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Acoustic assessment and distribution of the main pelagic fish species in ICES Subdivision 9a South during the *ECOCADIZ 2019-07* Spanish survey (July-August 2019).

By

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ABSTRACT

The present working document summarises the main results obtained from the Spanish (pelagic ecosystem-) acoustic-trawl survey conducted by IEO between 31st July and 13rd August 2019 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 27 valid fishing hauls were carried out for echo-trace ground-truthing purposes. Chub mackerel was the most frequent species in the fishing hauls, followed by horse mackerel, anchovy, sardine, mackerel, blue jack mackerel, Atlantic pomfret (*Brama brama*) and bogue. Longspine snipefish, boarfish and transparent goby (*Aphia minuta*) showed a medium relative frequency of occurrence. Mediterranean horse-mackerel and pearlside showed a low occurrence. Pearlside was the most abundant species in these hauls, followed by sardine, chub mackerel, anchovy and longspine snipefish, with the remaining species showing negligible relative contributions. The estimate of total NASC allocated to the "pelagic fish species assemblage" has been the highest one ever recorded within the time series, denoting a high fish density during the survey. Such an increase is the result of the relatively high acoustic contributions of anchovy, sardine, chub mackerel, and the unexpected high contributions of the transparent goby and the Atlantic pomfret, species which usually have showed an accidental occurrence or very low abundance through the time-series. Anchovy was mainly distributed between Cape Santa Maria and Bay of Cadiz, although showing the highest densities in the Spanish central-western shelf waters. Anchovy eggs distribution resembled the adults' and, although overall egg density was higher than previous years, the spawning area showed a reduction as compared with the observed ones in previous years. Largest anchovies were mainly distributed in the westernmost waters and the smallest ones were concentrated between Doñana and Bay of Cadiz. Anchovy acoustic estimates in summer 2019 were of 5 485 million fish and 57 700 t (i.e. the historical biomass maximum in the time-series), well above the historical average (ca. 24 kt), showing a recent increasing trend. Sardine, widely distributed over the surveyed area, also recorded a high acoustic echo-integration in summer 2019 as a consequence of the occurrence of dense mid-water schools in the coastal fringe (20-60 m depth) comprised between Guadiana river mouth and Doñana. Acoustic estimates were of 2 917 million fish and 62 682 t, a biomass well above the historical average (ca. 47 kt). Spanish waters concentrated the bulk of the population. Chub mackerel was distributed all over the surveyed area but showing the highest densities in the Portuguese shelf waters. Acoustic estimates were of 465 million fish and 32 696 t, with the bulk of the population concentrated in the Portuguese waters, where the smallest fish were also recorded. Estimates showed a relative stable recent trend, with the recent biomasses very close to the historical average (ca. 35 kt).

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 2019-07* survey, namely the acoustic estimates of abundance and biomass (age-structured for anchovy, sardine and chub mackerel) and the spatial distribution of the assessed species.

MATERIAL AND METHODS

The *ECOCADIZ 2019-07* survey was carried out between 31st July and 13rd August 2019 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 2019* 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. 15 m-mean vertical opening pelagic trawl (*Tuneado* 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).

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, mackerel and horse-mackerel species, and bogue. Otoliths were dissected from anchovy, sardine and chub mackerel sampled specimens.

The following TS/length relationship table was used for acoustic estimation of assessed species (following recent IEO standards after ICES, 1998 and recommendations by ICES, 2006a,b. b_{20} values for transparent goby and Atlantic pomfret following to Foote, 1987 for physoclists):

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
Transparent goby (*Aphia minuta*)	-67.5
Atlantic pomfret (*Brama brama*)	-67.5
Blue whiting (*Micromesistius poutassou*)	-67.5
Silvery lightfish/pearlside (*Maurolicus muelleri*)	-72.2
Longspine snipefish (*Macroramphosus scolopax*)	-80.0
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.

A *Continuous Underway Fish Egg Sampler* (CUFES, 121 stations), 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 biological (ichthyoplankton and *in vivo* fluorescence) and hydrographical variables (sub-surface sea temperature and salinity). Vertical profiles of hydrographical variables were also recorded by night from 150 CTD casts distributed in 15 transects 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 six (26) *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 seven (27) 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**).

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. This type of hauls is also conducted in depths showing hard and/or very irregular bottoms or when the echotraces to be identified either are very scarce or very located in the bathymetric gradient. Given that all of these situations were not very uncommon in the sampled area, 41% of valid hauls (11 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 42-183 m.

