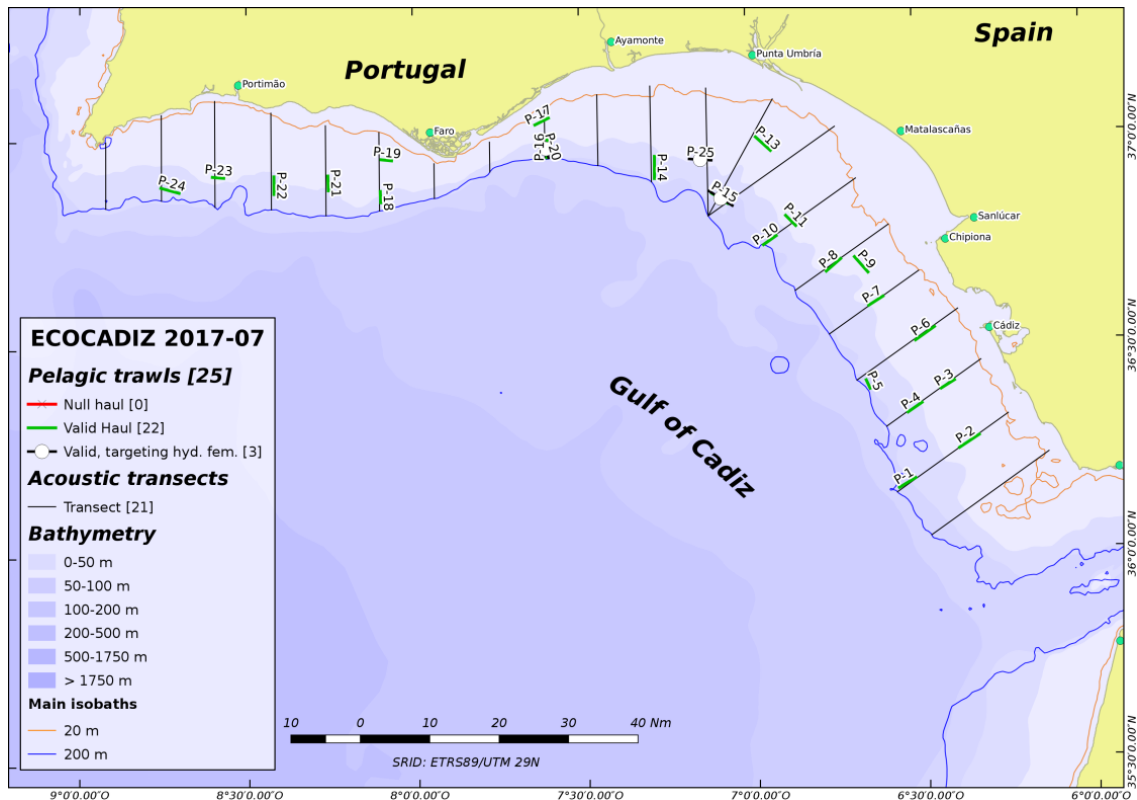
Figure 4. *ECOCADIZ 2017-07* survey. Location of ground-truthing fishing hauls. Night directed hauls aimed at the capture of anchovy with hydrated ovaries are also illustrated (Anchovy DEPM).
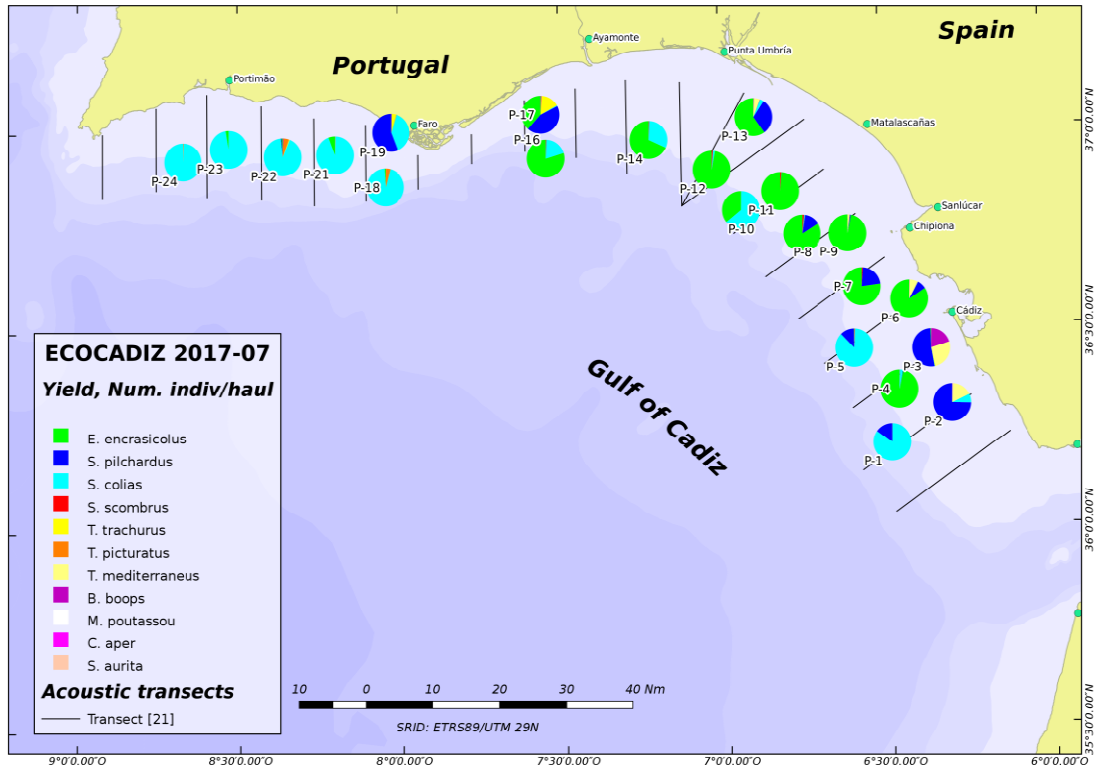
Figure 5. *ECOCADIZ 2017-07* survey. Species composition (percentages in number) in fishing hauls.
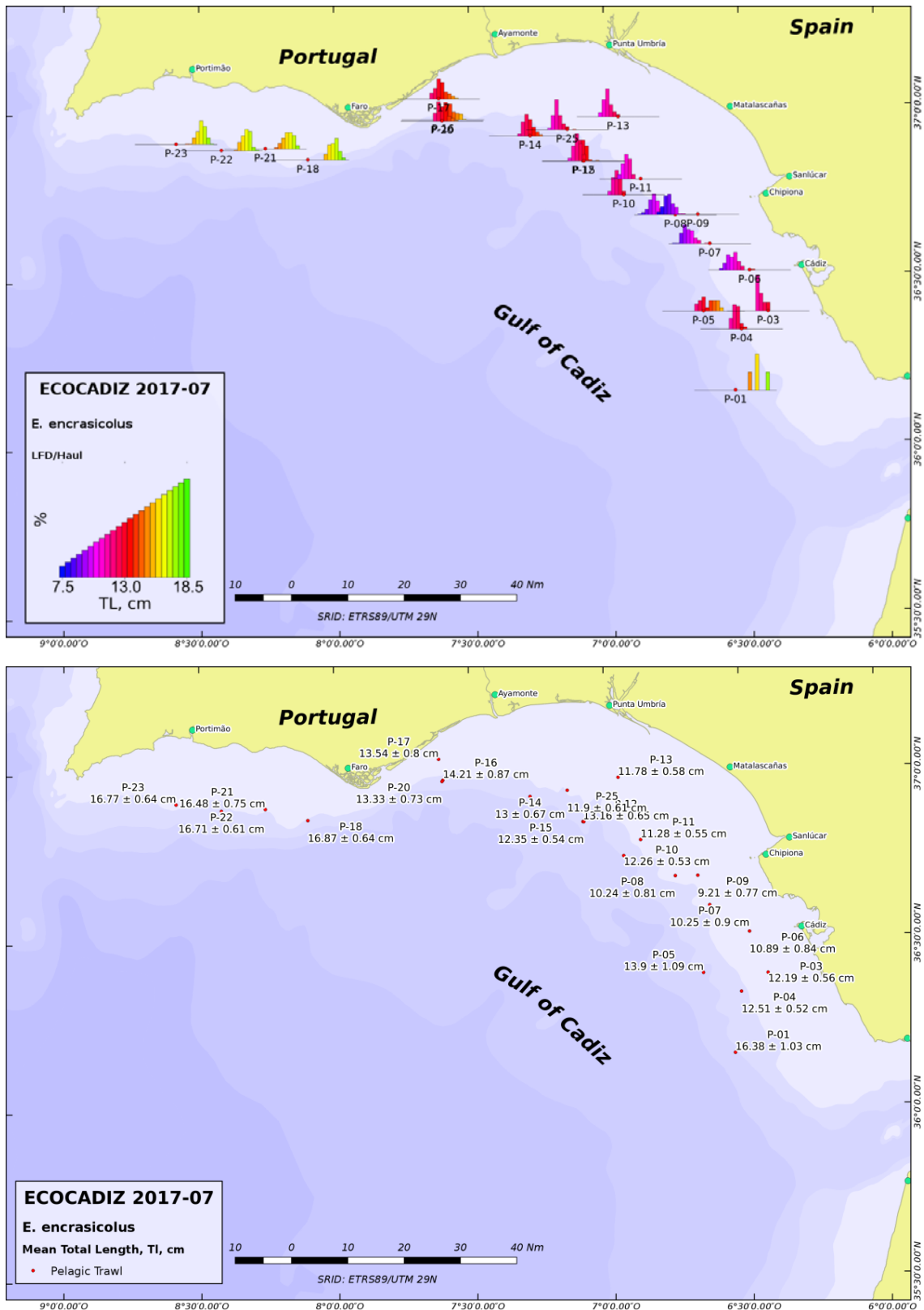
Figure 6. *ECOCADIZ 2017-07* survey. *Engraulis encrasicolus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
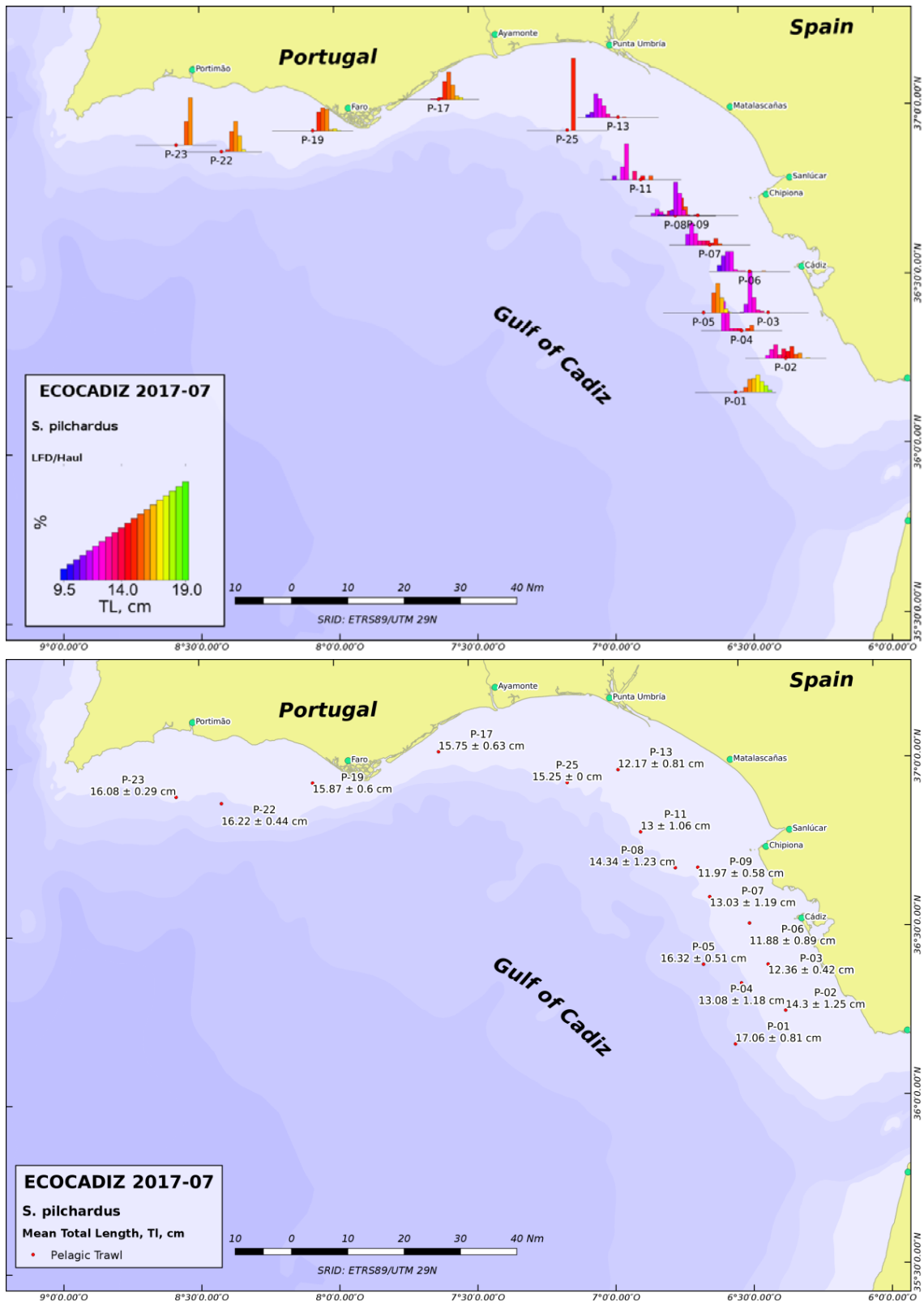
Figure 7. *ECOCADIZ 2017-07* survey. *Sardina pilchardus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
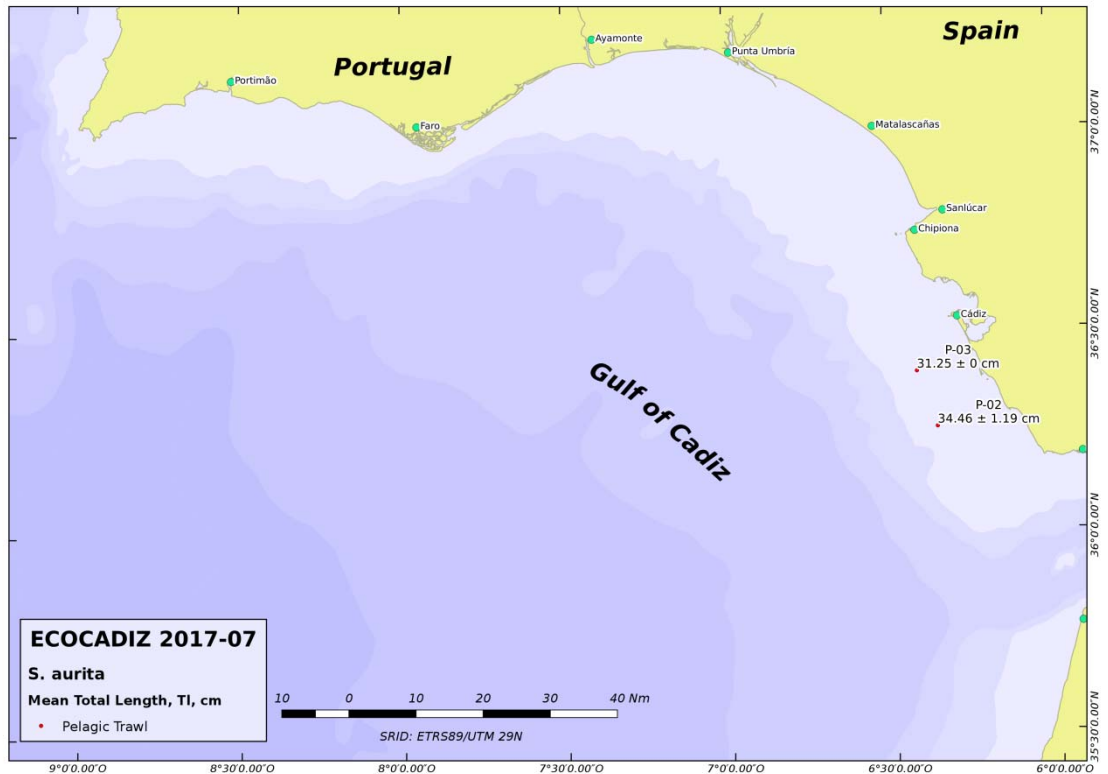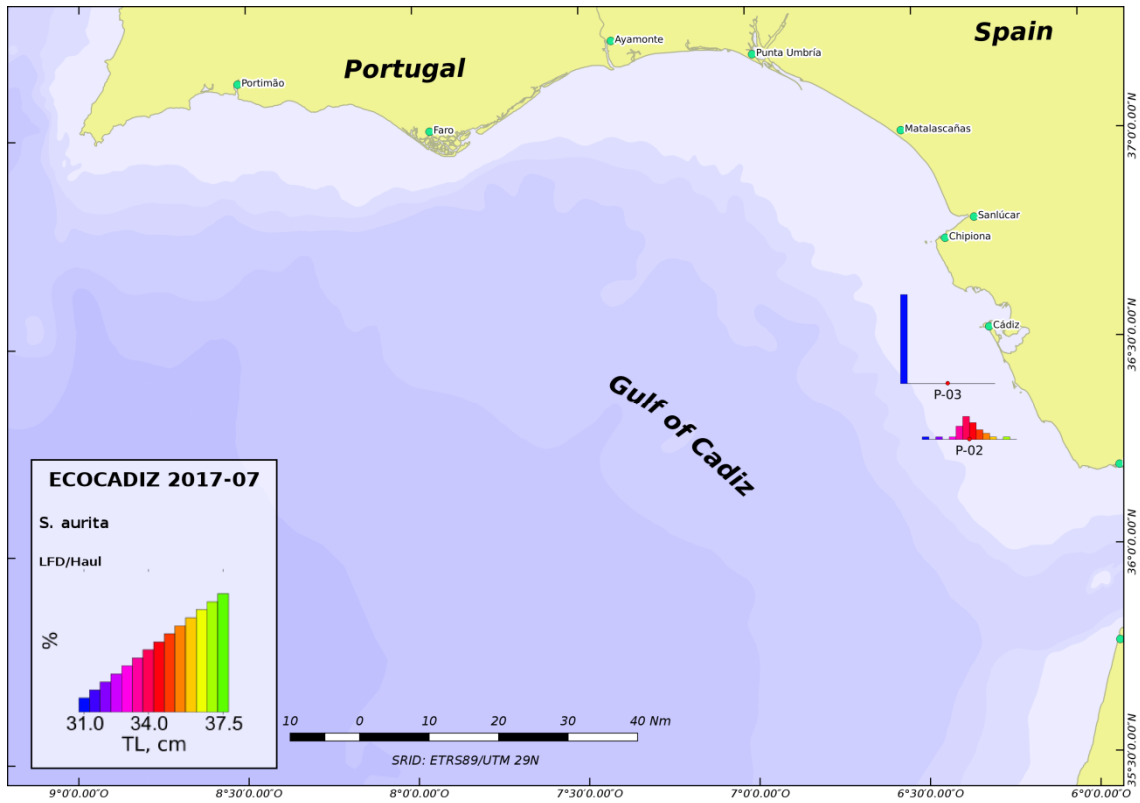
Figure 8. *ECOCADIZ 2017-07* survey. *Sardinella aurita*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
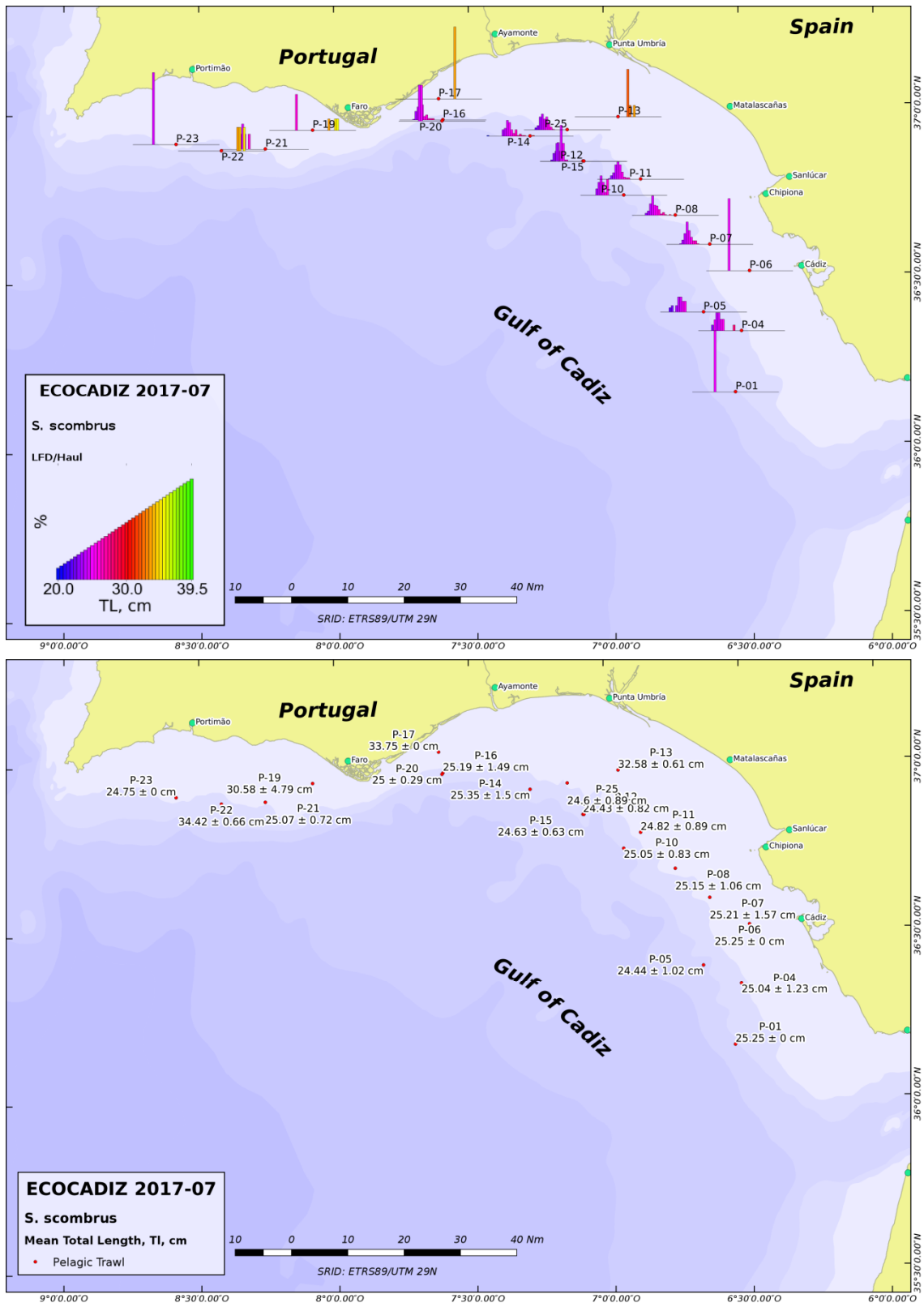
Figure 9. *ECOCADIZ 2017-07* survey. *Scomber scombrus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
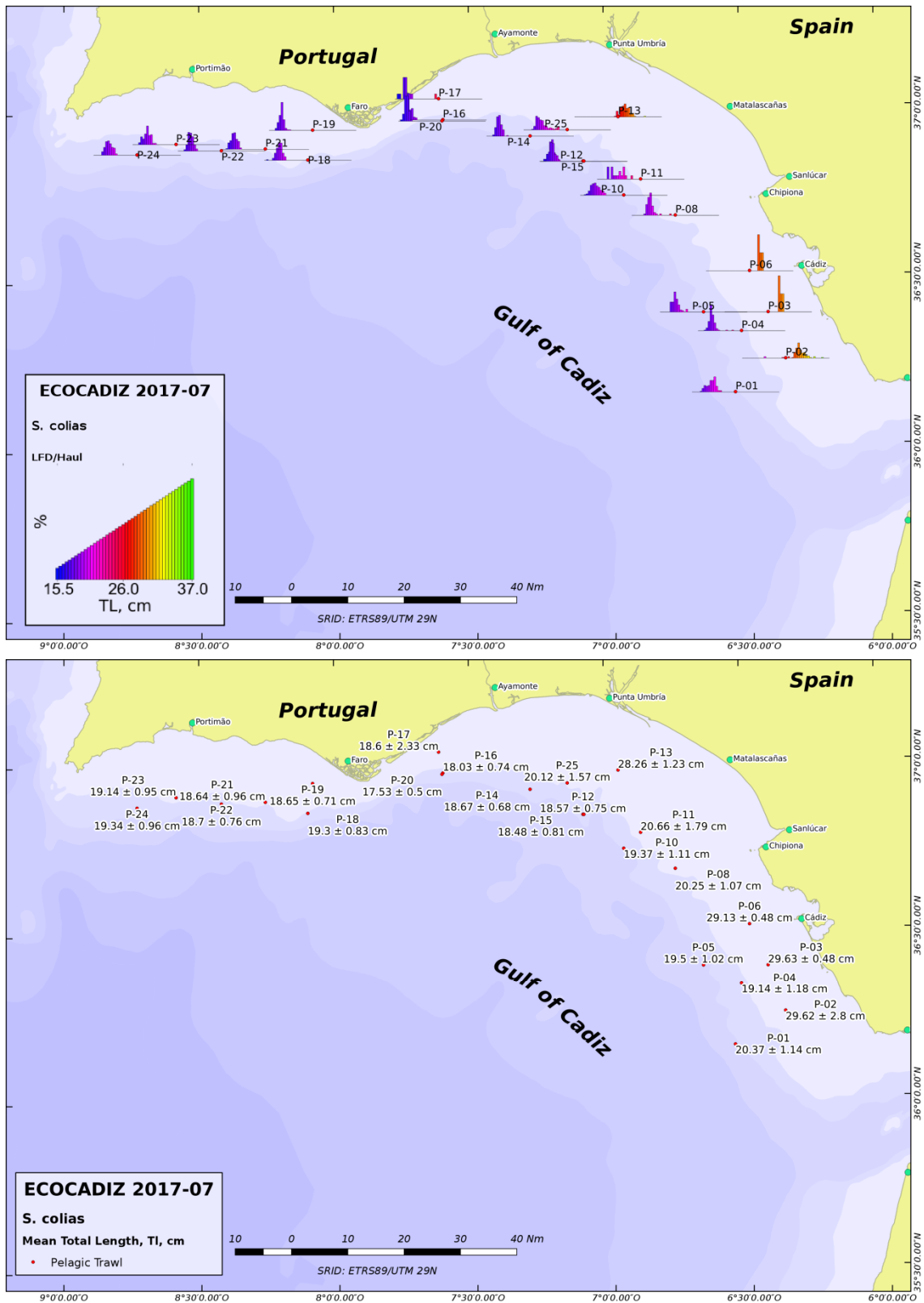
Figure 10. *ECOCADIZ 2017-07* survey. *Scomber colias*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
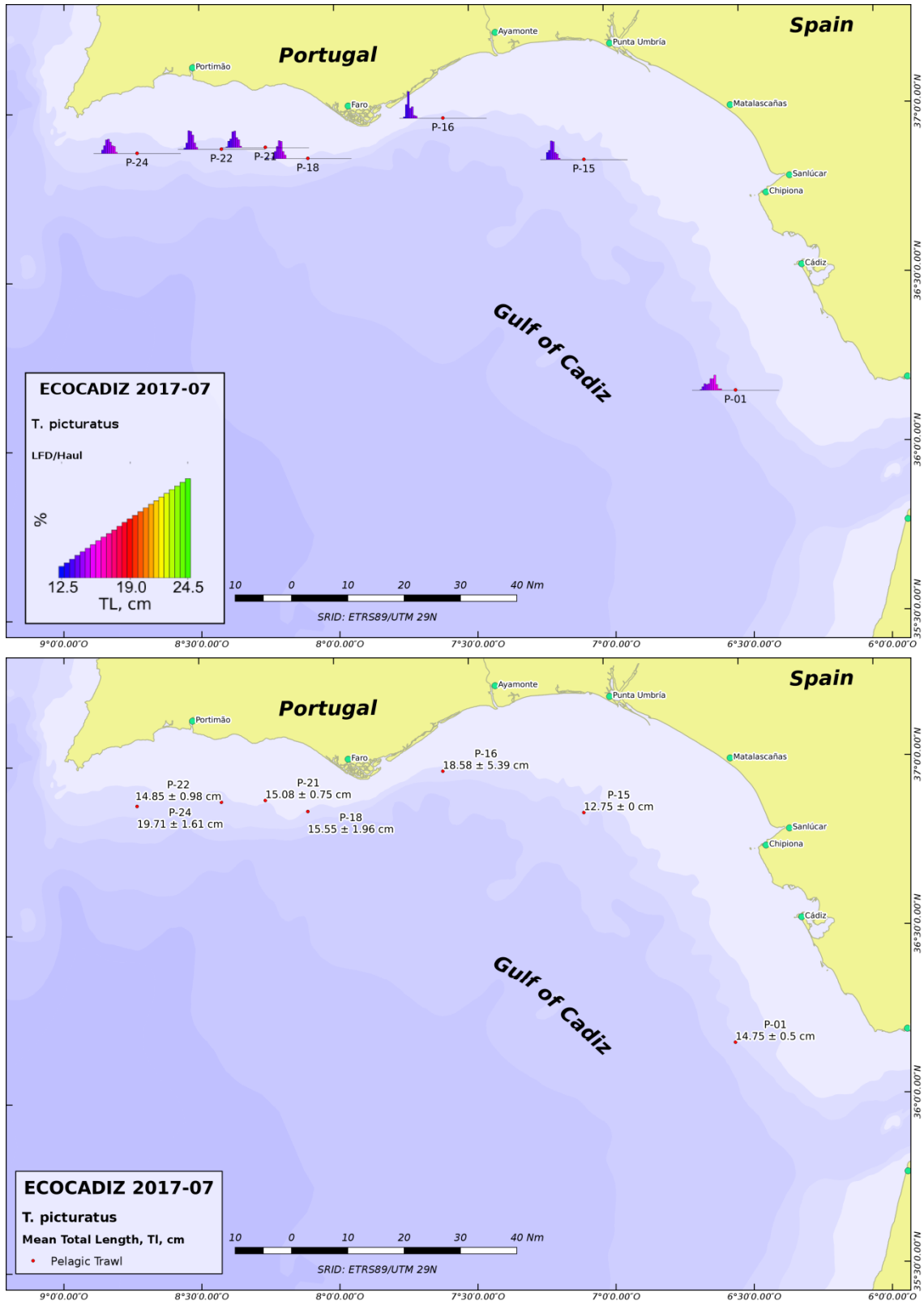
Figure 11. *ECOCADIZ 2017-07* survey. *Trachurus picturatus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
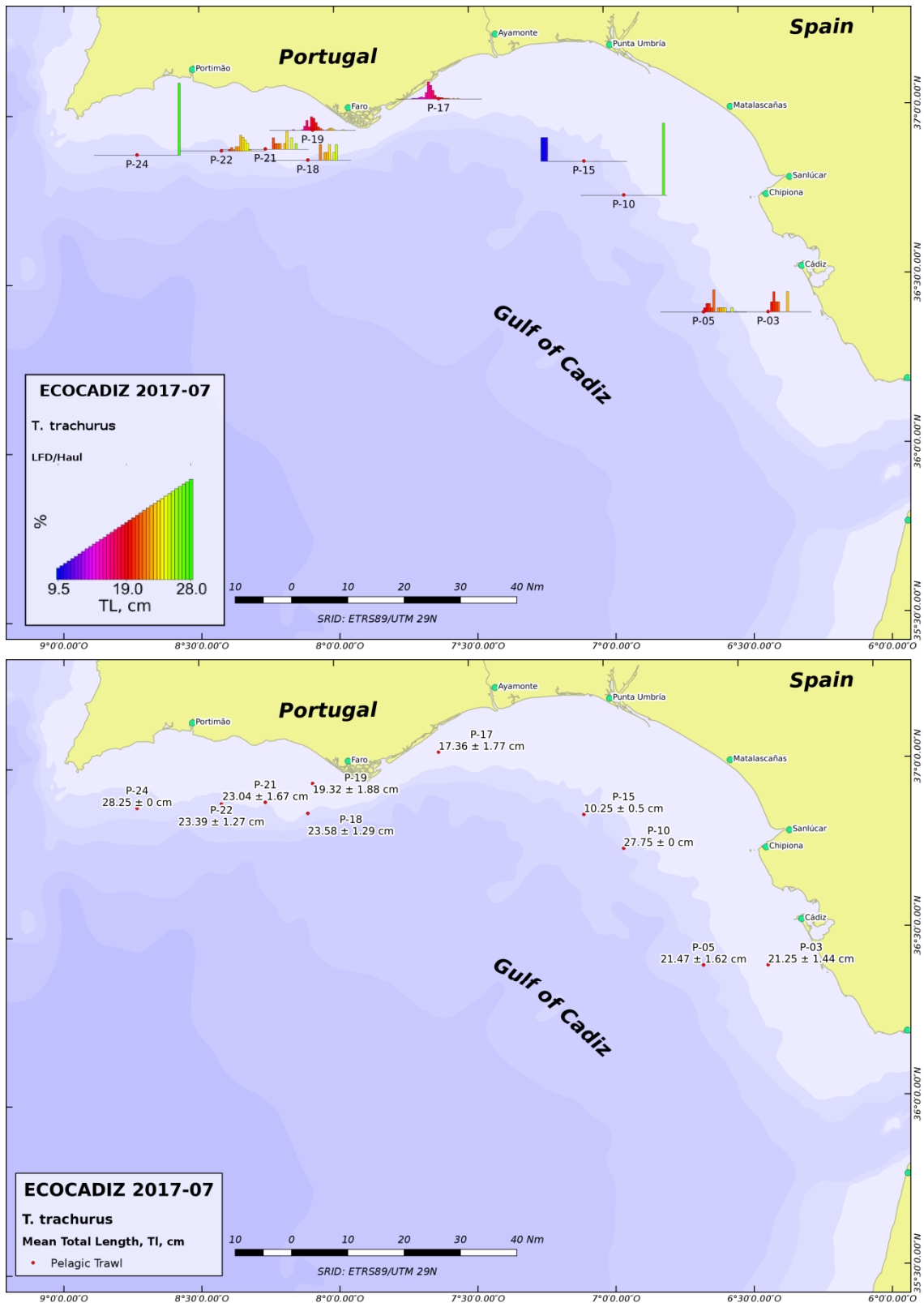
Figure 12. *ECOCADIZ 2017-07* survey. *Trachurus trachurus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
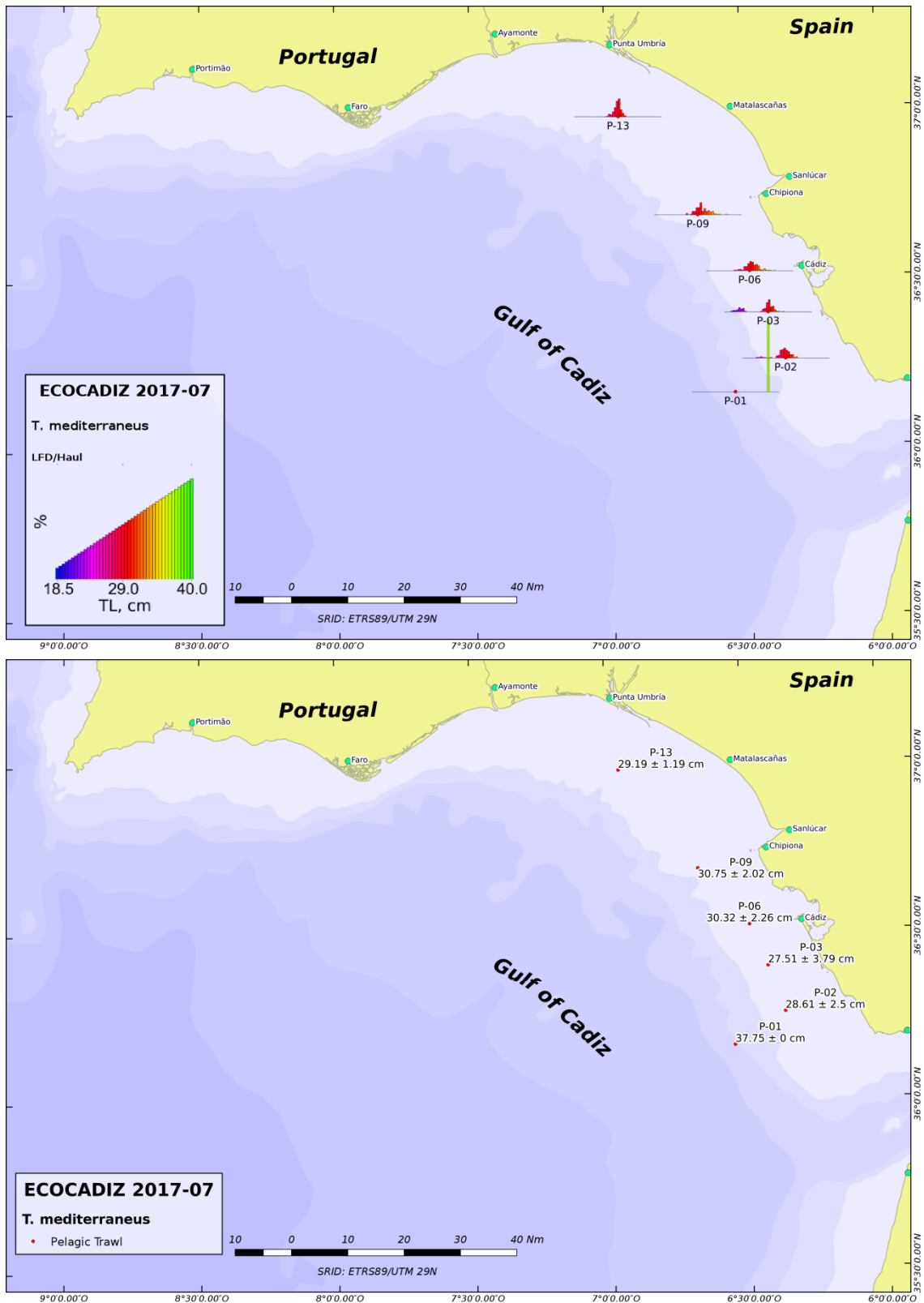
Figure 13. *ECOCADIZ 2017-07* survey. *Trachurus mediterraneus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
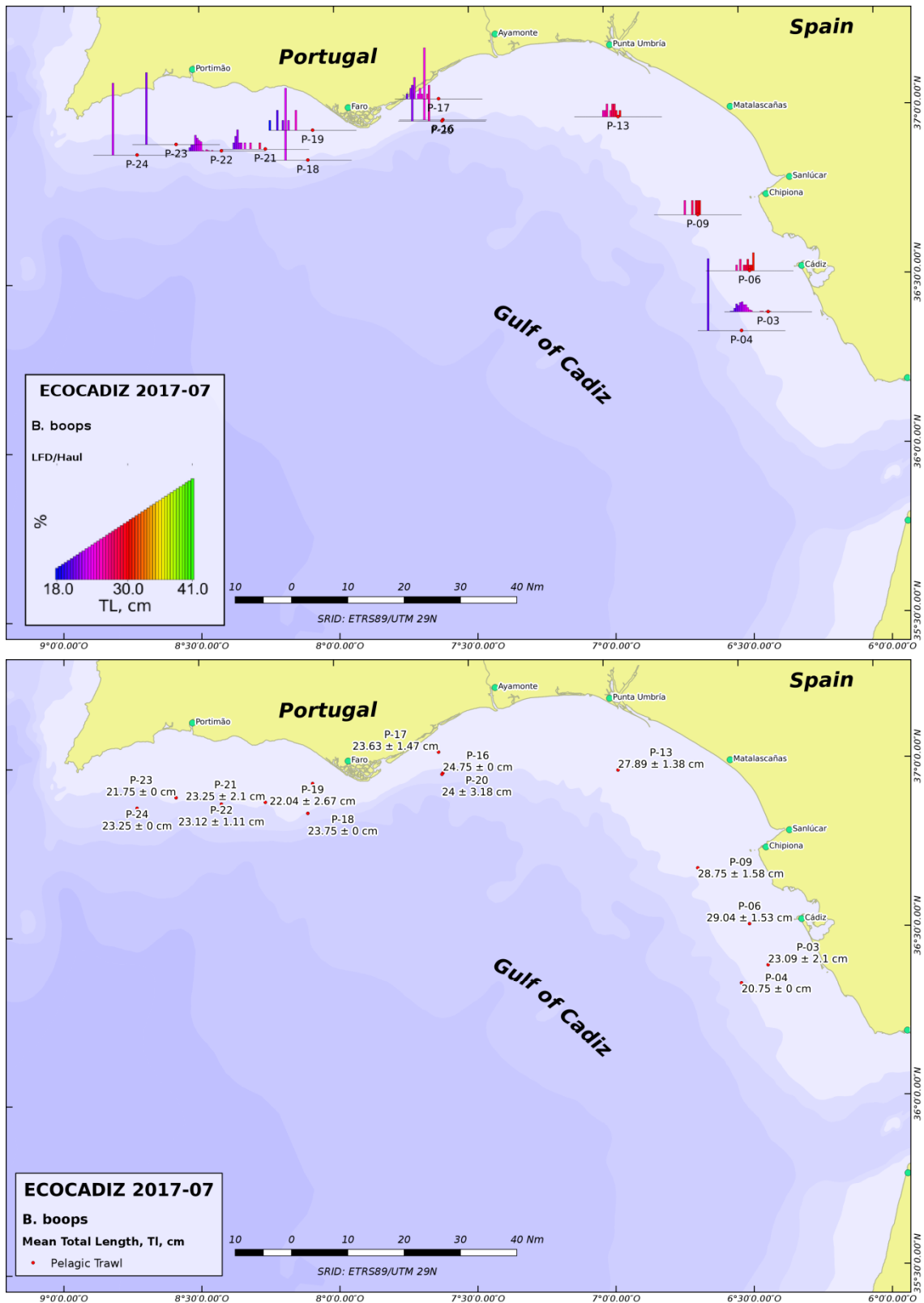
Figure 14. *ECOCADIZ 2017-07* survey. *Boops boops*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.
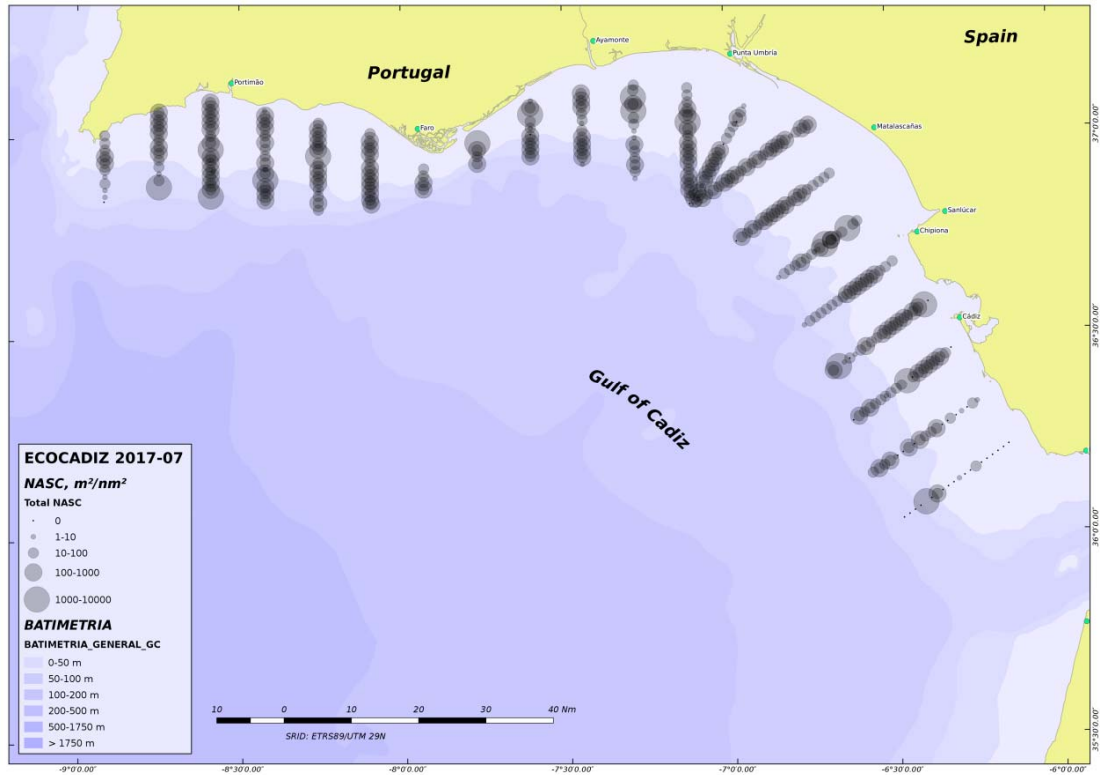
Figure 15. *ECOCADIZ 2017-07* survey. Distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the pelagic fish species assemblage.
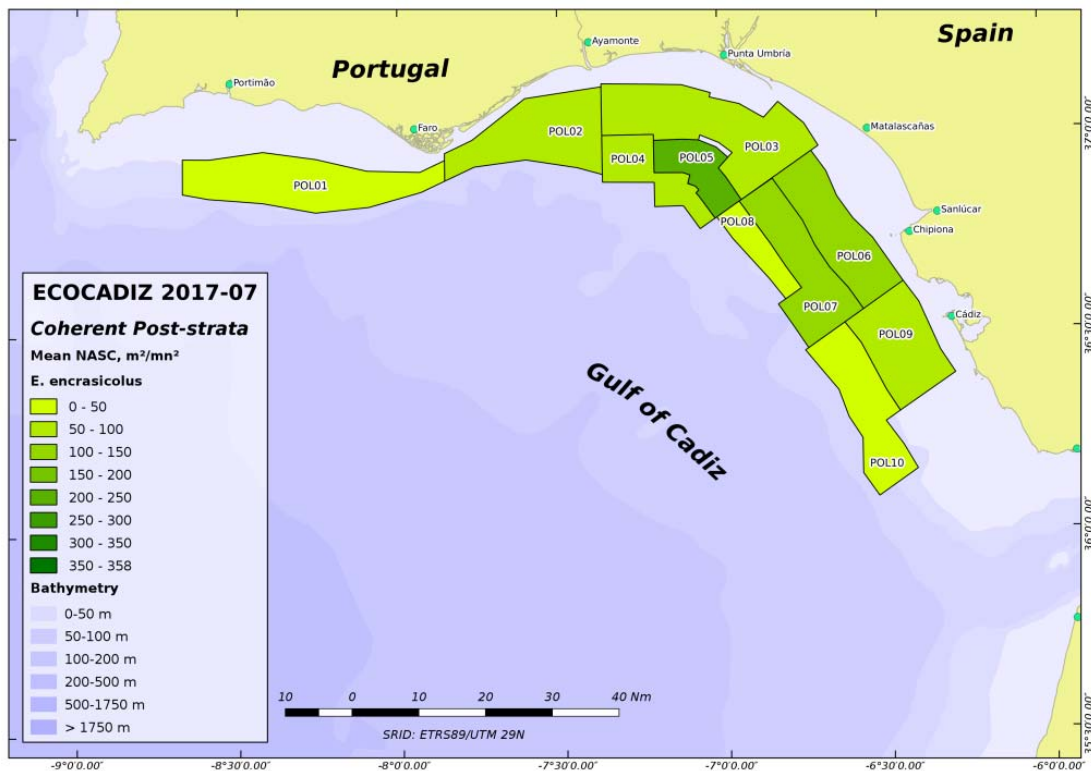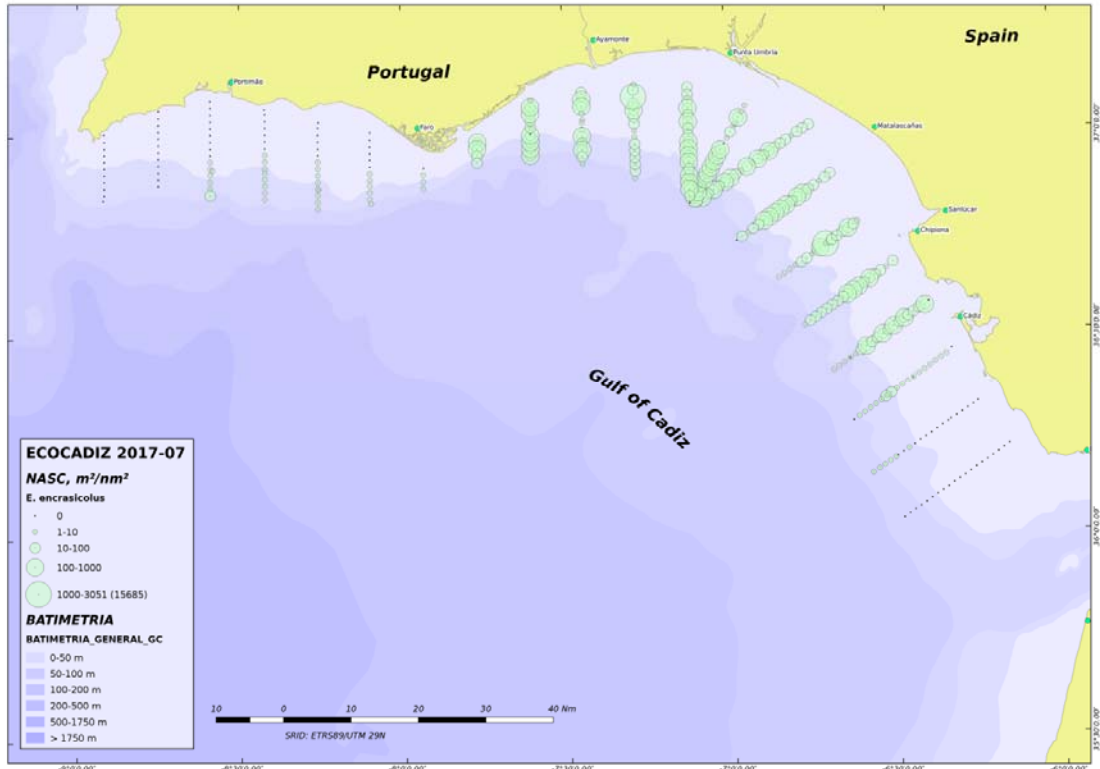
Figure 16. *ECOCADIZ 2017-07* survey. Anchovy (*Engraulis encrasicolus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

Figure 17. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 16**) 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 2017-07: Anchovy (*E. encrasicolus*)
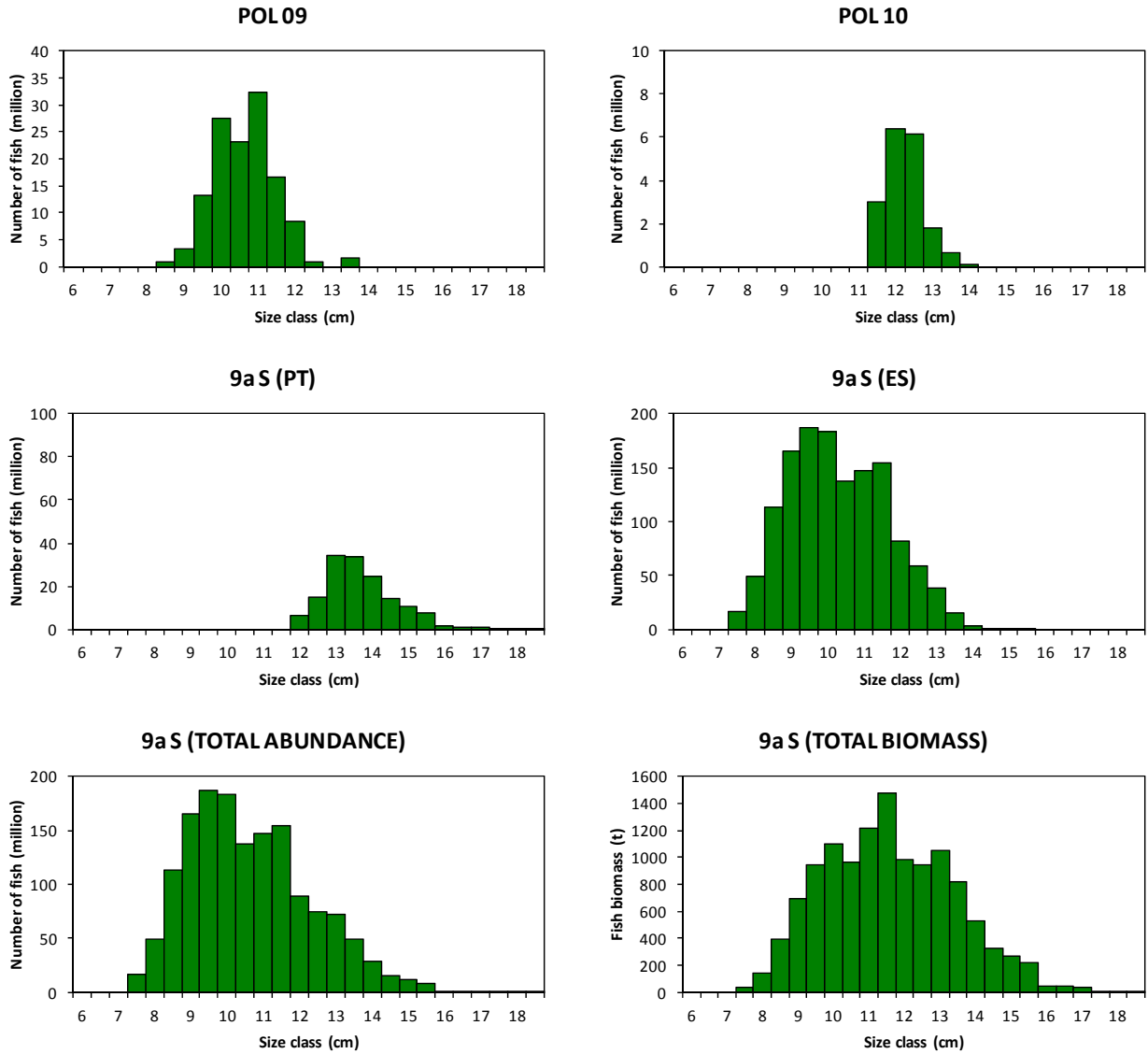
Figure 17. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Cont'd.
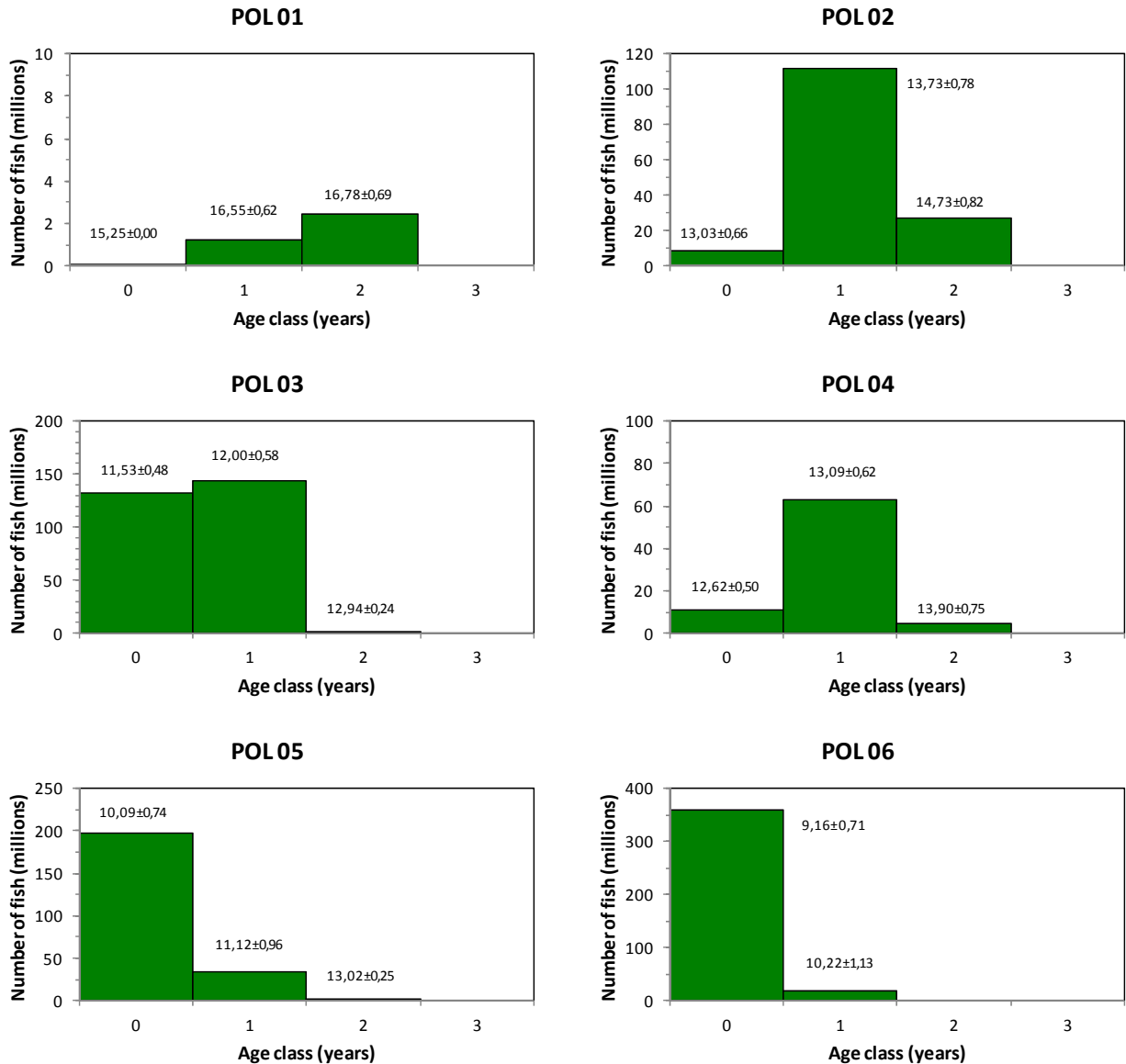
ECOCADIZ 2017-07: Anchovy (*E. encrasicolus*)