During the survey were captured 2 Chondrichthyan, 37 Osteichthyes, 6 Cephalopod, 3 Crustacean and 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 table includes all the species under study and also those species with a higher occurrence than the former ones. 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 (24 hauls, 89% presence index) followed by horse mackerel and anchovy (with relative occurrences of 74 and 63%, respectively), sardine, mackerel, jack mackerel, Atlantic pomfret (*Brama brama*) and bogue (between 37 and 48%), snipefish, boarfish and transparent goby (*Aphia minuta*) (19-22%), Mediterranean horse-mackerel and pearlside (7% each one). Round sardinella was absent in the catches and the occurrence of blue whiting (4%) was incidental.

For the purposes of the acoustic assessment, anchovy, sardine, mackerel species, horse & jack mackerel species, bogue, goby, pomfret, snipefish and pearlside 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 25.9 tonnes and 841 thousand fish (**Table 3**). 49% of this fished biomass corresponded to chub mackerel, 33% to sardine, 8% to anchovy, and contributions lower than 3% to the remaining species. The most abundant species in ground-

truthing trawl hauls was pearlside (27%), followed by sardine (27%), chub mackerel (24%), anchovy (17%) and snipefish (3%), with the remaining species showing lower contributions than 1.5%.

Species	# of fishing stations	Occurrence (%)	Total weight (kg)	Total number
Merluccius merluccius	25	93	118,878	1054
Scomber colias	24	89	12658,800	199954
Trachurus trachurus	20	74	654,182	5566
Loligo subulata	19	70	6,465	1041
Engraulis encrasicolus	17	63	2036,631	144812
Sardina pilchardus	13	48	8498,372	216529
Loligo media	12	44	3,131	1124
Scomber scombrus	12	44	35,398	375
Trachurus picturatus	12	44	184,676	3560
Brama brama	11	41	666,044	945
Boops boops	10	37	24,650	216
Spondyliosoma cantharus	9	33	12,683	61
Trachinus draco	9	33	3,671	35
Diplodus annularis	8	30	4,804	77
Pagellus erythrinus	8	30	56,959	327
Alosa fallax	7	26	2,684	10
Macroramphosus scolopax	6	22	204,464	28328
Capros aper	5	19	7,486	1221
Aphia minuta	5	19	4,593	11844
Pagellus acarne	5	19	35,573	108
Illex coindetii	5	19	1,100	29
Polybius henslowi	4	15	5,520	311
Diplodus bellottii	4	15	13,982	234
Lepidopus caudatus	4	15	0,138	5
Spicara flexuosa	3	11	15,226	243
Diplodus vulgaris	3	11	62,924	362
Chelidonichthys obscurus	2	7	0,214	2
Zeus faber	2	7	4,286	3
Trachurus mediterraneus	2	7	320,380	661
Maurolicus muelleri	2	7	167,214	226431
Loligo vulgaris	2	7	0,134	2
Lepidotrigla cavillone	1	4	0,088	3
Arnoglossus laterna	1	4	0,004	1
Mola mola	1	4	54,000	1
Microchirus boscanion	1	4	0,022	2
Raja clavata	1	4	0,368	1
Goneplax rhomboides	1	4	0,003	1
Micromesistius poutassou	1	4	0,022	1

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 was captured between Cape Santa María and Cape Trafalgar, although the highest yields were recorded in the Spanish central waters. The size composition of anchovy catches confirms the usual pattern exhibited by the species in the area during the survey season, with the largest fish inhabiting the westernmost waters and the smallest ones concentrated in the surroundings of the Guadalquivir river mouth and adjacent shallow waters (**Figure 6**). Sardine catches showed a quite similar distribution to the

above described for anchovy, but showing the highest yields in the surroundings of the Cadiz Bay and between Cape Santa María and the Guadiana river mouth. Juvenile sardines were mainly captured in the shallowest hauls conducted in the coastal fringe between Matalascañas 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, pomfret and transparent goby were restricted to the central and easternmost Spanish waters. The size composition of these last species in fishing hauls is shown in **Figures 8** to **18**.

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

A total of 328 nmi (ESDU) from 21 transects has been acoustically sampled by echo-integration for assessment purposes. From this total, 214 nmi (11 transects) were sampled in Spanish waters, and 114 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	VAM	HOM	HMM	JAA	BOG	FIM	POA	SNS	MAV
Total Area	259503	50456	74313	44	45335	6474	4904	2744	1265	12772	45617	6273	9307
(%)	(100,0)	(19,4)	(28,6)	(0,02)	(17,5)	(2,5)	(1,9)	(1,1)	(0,5)	(4,9)	(17,6)	(2,4)	(3,6)
Portugal	71465	10780	1402	2	43856	4889	0	2717	1206	0	0	6272	341
(%)	(27,5)	(21,4)	(1,9)	(4,5)	(96,7)	(75,5)	(0,0)	(99,0)	(95,3)	(0,0)	(0,0)	(99,9)	(3,7)
Spain	188038	39675	72910	41	1479	1585	4904	27	60	12772	45617	1	8967
(%)	(72,5)	(78,6)	(98,1)	(93,2)	(3,3)	(24,5)	(100,0)	(1,0)	(4,7)	(100,0)	(100,0)	(0,1)	(96,3)

For this "pelagic fish assemblage" has been estimated a total of 259 503 m^2 nmi^{-2}, the highest estimate ever recorded within the time-series (**Figure 19**). Portuguese waters accounted for 28% of this total back-scattering energy and the Spanish waters the remaining 72%. 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 19**. By species, anchovy (29%), sardine (19%), pomfret and chub mackerel (18% each) were the most important species in terms of their contributions to the total back-scattering energy. Transparent goby (5%), pearlside (4%), Atlantic and Mediterranean horse mackerel and snipe fish (2-3%) were the following species in importance. The remaining species contributed with less than 1%.

Some inferences on the species' distribution may be carried out from regional contributions to the total energy attributed to each species: Mediterranean horse mackerel, pomfret, transparent goby, sardine, pearlside, mackerel and anchovy seemed to show greater densities in the Spanish waters, whereas chub mackerel, blue jack mackerel, horse mackerel, bogue and snipefish could be considered as typically "Portuguese species" in this survey.

According to the resulting values of integrated acoustic energy, the species acoustically assessed in the present survey finally were anchovy, sardine, mackerel, chub mackerel, blue jack mackerel, horse mackerel, Mediterranean horse mackerel, bogue, transparent goby, Atlantic pomfret, longspine snipefish and pearlside.

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 post-strata considered for the acoustic estimation are shown in **Figure 20**. The estimated abundance and biomass by size class and age group are given in **Tables 5** and **6**, and **Figures 21** and **22**.

Anchovy was mainly distributed between Cape Santa Maria and Bay of Cadiz, although showing the highest densities in the Spanish shelf waters between El Rompido (RA10) and Bay of Cadiz (RA03) (**Figure 20**).

Five (5) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing stations (**Figure 20**). The acoustic estimates by homogeneous post-stratum and total area are shown in **Table 5** and **Figure 21**. Overall acoustic estimates in summer 2019 were of 5485 million fish and 57 700 tonnes. By geographical strata, the Spanish waters yielded 99% (5405 million) and 97% (56 139 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 80 million and 1560 t. The current biomass estimate (57 700 t) becomes in the historical maximum within the time-series (2006: 35 539 t; 2016: 34 184 t; 2018: 34 908 t; see **Figure 48**). The *PELAGO 19* spring Portuguese survey previously estimated for this same area 29 876 t (3 398 million), with all the anchovy located in the Spanish waters.

The size class range of the assessed population varied between the 8.5 and 17.5 cm size classes, with one main modal class at 12.0 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 (**Table 5; Figure 21;** see also **Figure 6**).

The population was composed by fishes not older than 2 years. As it has been happening in the last years, during the 2018 survey some recruitment (age 0 fish) has also been recorded, probably as a consequence of the delayed survey dates. In fact, age 0 fish accounted for 42 and 30% of the total estimated abundance and biomass, respectively. Age 1 fish represented 55% and 66% of the total abundance and biomass (**Table 6**; **Figure 22**).

The Gulf of Cadiz anchovy egg distribution from CUFES sampling is shown in **Figure 23**. Anchovy egg distribution and densities in summer 2019 are quite coincident with that of adults. The estimated total egg density is higher than the observed in the most recent years but the spawning area showed a reduction as compared with those observed ones in previous years.

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 post-strata considered for the acoustic estimation are shown in **Figure 24**. Estimated abundance and biomass by size class and age group are given in **Tables 7** and **8**, and **Figures 25** and **26**.

Sardine also recorded a high acoustic echo-integration in summer 2019 as a consequence of the occurrence of dense mid-water schools in the coastal fringe (20-60 m depth) comprised between Ayamonte (RA11) and Doñana (RA06), (**Figure 24**).