Figure 18. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 16**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the y axis.
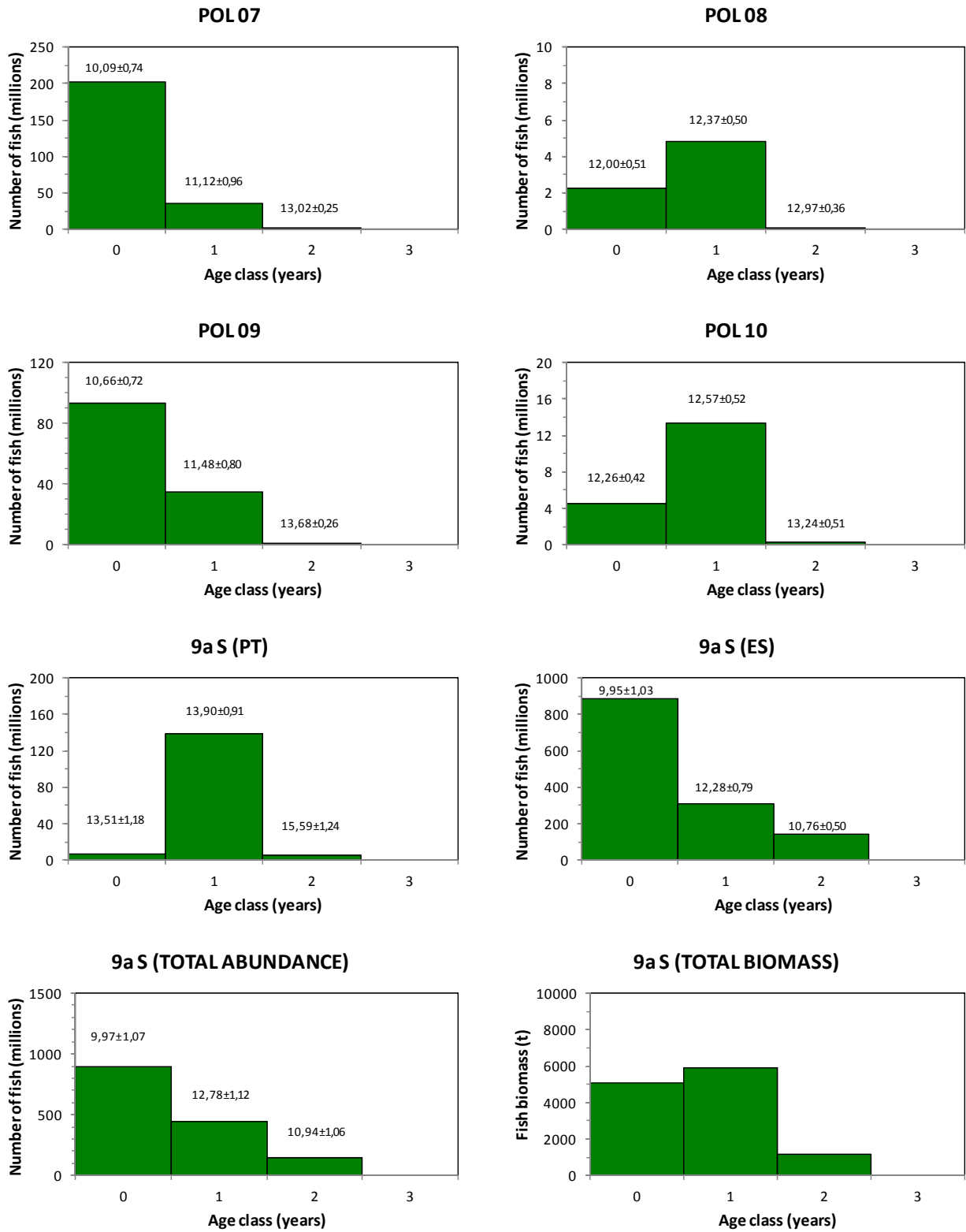
Figure 18. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Cont'd.
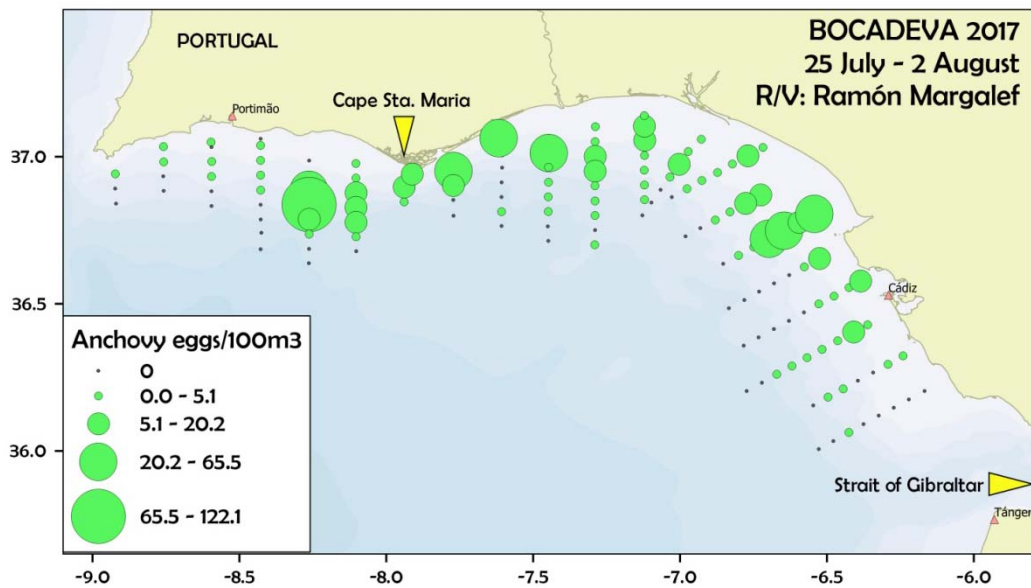
BOCADEVA 2017-07	
CUFES st	142
Positive anchovy st	88 (62 %)
Max number eggs by st	1453
Total anchovy eggs (in number)	7630
Max density by st (eggs/100 m^3)	122
Total density (eggs/100 m^3)	656

	2004	2005	2006	2007	2008	2009	2010	2011	2013	2014	2015	2016	2017
Tot density	2108	257	641	2374	530	901	1176	2565	786	3657	1010	672	656
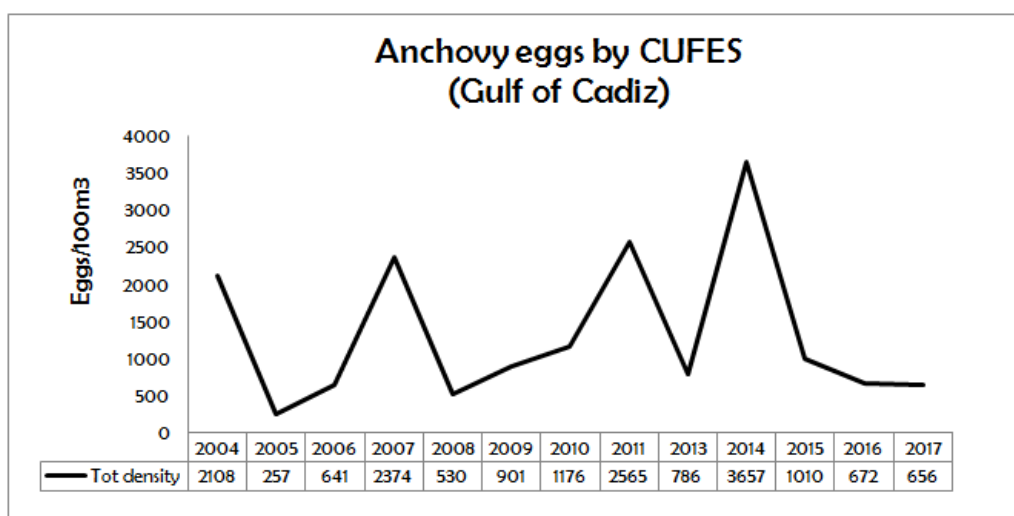
Figure 19. *ECOCADIZ 2017-07* survey. Anchovy (*E. encrasicolus*). Top: distribution of anchovy egg densities as sampled by CUFES (eggs m^{-3}) during the *BOCADEVA* anchovy DEPM survey. Centre: main descriptors of the CUFES sampling. Bottom: historical series of GoC anchovy egg densities as sampled by CUFES.
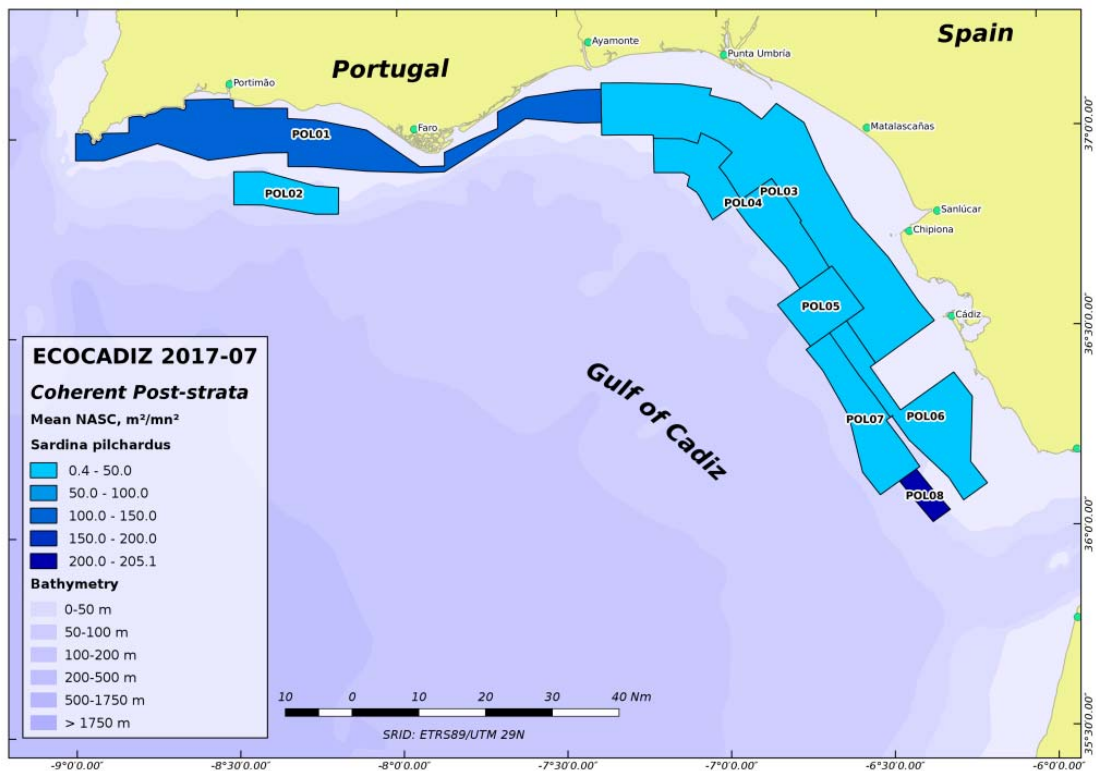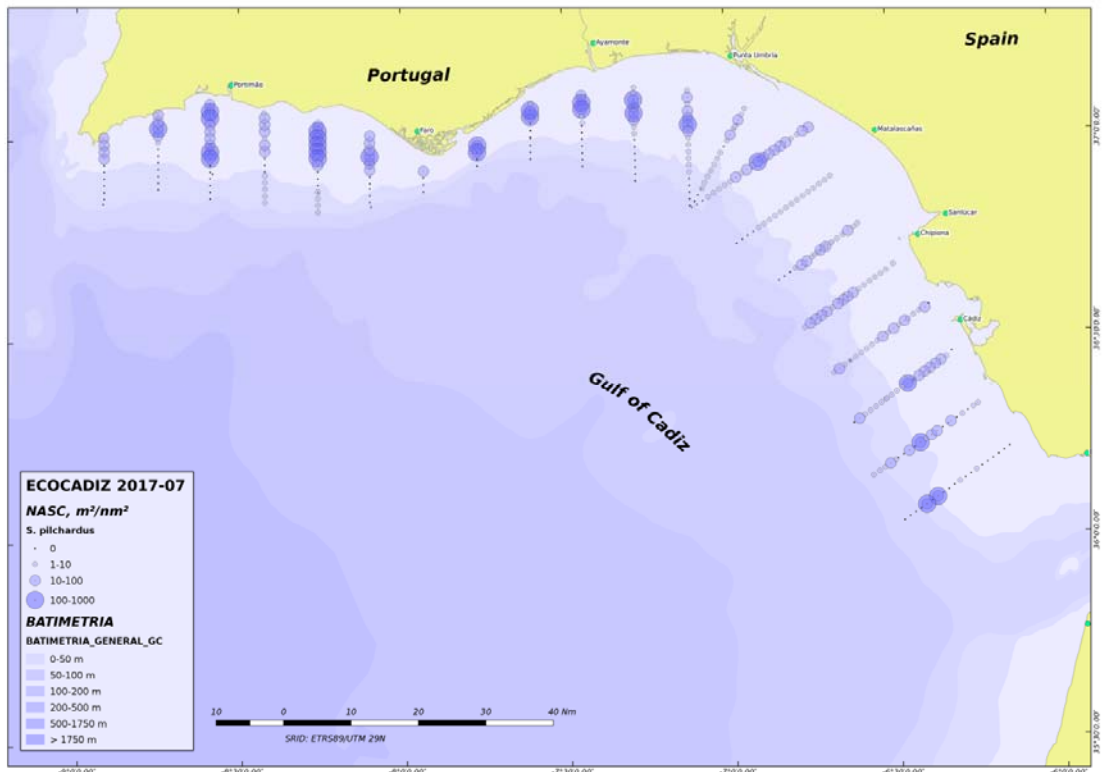
Figure 20. *ECOCADIZ 2017-07* survey. Sardine (*Sardina pilchardus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.
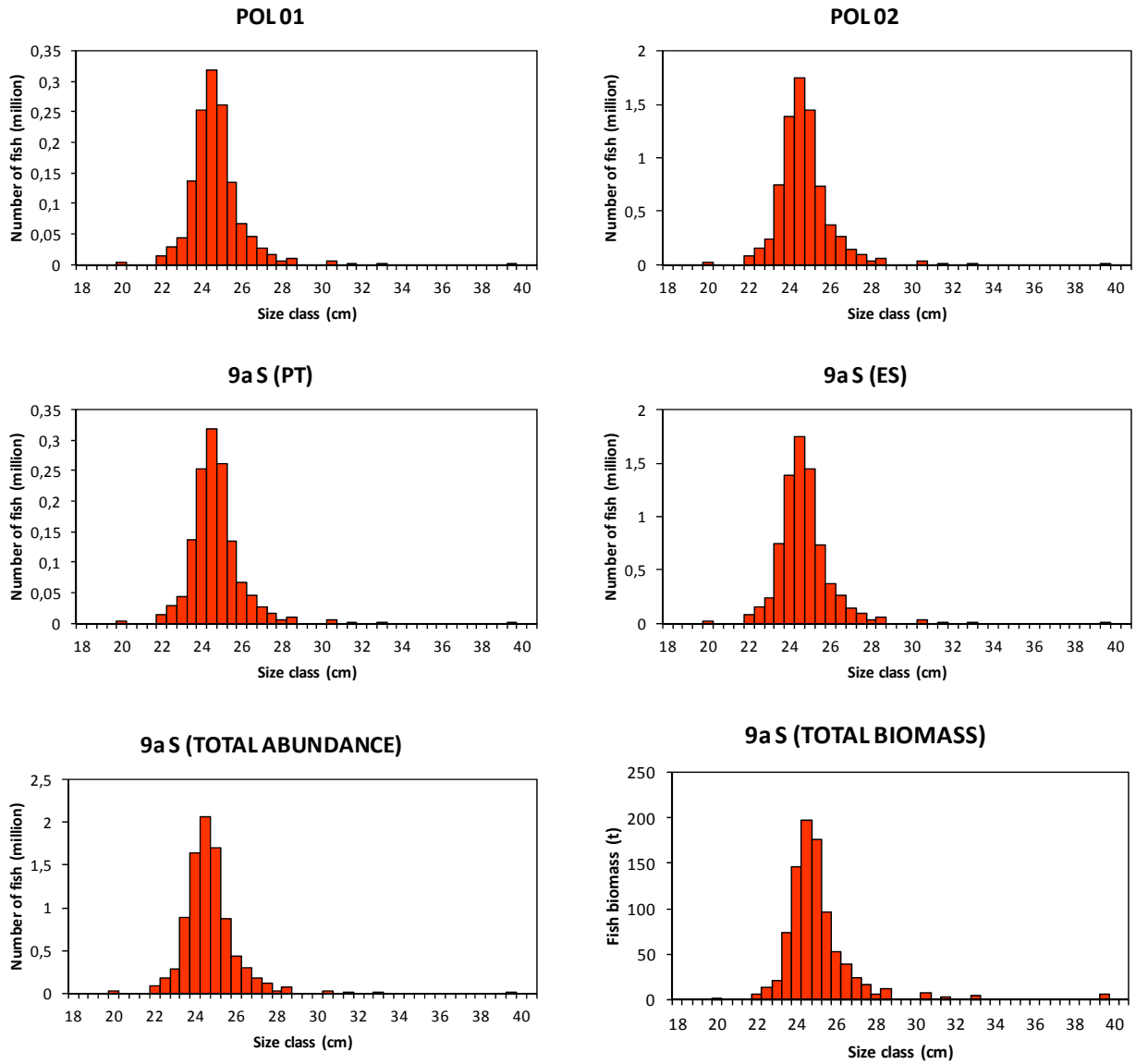
ECOCADIZ 2017-07: Sardine (*S. pilchardus*)
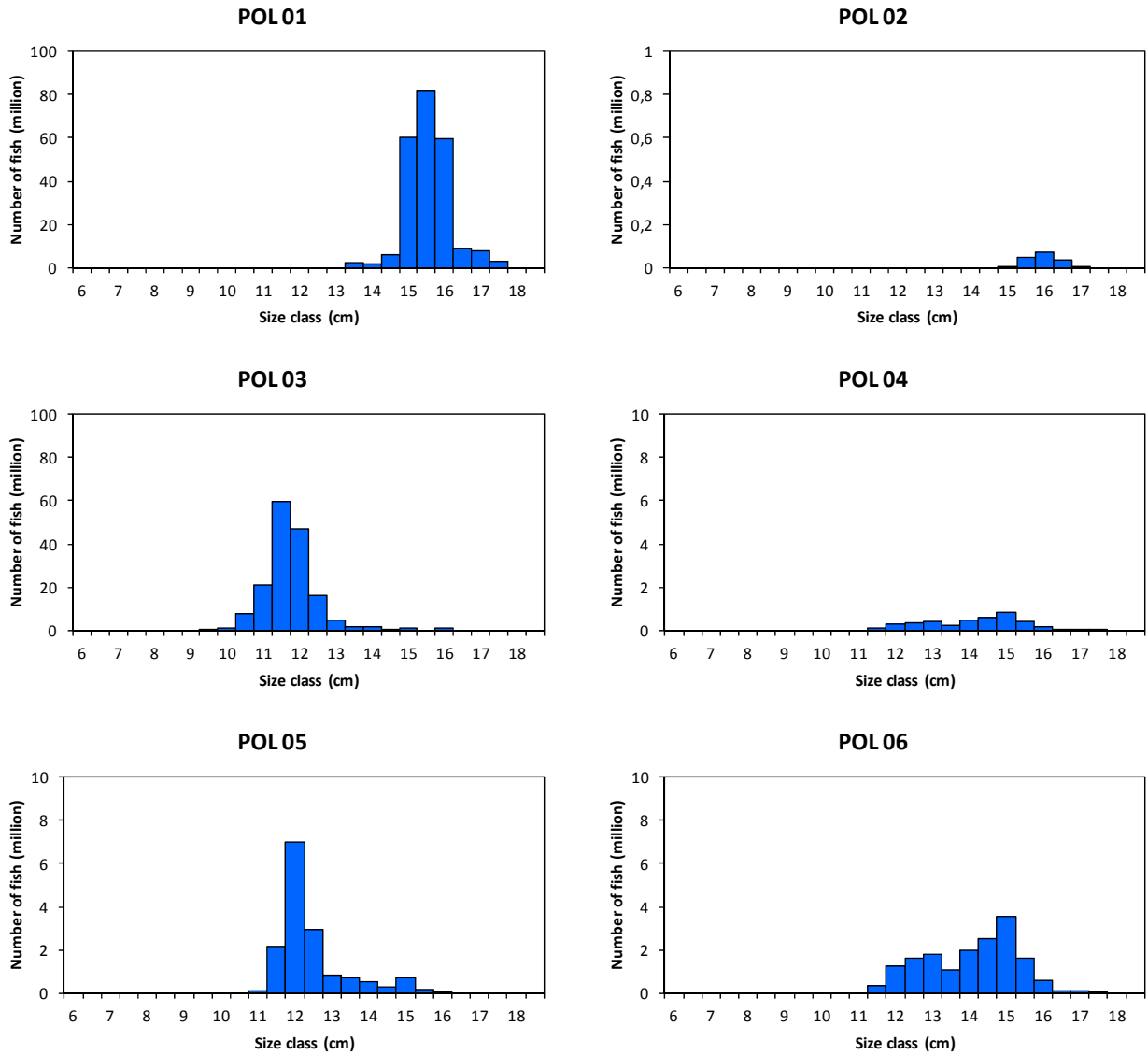
Figure 21. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 20**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ 2017-07: Sardine (*S. pilchardus*)

Figure 21. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Cont'd.