Seven (7) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 24**). The estimates of Gulf of Cadiz sardine abundance and biomass in summer 2019 were 2 917 million fish and 62 682 t (**Table 7**), a biomass well above the historical average (ca. 47 kt), but lower than the biomass estimated in 2018 (114 631 t; see **Figure 48**). Spanish waters concentrated the bulk of the population (2 495 million and 44 899 t). The estimates for the Portuguese waters were 422 million and 17 783 t.

Sizes of the assessed population ranged between 10.5 and 20.0 cm size classes. The length frequency distribution of the population was clearly bimodal, with one main mode at 11.5 cm size class and a secondary one at 15.0 cm (**Table 7**; **Figure 25**). The relatively important juvenile fraction in the estimated population (≤11.5 cm), was mainly located in relatively shallow waters along the coastal fringe comprised between Matalascañas and the Bay of Cadiz (**Table 7**; **Figure 25**; see also **Figure 7**).

The population was composed by fishes not older than 3 years, with the 61% of the estimated numbers belonging to the age group 0 (40% of the estimated biomass; **Table 8**; **Figure 26**). Age 1 sardines accounted for 39% and 59% of the abundance and biomass of the whole population, respectively. Age 0 sardines occurred almost exclusively in Spanish waters (99% of the age 0 fish estimated in the entire Gulf), where they also were the dominant age group (71% and 55% of abundance and biomass). Age 1 fish was the dominant age group in the Portuguese waters (95% in abundance and biomass), although only accounted 23% of the one year olds estimated in the whole surveyed area.

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 and the coherent post-strata considered for the acoustic estimation are shown in **Figure 27**. Estimated abundance and biomass by size class are given in **Table 9** and **Figure 28**.

Atlantic mackerel showed very scattered and low acoustic records during the 2019 survey, which were mainly observed over the shelf located in the central part of the Gulf of Cadiz (**Figure 27**). Juveniles were mainly recorded in the Spanish outer shelf central waters, whereas larger fish occurred in shallower waters.

Three (3) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 27**). The estimates of Gulf of Cadiz mackerel abundance and biomass in summer 2019 were 22 million fish and 1 115 t (**Table 9**). Spanish waters concentrated the bulk of the population (20 million and 1 049 t). The estimates for the Portuguese waters were 1 million and 66 t.

The size class range of the assessed population varied between the 15.5 and 33.0 cm size classes, with one main modal class at 17.0 cm (juvenile/sub-adult fish) and secondary modes at 28.5 and 32.5 cm (**Table 9**, **Figure 28**).

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 and the coherent post-strata considered for the acoustic estimation are shown in **Figure 29**. Estimated abundance and biomass by size class and age group are given in **Tables 10** and **11**, and **Figures 30** and **31**.

Chub mackerel was widely distributed in the surveyed area, although the highest densities occurred all over the Portuguese shelf waters. In the Spanish waters the species occurred in the middle-outer shelf waters, where the largest fish were also found (**Figure 29**).

Five (5) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 29**). The estimates of Gulf of Cadiz chub mackerel abundance and biomass in summer 2019 were 465 million fish and 32 696 t (**Table 10**). These estimates and the most recent ones show a relative stable recent trend, with biomasses very close to the historical average (ca. 35 kt; see **Figure 48**). Portuguese waters concentrated the bulk of the population (454 million and 31 536 t). The estimates for the Spanish waters were 11 million and 1 159 t.

Sizes of the assessed population ranged between 16.5 and 27.5 cm size classes. The length frequency distribution of the population was clearly mixed, with one main mode at 19.5 cm size class and a secondary one at 23.5 cm (**Table 10**; **Figure 30**).

The population was composed by fishes not older than 3 years, with the 49% of the estimated numbers belonging to the age group 1 (51% of the estimated biomass; **Table 11**; **Figure 31**). Age 0 fish accounted for 35% and 26% of the abundance and biomass of the whole population, respectively. Age 0 occurred almost exclusively in Portuguese waters (99% of the age 0 fish estimated in the entire Gulf), where they accounted for 35% and 27% of abundance and biomass. Age 1 fish was the dominant age group in the Portuguese waters (49% in abundance and 51% in biomass), and accounted 98% of the one year olds estimated in the whole surveyed area.

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 and the coherent post-strata considered for the acoustic estimation are illustrated in **Figure 32**. Estimated abundance and biomass by size class are given in **Table 12** and **Figure 33**.

The species was mainly distributed all over the Portuguese outer shelf waters. An incidental occurrence was also recorded in the Spanish easternmost waters. The surveyed population was composed by juveniles and sub-adults (**Figure 32**).

Five (5) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 32**). The estimates of blue jack mackerel abundance and biomass in summer 2019 were 31 million fish and 2 291 t (**Table 12**). Portuguese waters concentrated the bulk of the population (30 million and 2 272 t). The estimates for the Spanish waters were 1 million and 19 t.

The size class range of the assessed population was comprised between the 13.5 and 25.5 cm size classes, with one main modal class at 23.0 cm and a secondary mode at 15.0 cm (**Table 12**, **Figure 33**).

Horse mackerel

The survey's length-weight relationship for horse mackerel is shown in **Table 4**. The distribution of the back-scattering energy attributed to this species and the coherent post-strata considered for the acoustic estimation are illustrated in **Figure 34**. Estimated abundance and biomass by size class are given in **Table 13** and **Figure 35**.

Horse mackerel showed a quite similar distribution pattern to the abovementioned one for blue jack mackerel, with the species being almost absent in the easternmost shelf and showing relatively higher

densities in the shelf area comprised between Cape San Vicente and Cape Santa Maria. Juveniles were scarce and occurred incidentally in the Spanish outer shelf central waters (**Figure 34**).

Four (4) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 34**). The estimates of horse mackerel abundance and biomass in summer 2019 were 51 million fish and 6 156 t (**Table 13**). Portuguese waters concentrated the bulk of the population (39 million and 4 592 t). The estimates for the Spanish waters only were 1 million and 19 t.

The size class range of the assessed population was comprised between the 14.5 and 31.5 cm size classes, with one main modal class at 25.0 cm and a very residual secondary mode at 15.5 cm (**Table 13**, **Figure 35**).

Mediterranean horse-mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Back-scattering energy attributed to the species and the coherent post-strata are represented in **Figure 36**. Estimated abundance and biomass by size class are given in **Table 14** and **Figure 37**.

Mediterranean horse mackerel was restricted, as usual, to the Spanish waters, more specifically between Doñana and Sancti-Petri, with the population being composed by adult fish (**Figure 36**).

Two (2) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 36**). The estimates of Mediterranean horse mackerel abundance and biomass in summer 2019 were 15 million fish and 7 170 t (**Table 14**).

The size class range of the assessed population was comprised between the 32.0 and 46.0 cm size classes, with one main modal class at 38.5-39.0 cm and a secondary mode at 42.0 cm (**Table 14**, **Figure 37**).

Bogue

Parameters of the survey's length-weight relationship for bogue are shown in **Table 4**. Back-scattering energy attributed to bogue and their coherent post-strata for the acoustic assessment are shown in **Figure 38**. Estimated abundance and biomass by size class are given in **Table 15** and **Figure 39**.

Bogue showed a distribution pattern quite similar to the described ones for blue jack mackerel and horse-mackerel, with a very incidental occurrence in Spanish waters (just in front of the Bay of Cadiz) and the highest densities being recorded in the westernmost waters of the Gulf (**Figure 38**).

Two (2) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 38**). The estimates of bogue abundance and biomass in summer 2019 were 8 million fish and 863 t (**Table 15**). Portuguese waters concentrated the bulk of the population (7 million and 823 t). The estimates for the Spanish waters only were 0.4 million and 41 t.

The size class range of the assessed population was comprised between the 19.0 and 26.0 cm size classes, with one main modal class at 22.0 cm (**Table 15**, **Figure 39**).

Transparent goby

Parameters of the survey's length-weight relationship for transparent goby are shown in **Table 4**. Back-scattering energy attributed to the species and coherent post-strata are shown in **Figure 40**. Estimated abundance and biomass by size class are given in **Table 16** and **Figure 41**.

This gobiid species showed this year unusually high acoustic integration and densities, which were exclusively recorded over the inner-middle shelf waters of the Spanish part of the Gulf, between Mazagón and Bay of Cadiz. Its occurrence was associated to the typical (plankton-) scattering layer recorded close to the bottom in the Guadalquivir river mouth's influence area (**Figure 40**).

Two (2) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 40**). The estimates of transparent goby abundance and biomass in summer 2019 were 8 million fish and 863 t (**Table 16**).

The size class range of the assessed population was comprised between the 2.0 and 5.5 cm size classes, with one modal class at 4.5 cm (**Table 16**, **Figure 41**).