ECOCADIZ 2017-07: Sardine (*S. pilchardus*)
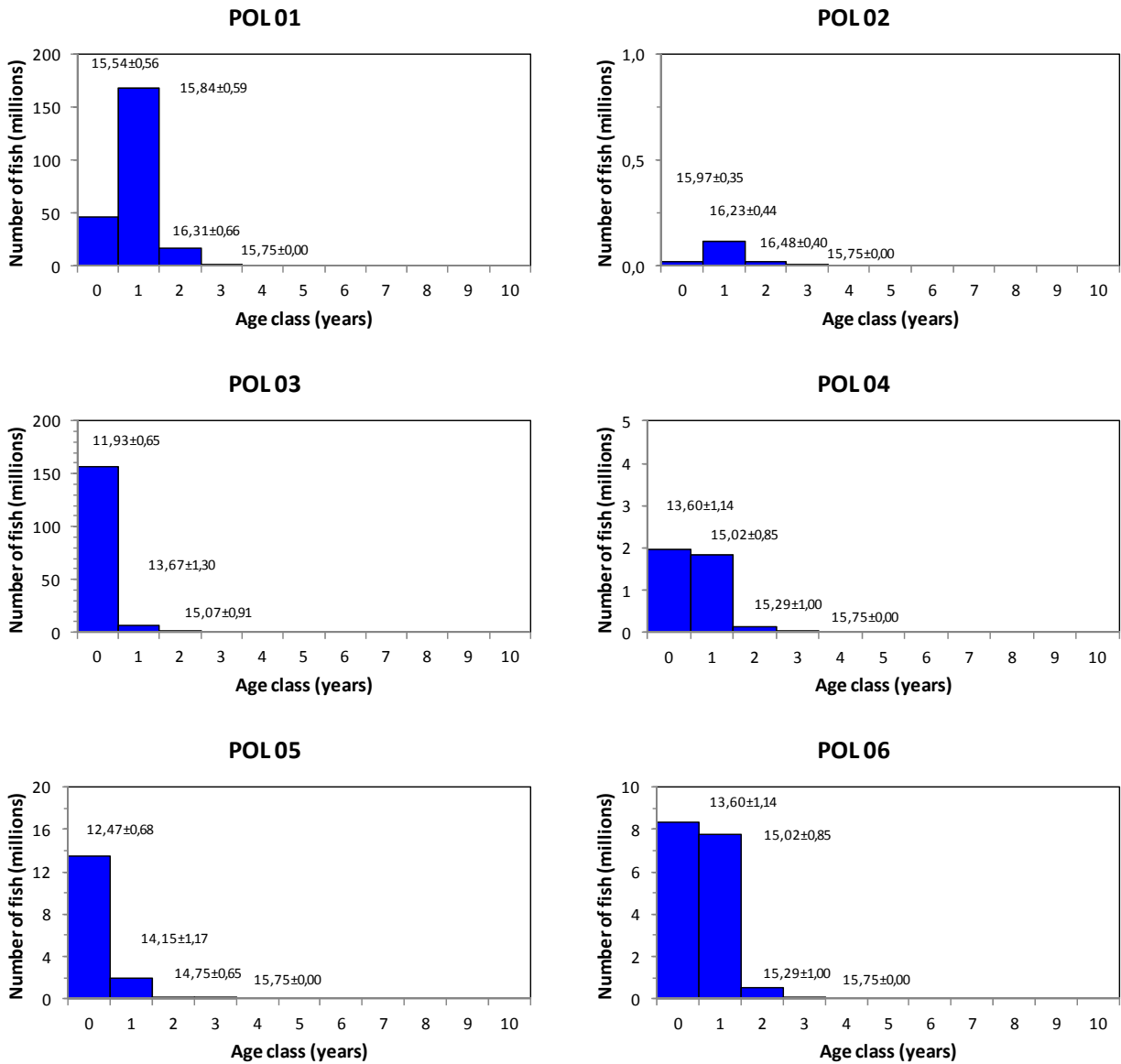
Figure 22. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 20**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ 2017-07: Sardine (*S. pilchardus*)
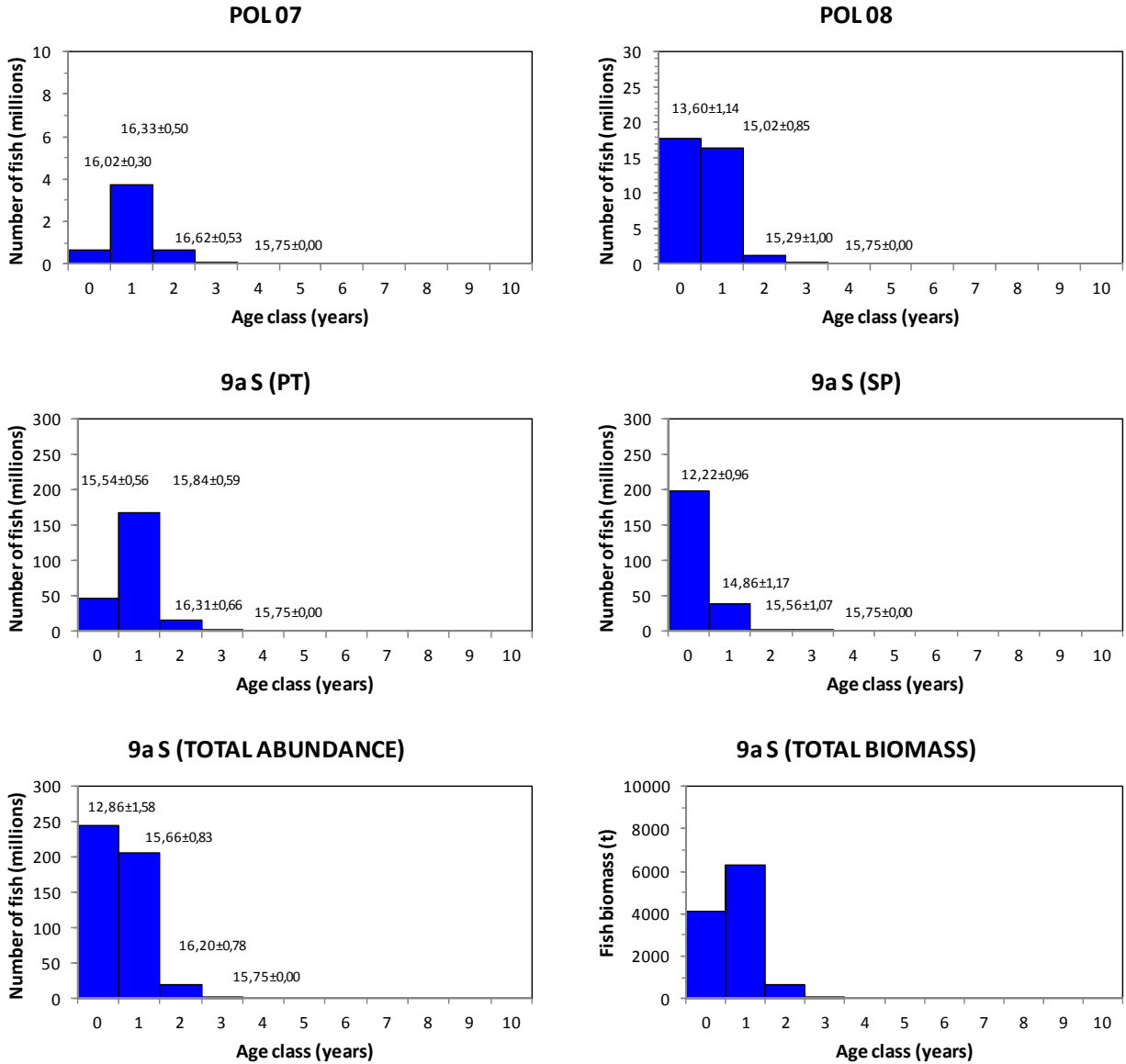
Figure 22. *ECOCADIZ 2017-07* survey. Sardine (*S. pilchardus*). Cont'd.
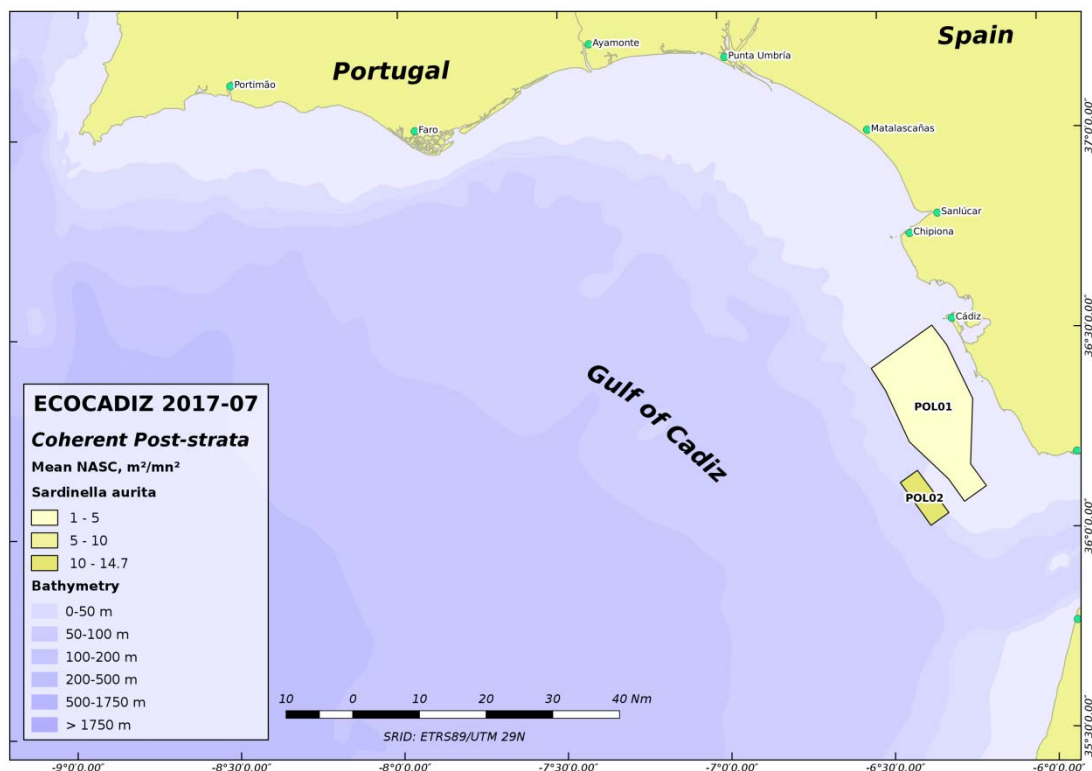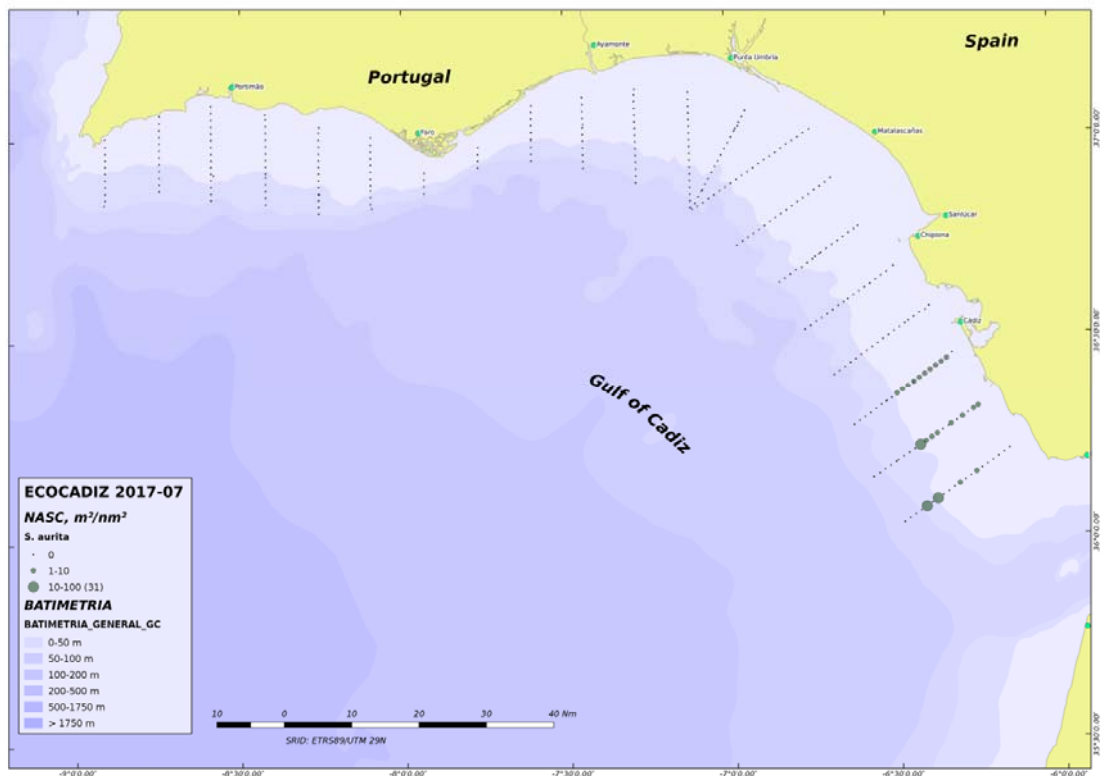
Figure 23. *ECOCADIZ 2017-07* survey. Round sardinella (*Sardinella aurita*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ 2017-07: Round sardinella (*S. aurita*)
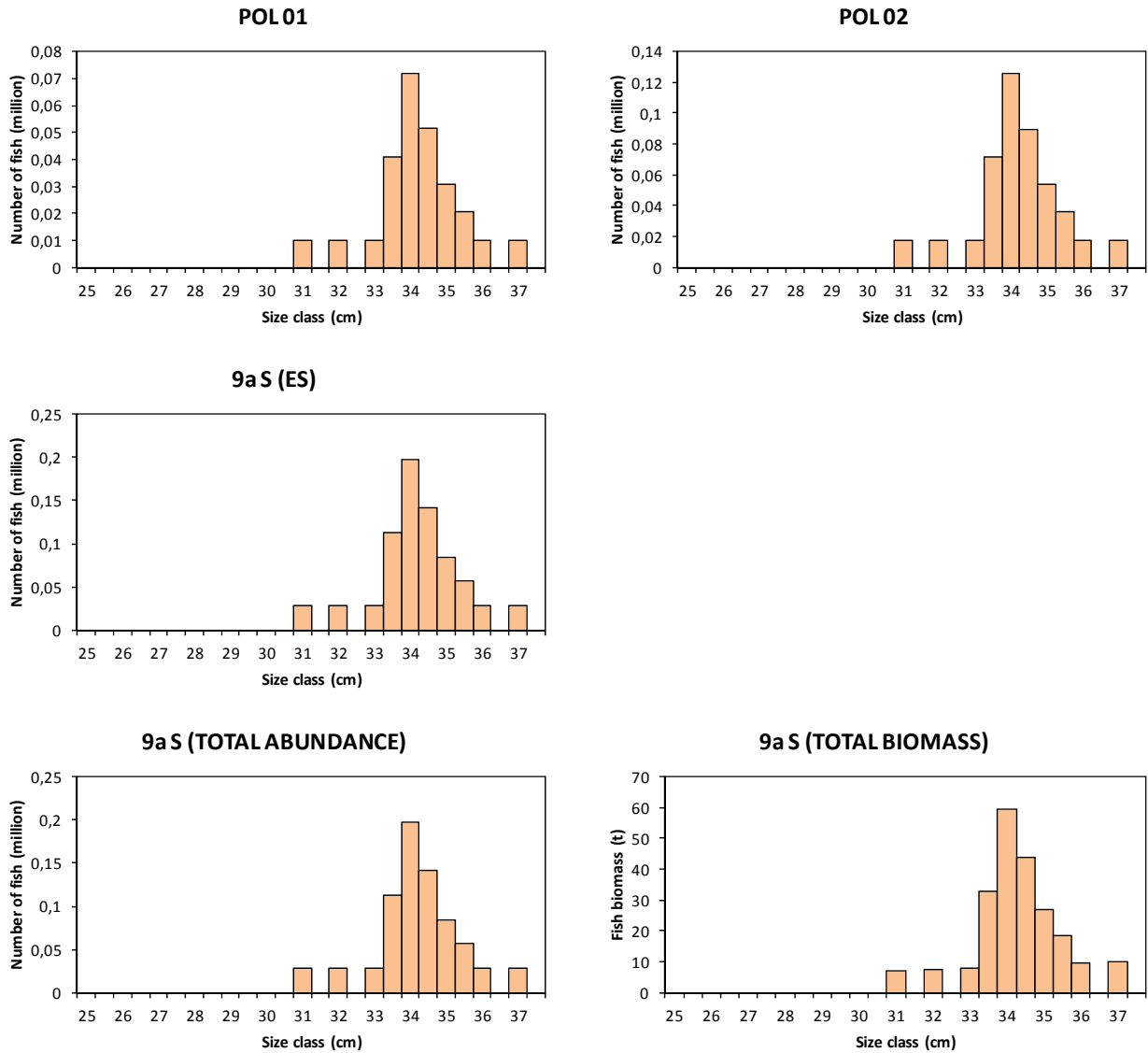
Figure 24. *ECOCADIZ 2017-07* survey. Round sardinella (*Sardinella aurita*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 23**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.
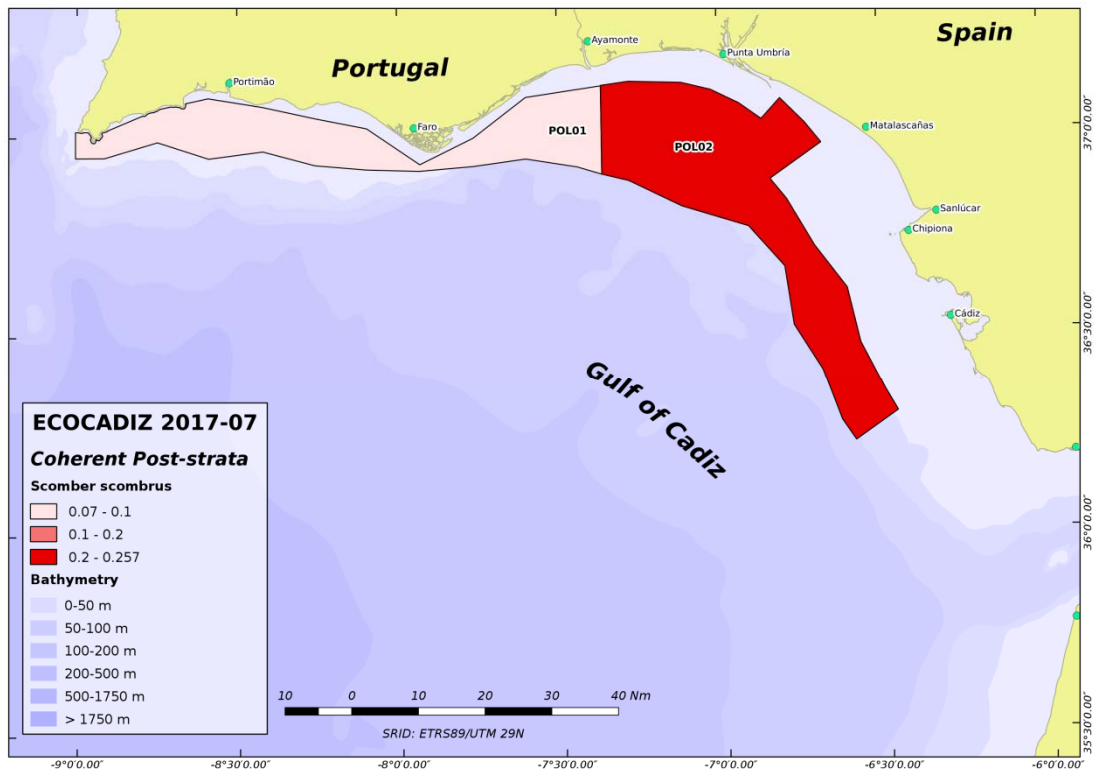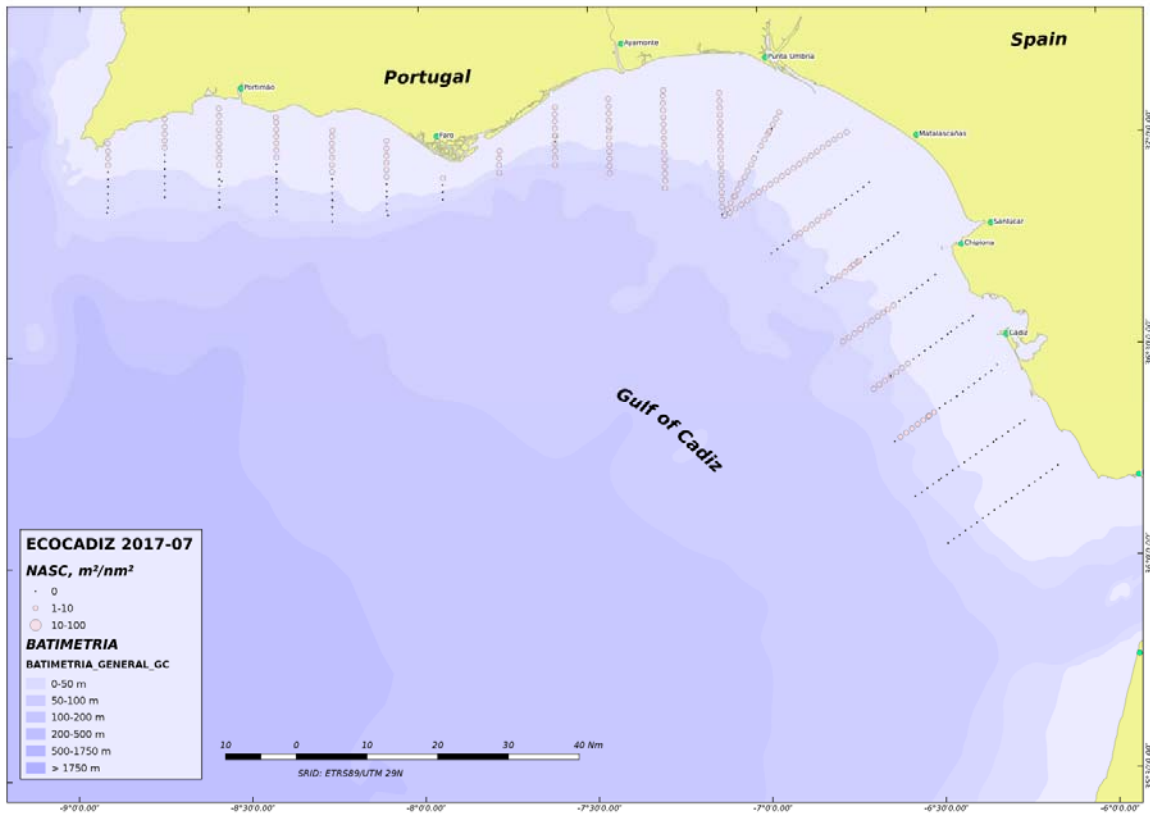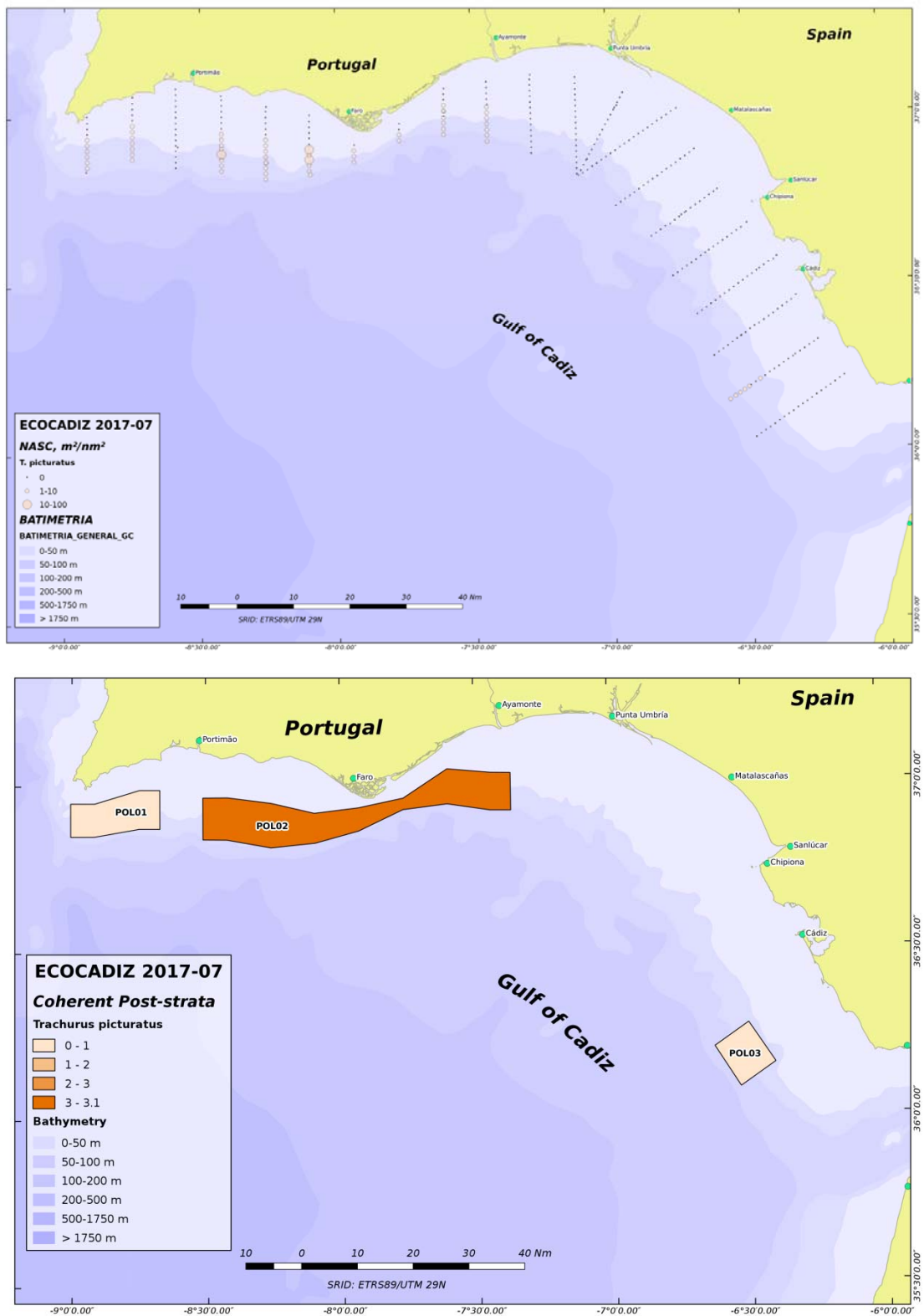
Figure 25. *ECOCADIZ 2017-07* survey. Mackerel (*Scomber scombrus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.
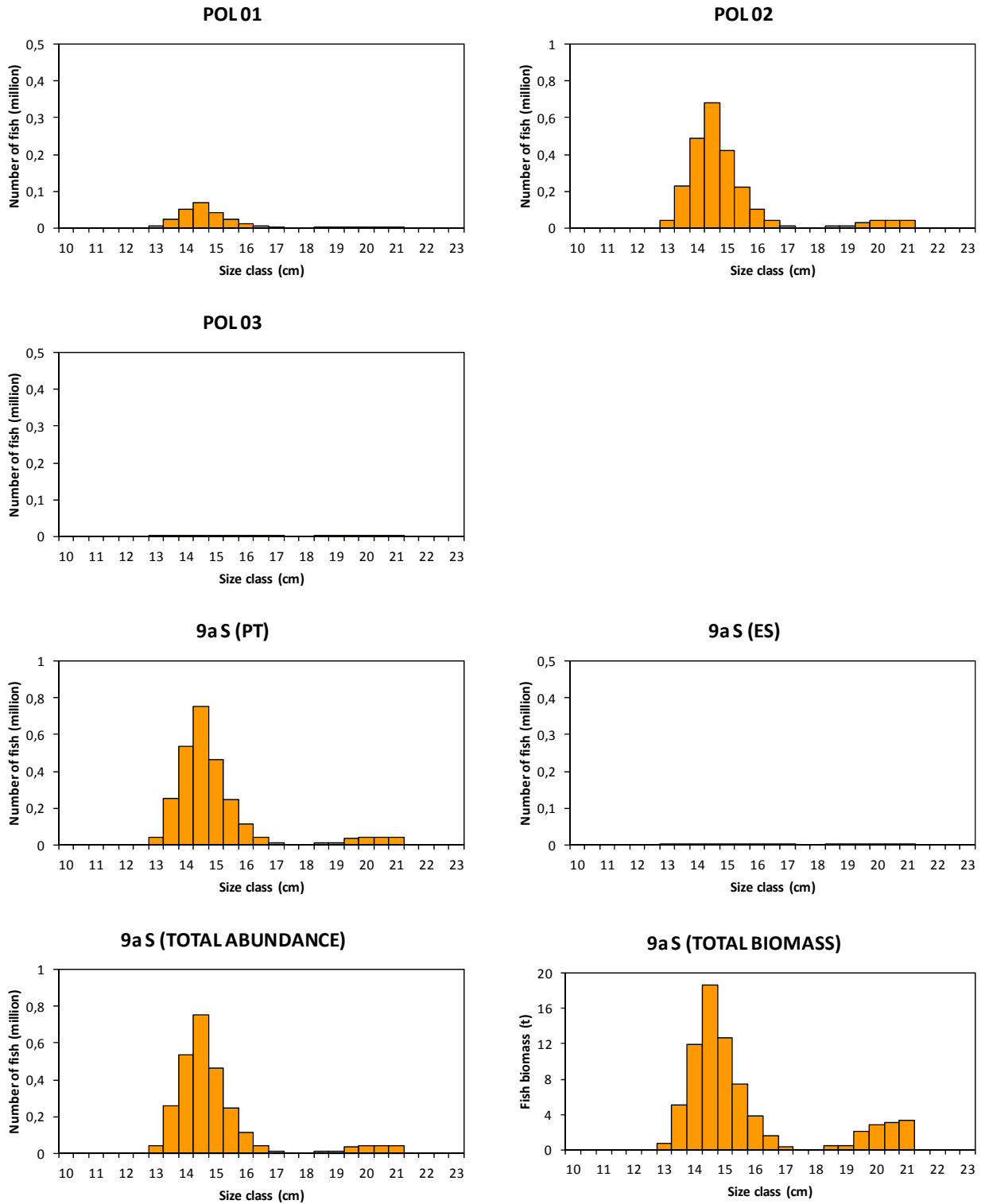
ECOCADIZ 2017-07: Mackerel (*S. scombrus*)