Atlantic pomfret

Parameters of the survey's length-weight relationship for *Brama brama* are shown in **Table 4**. Back-scattering energy attributed to the species and coherent post-strata are shown in **Figure 42**. Estimated abundance and biomass by size class are given in **Table 17** and **Figure 43**.

The Atlantic pomfret showed an unexpected high frequency of occurrence and abundance in the fishing hauls not recorded in previous surveys. The species acoustically contributed with 17% of the total NASC recorded in the survey, although it was restricted to the Spanish middle-outer shelf waters (**Figure 42**).

One (1) size-based homogeneous sector was delimited for the acoustic assessment (**Figure 42**). The estimates of Atlantic pomfret abundance and biomass in summer 2019 were 8 million fish and 62 573 t (**Table 17**).

The size class range of the assessed population was comprised between the 35.5 and 51.5 cm size classes, with one main modal class at 41.5 cm (**Table 17**, **Figure 43**).

Longspine snipefish

The survey's length-weight relationship for this species is shown in **Table 4**. Back-scattering energy attributed to the species and coherent post-strata are represented in **Figure 44**. Estimated abundance and biomass by size class are given in **Table 18** and **Figure 45**.

M. scolopax showed an incidental occurrence mainly restricted to the westernmost outer shelf waters just to the west of Portimão (**Figure 44**).

Three (3) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 44**). The estimates of snipefish abundance and biomass in summer 2019 were 2 931 million fish and 22 468 t (**Table 18**). Portuguese waters concentrated the bulk of the population (2 931 million and 22 465 t). The estimates for the Spanish waters only were 0.4 million and 3 t.

The size class range of the assessed population was comprised between the 10.0 and 12.5 cm size classes, with one modal class at 11.0 cm (**Table 18**, **Figure 45**).

Pearlside

The survey's length-weight relationship for this species is shown in **Table 4**. Back-scattering energy attributed to the species and coherent post-strata are illustrated in **Figure 46**. Estimated abundance and biomass by size class are given in **Table 19** and **Figure 47**.

Pearlside was located close to the deepest limit of the surveyed area (200 m), just in the transition between outer shelf and upper slope waters. The highest densities were recorded in the Spanish outer shelf (**Figure 46**).

Three (3) size-based homogeneous sectors were delimited for the acoustic assessment (**Figure 46**). The estimates of pearlside abundance and biomass in summer 2019 were 4 615 million fish and 3 412 t (**Table 19**). Spanish waters concentrated the bulk of the population (4 413 million and 3 262 t). The estimates for the Portuguese waters were 203 million and 150 t.

The size class range of the assessed population was comprised between the 3.0 and 5.5 cm size classes, with one modal class at 4.0 cm (**Table 19**, **Figure 47**).

(SHORT) DISCUSSION

The total NASC estimated in this survey for "pelagic fish assemblage", 259 503 m^2 nmi^{-2}, is the highest estimate ever recorded within the time-series (**Figure 19**), a situation which was repeated in the last year's survey. In the current survey such an increase in acoustic energy is the result of the relatively high partial contributions of anchovy, sardine, chub mackerel (as was also the case the last year), and the unexpected high contributions of the transparent goby and the Atlantic pomfret, species which usually have showed an accidental occurrence or very low abundance through the time-series. Anchovy has shown an increased contribution in relation to the one recorded last year, but almost exclusively restricted to the Spanish waters. In many of the anchovy positive hauls, this species was the dominant in terms of numbers and weight. Sardine also showed during the 2019 survey the occurrence of dense schools in the coastal (20-60 m) waters in the central part of the Gulf (between the Guadiana river mouth and Doñana), although not so numerous as in the 2018 survey.

The current anchovy biomass estimate (57 700 t) becomes in the historical maximum within the time-series (2006: 35 539 t; 2018: 34 908 t; see **Figure 48**) and denotes a strong increase in relation to the previous years, up to levels well above the historical average (ca. 24 kt), showing a recent increasing trend. Although the spring *PELAGO 19* survey also estimated increased population levels (29 876 t), such increase was not so pronounced as the estimated by its summer counterpart.

The estimates of Gulf of Cadiz sardine abundance and biomass in summer 2019 were 2 917 million fish and 62 682 t, a biomass well above the historical average (ca. 47 kt), but lower than the biomass estimated the previous year (114 631 t, **Figure 48**).