Figure 26. *ECOCADIZ 2017-07* survey. Mackerel (*Scomber scombrus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 25**) 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.
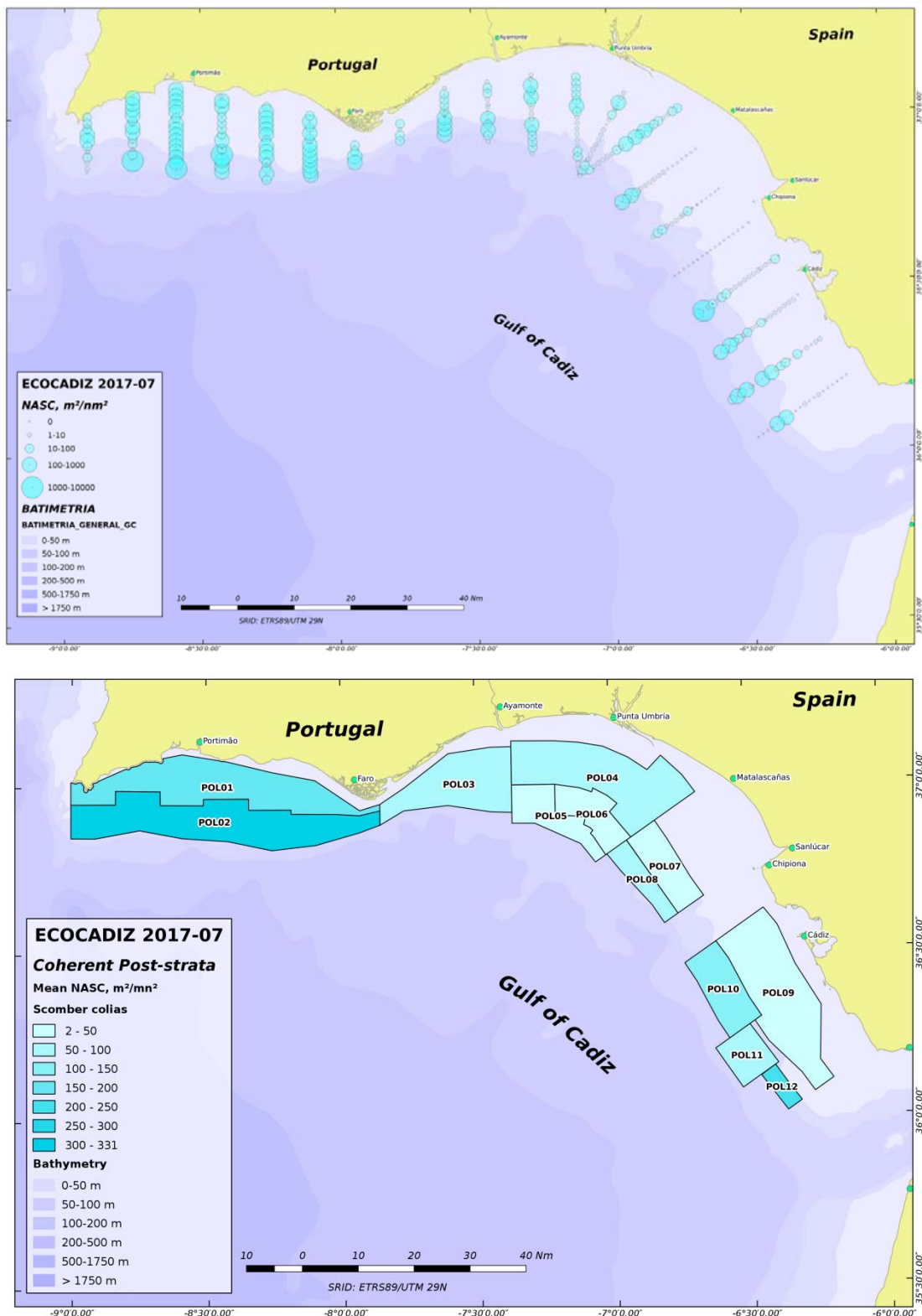
Figure 27. *ECOCADIZ 2017-07* survey. Chub mackerel (*Scomber colias*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

Figure 28. *ECOCADIZ 2017-07* 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 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 2017-07: Chub mackerel (*S. colias*)
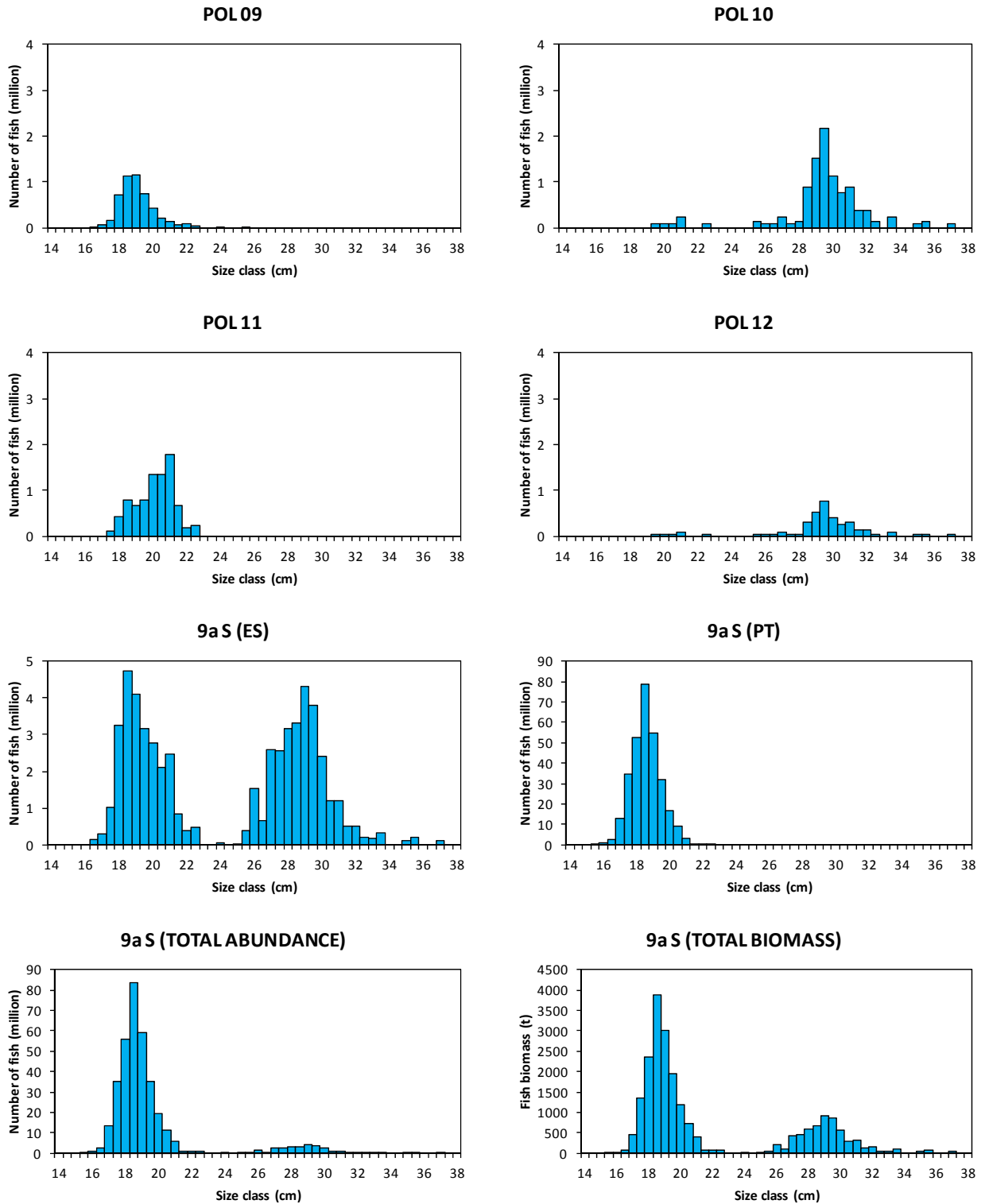
Figure 28. *ECOCADIZ 2017-07* survey. Chub mackerel (*Scomber colias*). Cont'd.

Figure 29. *ECOCADIZ 2017-07* survey. Blue jack mackerel (*Trachurus picturatus*). 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.
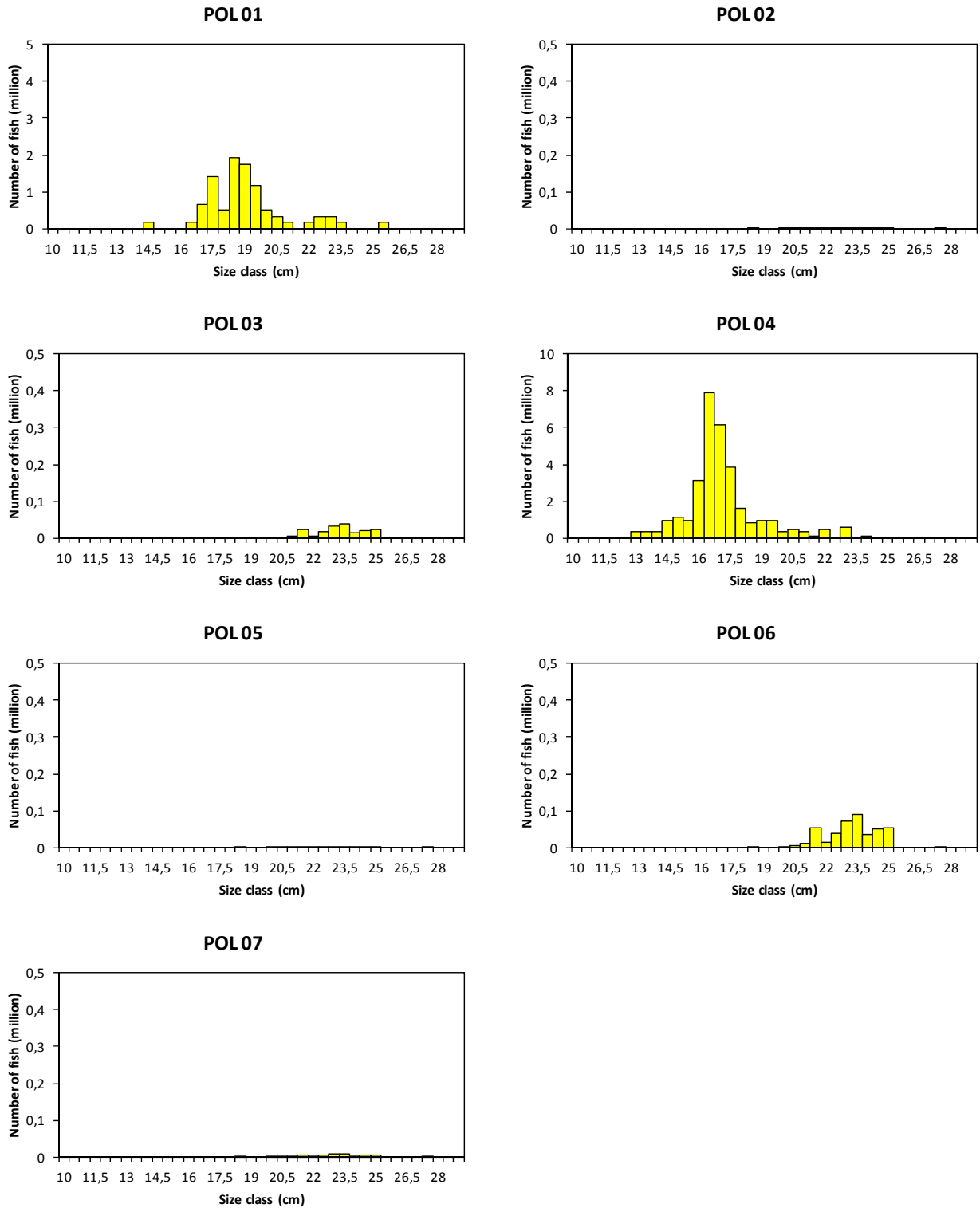
ECOCADIZ 2017-07: Blue jack mackerel (*T. picturatus*)

Figure 30. *ECOCADIZ 2017-07* survey. Blue jack mackerel (*Trachurus picturatus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 29**) 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.
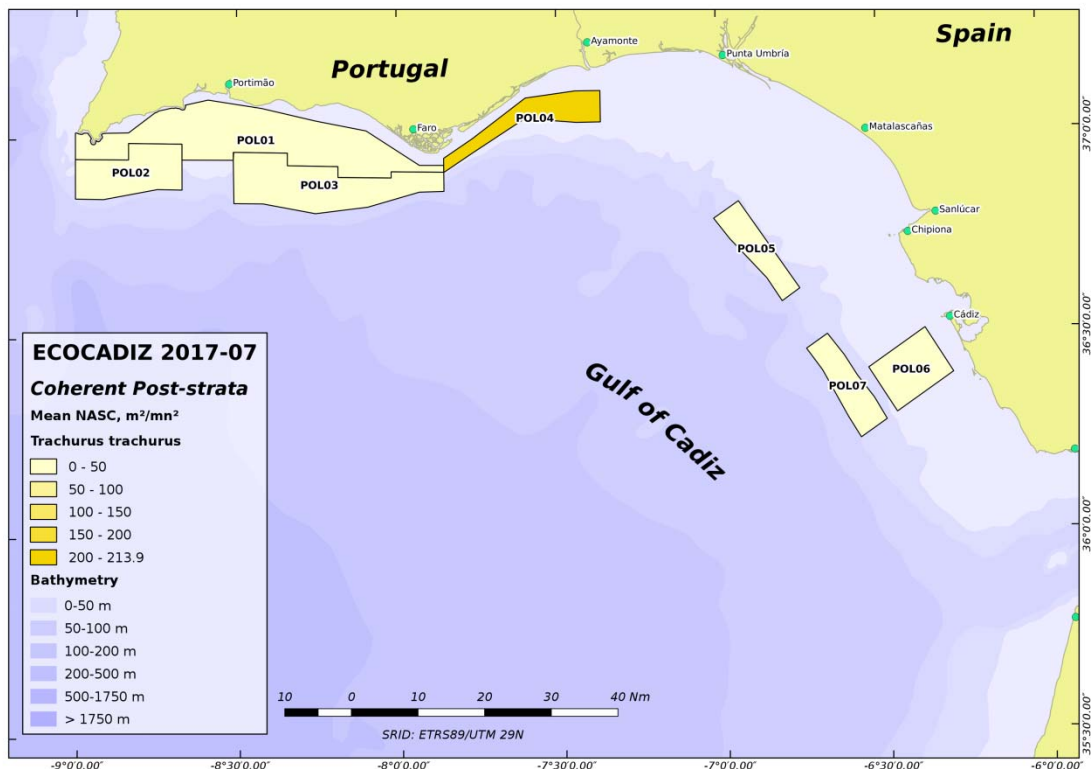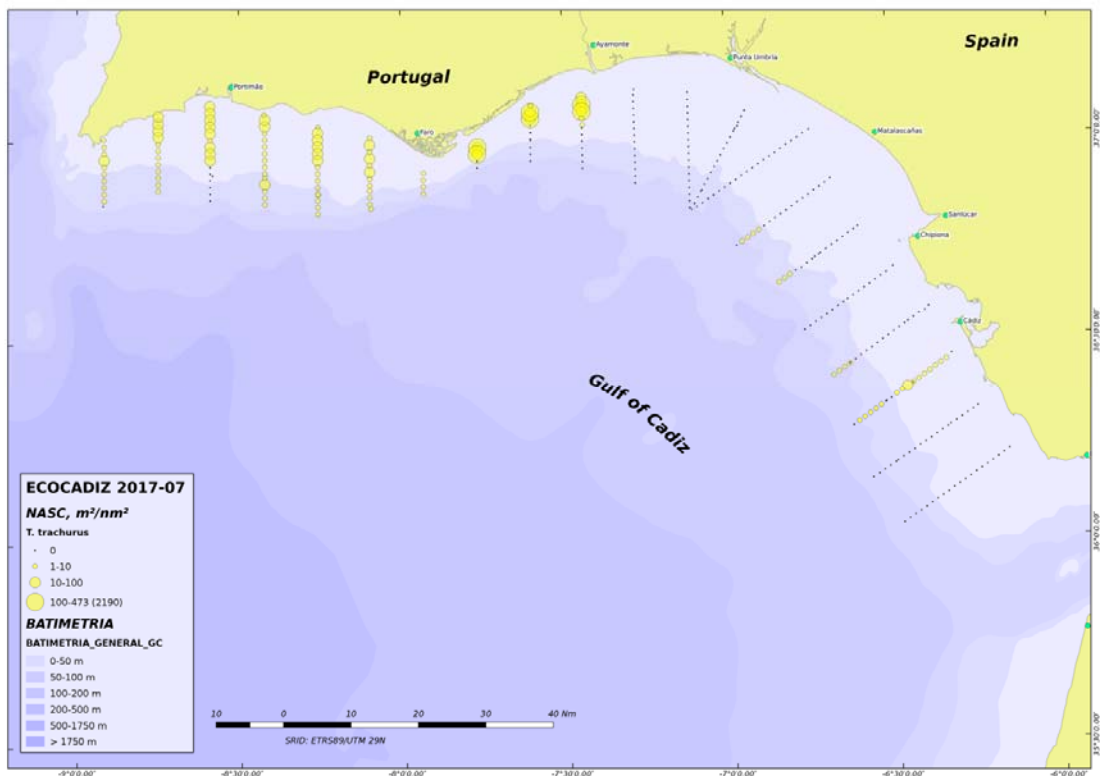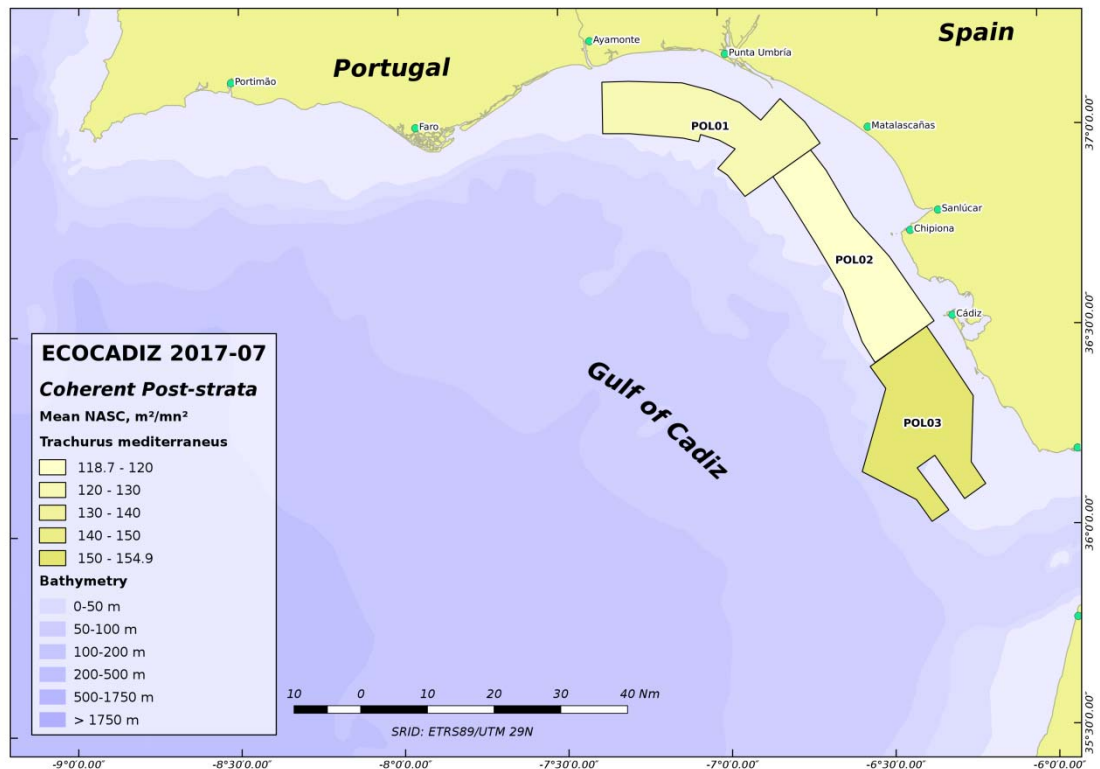
Figure 31. *ECOCADIZ 2017-07* survey. Horse mackerel (*Trachurus trachurus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

Figure 32. *ECOCADIZ 2017-07* 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 31**) 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 2017-07: Horse mackerel (*T. trachurus*)
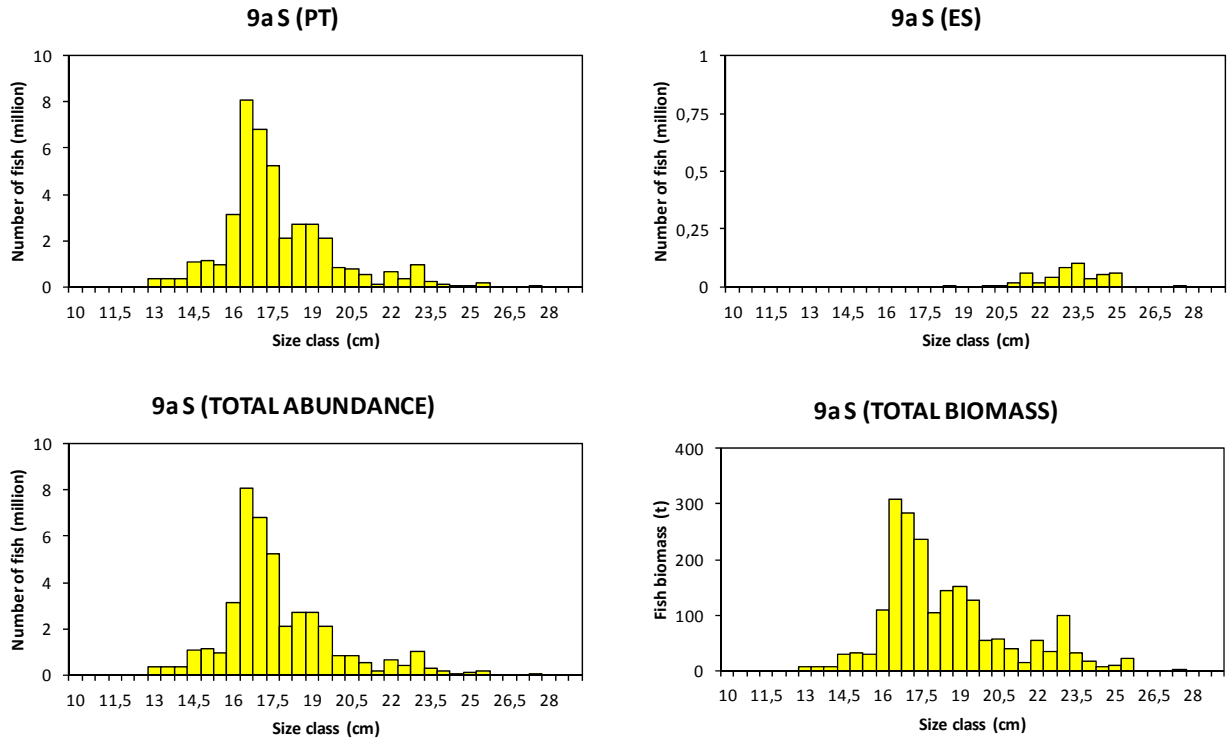
Figure 32. *ECOCADIZ 2017-07* survey. Horse mackerel (*Trachurus trachurus*). Cont'd.
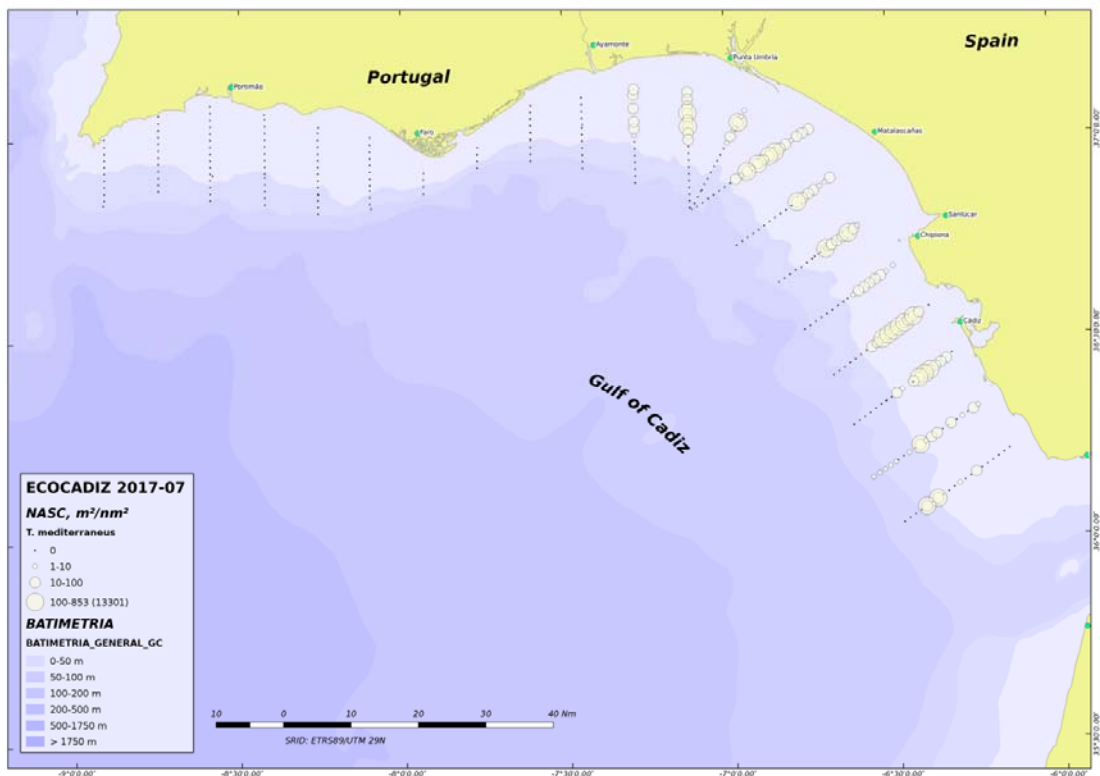
Figure 33. *ECOCADIZ 2017-07* survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