Chub mackerel acoustic estimates were of 465 million fish and 32 696 t, with the bulk of the population concentrated in the Portuguese waters, where the smallest fish were also recorded. Estimates showed a relative stable recent trend, with the recent biomasses very close to the historical average (ca. 35 kt; **Figure 48**).

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Table 1. *ECOCADIZ 2019-07 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	01/08/19	36º 12,975' N	6º 08,870' W	06:06	23	36º 02,200' N	6º 28,800' W	10:02	241
R02	Sancti-Petri	01/08/19	36º 08,890' N	6º 34,190' W	11:04	149	36º 19,350' N	6º 14,860' W	14:48	28
R03	Cádiz	02/08/19	36º 26,712' N	6º 19,122' W	06:00	25	36º 17,150' N	6º 36,730' W	09:42	201
R04	Rota	02/08/19	36º 24,510' N	6º 40,720' W	10:39	200	36º 34,881' N	6º 21,885' W	00:00	20
R05	Chipiona	03/08/19	36º 31,220' N	6º 46,330' W	06:06	201	36º 40,347' N	6º 29,483' W	09:30	20
R06	Doñana	03/08/19	36º 46,610' N	6º 35,780' W	10:23	20	36º 38,050' N	6º 51,520' W	13:50	241
R07	Matalascañas	04/08/19	36º 54,300' N	6º 39,340' W	05:59	20	36º 44,006' N	6º 58,304' W	10:05	208
R08	Mazagón	04/08/19	36º 49,450' N	7º 06,060' W	13:58	192	37º 01,060' N	6º 44,720' W	17:36	23
R09	Punta Umbría	05/08/19	37º 03,902' N	6º 56,385' W	06:01	27	36º 49,663' N	7º 06,613' W	09:38	200
R10	El Rompido	05/08/19	36º 50,110' N	7º 07,200' W	13:20	156	37º 07,950' N	7º 07,190' W	16:38	21
R11	Isla Cristina	06/08/19	37º 06,762' N	7º 17,190' W	06:02	25	36º 53,379' N	7º 17,156' W	08:27	200
R12	V.R. do Sto. Antonio	06/08/19	36º 51,310' N	7º 27,130' W	10:52	129	37º 06,420' N	7º 27,140' W	13:25	21
R13	Tavira	07/08/19	37º 04,780' N	7º 37,140' W	06:00	20	36º 56,950' N	7º 37,090' W	06:44	214
R14	Fuzeta	07/08/19	36º 59,122' N	7º 47,076' W	15:44	44	36º 55,480' N	7º 47,040' W	16:06	65
R15	Cabo Sta. María	08/08/19	36º 55,590' N	7º 57,010' W	06:00	65	36º 52,070' N	7º 56,960' W	6:20	214
R16	Quarteira	08/08/19	36º 49,750' N	8º 06,880' W	10:26	111	37º 01,760' N	8º 07,040' W	11:38	20
R17	Albufeira	09/08/19	37º 01,452' N	8º 16,979' W	06:10	31	36º 49,376' N	8º 16,788' W	07:21	198
R18	Alfanzina	09/08/19	36º 50,290' N	8º 26,770' W	11:56	193	37º 04,550' N	8º 27,030' W	15:29	21
R19	Portimao	10/08/19	37º 05,990' N	8º 37,050' W	06:02	24	36º 51,270' N	8º 36,740' W	08:00	203
R20	Burgau	10/08/19	36º 51,960' N	8º 46,690' W	13:15	200	37º 02,644' N	8º 46,985' W	15:40	44
R21	Ponta de Sagres	11/08/19	36º 59,160' N	8º 56,800' W	05:59	26	36º 50,610' N	8º 56,610' W	06:49	208

Table 2. *ECOCADIZ 2019-07* survey. Descriptive characteristics of the fishing stations.