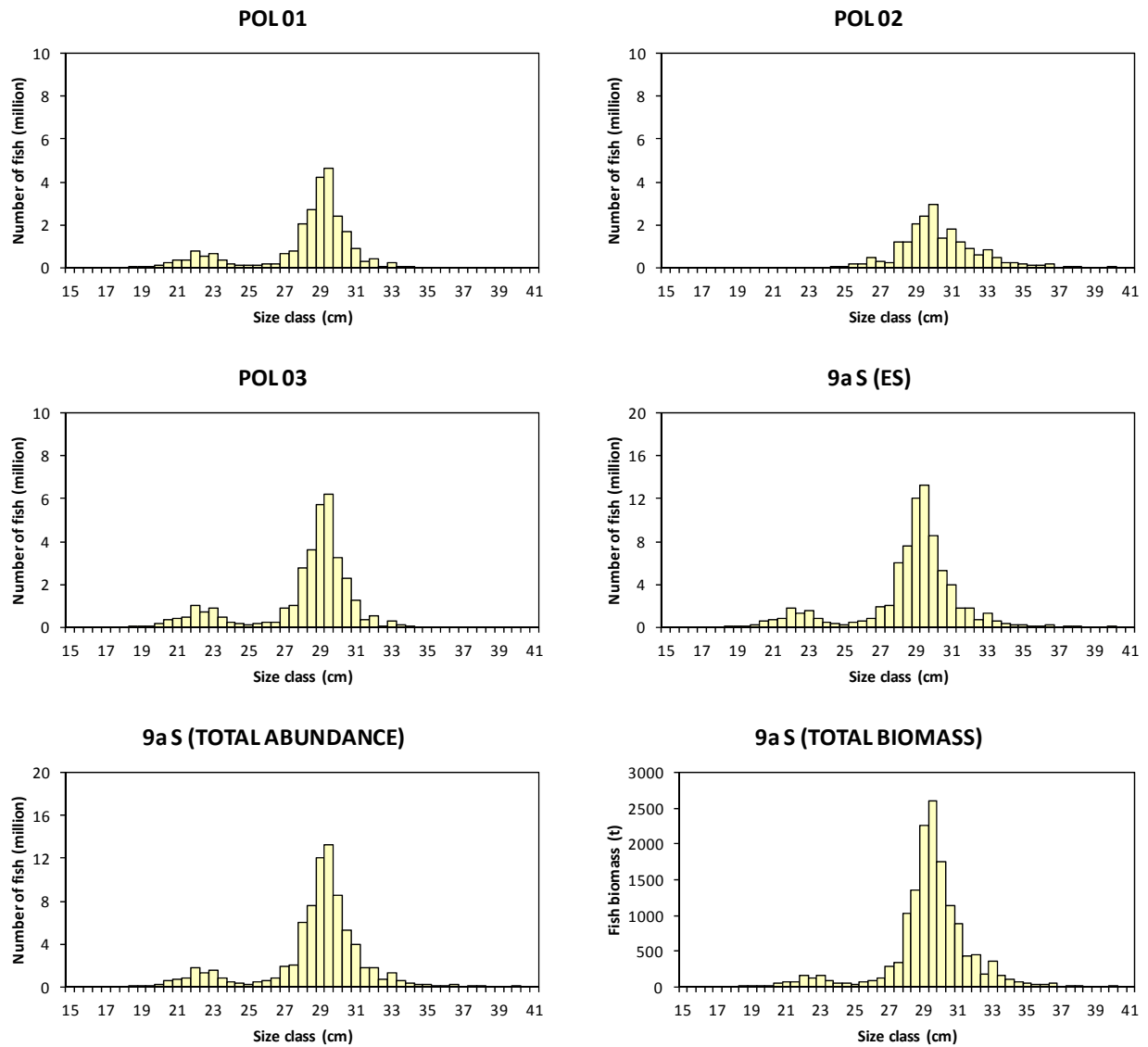**ECOCADIZ 2017-07: Mediterranean horse mackerel (*T. mediterraneus*)**

Figure 34. *ECOCADIZ 2017-07* 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 33**) 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.
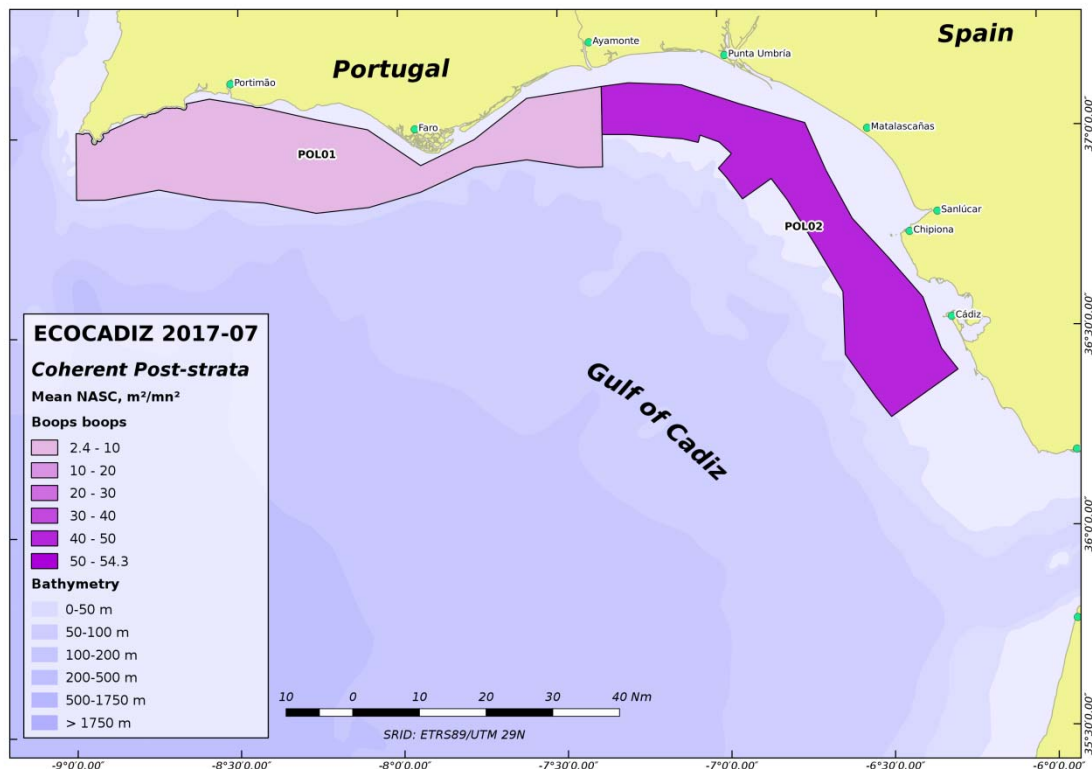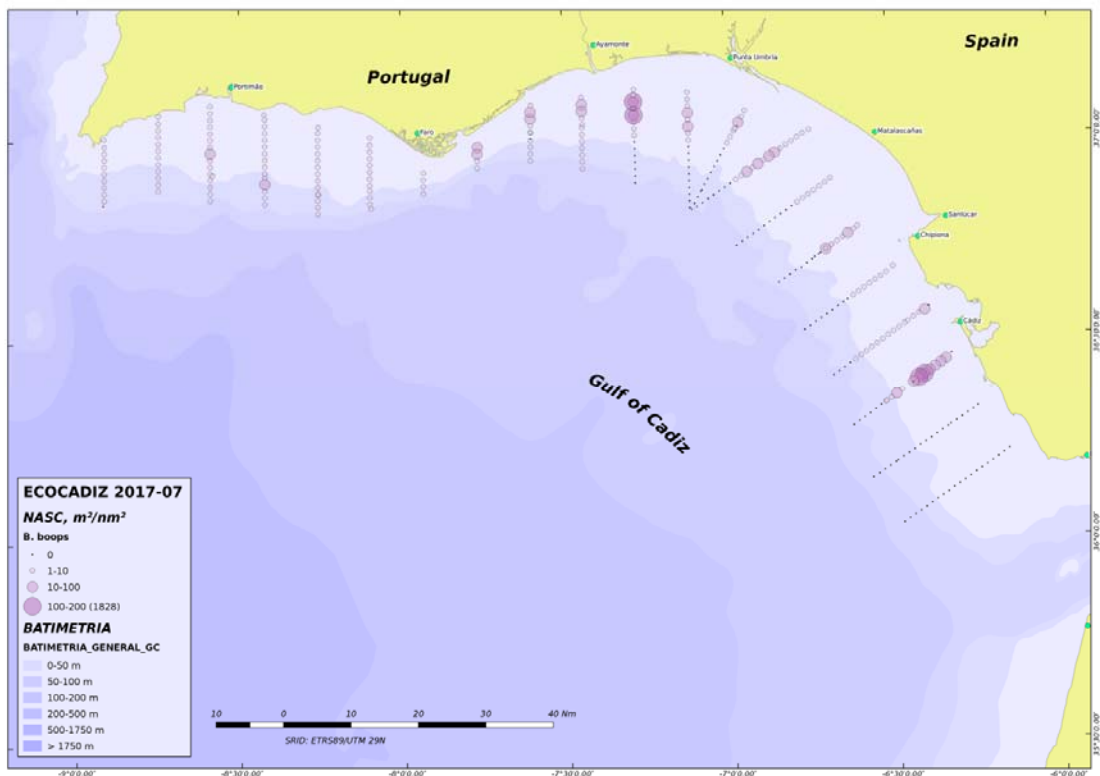
Figure 35. *ECOCADIZ 2017-07* survey. Bogue (*Boops boops*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ 2017-07: Bogue (*B. boops*)

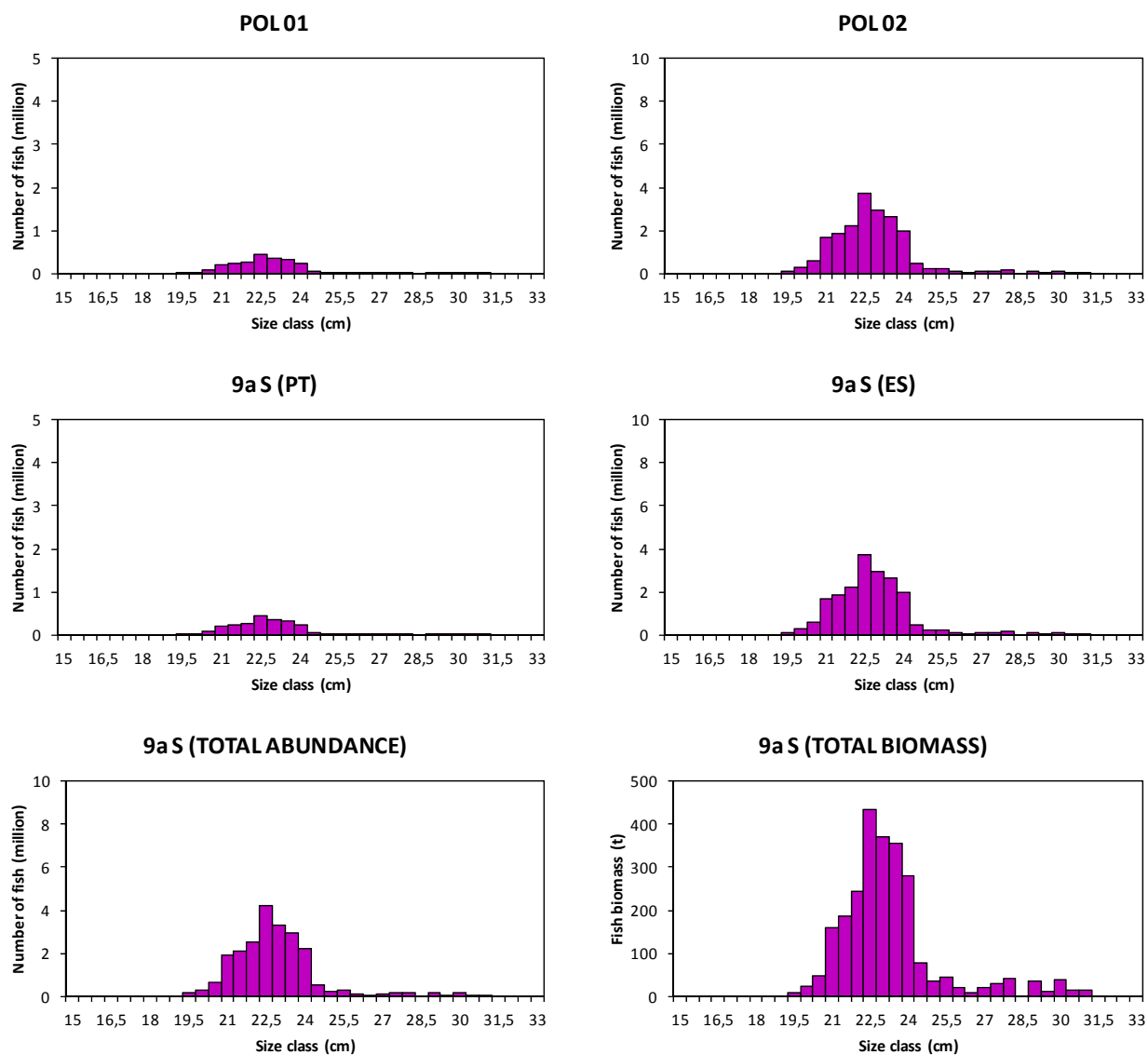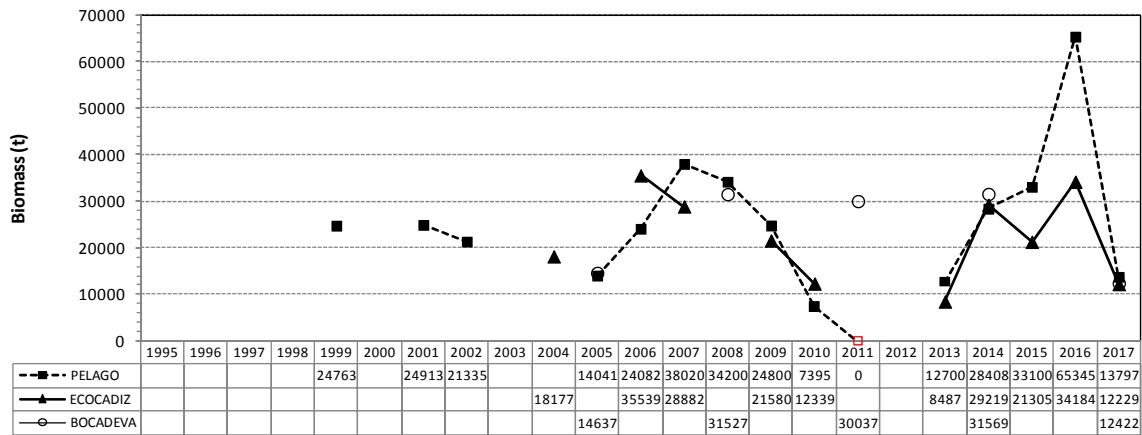**Figure 36.** *ECOCADIZ 2017-07* survey. Bogue (*Boops boops*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 35**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

Biomass trends (in tons)

Anchovy biomass estimates

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PELAGO					24763		24913	21335			14041	24082	38020	34200	24800	7395	0		12700	28408	33100	65345	13797
ECOCADIZ										18177		35539	28882		21580	12339			8487	29219	21305	34184	12229
BOCADEVA											14637			31527			30037			31569			12422

Sardine biomass estimates

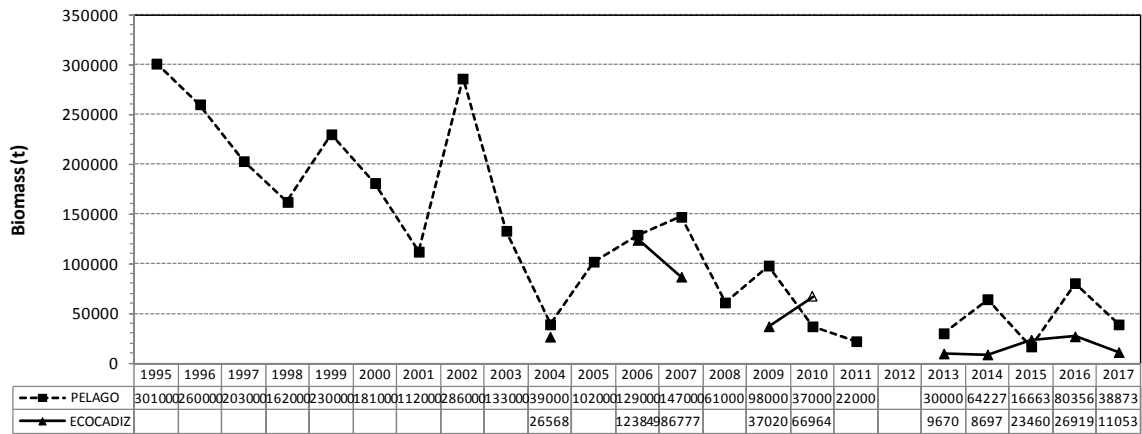|	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PELAGO	301000	260000	203000	162000	230000	181000	112000	286000	133000	39000	102000	129000	147000	61000	98000	37000	22000		30000	64227	16663	80356	38873
ECOCADIZ										26568		123849	86777		37020	66964			9670	8697	23460	26919	11053

Figure 37. Trends in biomass estimates (in tons) for the main assessed species in Portuguese (*PELAGO*) and Spanish (*ECOCADIZ* and *BOCADEVA*) survey series. Note that the *ECOCADIZ* survey in 2010 partially covered the whole study area. The anchovy null estimate in 2011 from the *PELAGO* survey should be considered with caution.