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	01-08-2019	36º 02.8258 N	6º 27.5187 W	118.26	36º 04.6665 N	6º 24.2185 W	92.6	08:17	09:02	0:45	1:10	3.246	R01	Cape Trafalgar
PE02	01-08-2019	36º 12.2035 N	6º 28.0417 W	100.28	36º 10.4644 N	6º 31.2328 W	120.76	12:07	12:50	0:43	1:12	3.113	R02	Sancti-Petri
PE03	02-08-2019	36º 22.2477 N	6º 27.1795 W	62.66	36º 24.1798 N	6º 23.7697 W	49.62	07:17	08:08	0:51	1:17	3.362	R03	Cádiz
PE04	02-08-2019	36º 23.9902 N	6º 39.4744 W	175.4	36º 25.6666 N	6º 40.9363 W	183.04	11:37	12:05	0:27	1:02	2.048	R04	Rota
PE05	02-08-2019	36º 29.0500 N	6º 32.7102 W	73.03	36º 27.2992 N	6º 35.7808 W	96.73	13:34	14:16	0:42	1:07	3.032	R04	Rota
PE06	03-08-2019	36º 37.4764 N	6º 35.0545 W	46.66	36º 35.7088 N	6º 38.0509 W	68.01	07:41	08:23	0:41	1:02	2.989	R05	Chipiona
PE07	03-08-2019	36º 39.8023 N	6º 48.2119 W	108.63	36º 41.6428 N	6º 44.9131 W	79.21	12:03	12:49	0:45	1:11	3.228	R06	Doñana
PE08	04-08-2019	36º 48.2986 N	6º 47.7196 W	57.98	36º 51.2457 N	6º 50.2405 W	57.49	07:47	8:37	0:50	1:10	3.572	R07	Matalascañas
PE09	04-08-2019	36º 47.1990 N	6º 52.5756 W	94.96	36º 45.3591 N	6º 55.7908 W	118.79	11:50	12:35	0:45	1:11	3.17	R07	Matalascañas
PE10	04-08-2019	36º 53.5684 N	6º 55.1256 W	72.92	36º 55.4394 N	6º 56.9512 W	69.32	15:26	15:59	0:33	0:59	2.374	R08	Mazagón
PE11	05-08-2019	36º 58.8694 N	6º 59.2051 W	54.47	37º 00.7732 N	7º 01.8807 W	48.83	07:21	08:03	0:41	1:16	2.865	R09	Punta Umbría
PE12	05-08-2019	36º 52.7992 N	7º 03.8962 W	109.65	36º 50.4193 N	7º 05.2735 W	141.78	12:09	12:46	0:37	1:05	2.621	R09	Punta Umbría
PE13	05-08-2019	36º 58.1839 N	7º 07.1824 W	81.75	36º 55.8414 N	7º 07.1809 W	99.68	14:34	15:07	0:32	0:57	2.34	R10	El Rompido
PE14	06-08-2019	36º 58.9606 N	7º 27.0352 W	105.34	36º 56.8828 N	7º 27.0894 W	135.35	11:36	12:05	0:28	0:56	2.076	R12	Vila Real do Santo Antonio
PE15	06-08-2019	37º 04.6033 N	7º 25.0948 W	43.02	37º 04.6153 N	7º 28.6036 W	44.79	14:31	15:10	0:39	0:59	2.808	R12	Vila Real do Santo Antonio
PE16	07-08-2019	36º 57.8844 N	7º 35.8137 W	126.63	36º 58.3597 N	7º 39.6316 W	124.62	07:51	08:34	0:42	1:20	3.096	R13	Tavira
PE17	07-08-2019	36º 59.7265 N	7º 35.1627 W	103.56	36º 59.1631 N	7º 37.8753 W	103.27	12:09	12:41	0:31	1:02	2.245	R13	Tavira
PE18	07-08-2019	37º 03.4497 N	7º 34.8718 W	45.56	37º 02.8950 N	7º 37.0614 W	42.44	14:09	14:35	0:25	0:47	1.838	R13	Tavira
PE19	08-08-2019	36º 54.6022 N	7º 56.9863 W	77.54	36º 52.6036 N	7º 56.9668 W	108.33	07:03	07:31	0:28	1:01	1.996	R15	Cape Santa María
PE20	08-08-2019	36º 57.7930 N	8º 06.8919 W	44.07	36º 56.3266 N	8º 06.8956 W	48.78	12:14	12:34	0:20	0:51	1.464	R16	Quarteira
PE21	08-08-2019	36º 51.8557 N	8º 05.6689 W	111.81	36º 50.7514 N	8º 07.9687 W	107.01	14:18	14:48	0:29	1:07	2.15	R16	Quarteira
PE22	09-08-2019	36º 50.5998 N	8º 15.6259 W	118.65	36º 51.9970 N	8º 18.5947 W	116.37	08:50	09:29	0:39	1:06	2.761	R17	Albufeira
PE23	09-08-2019	36º 57.2746 N	8º 26.9154 W	85.23	36º 53.8497 N	8º 26.8420 W	123.63	13:13	14:01	0:48	1:14	3.421	R18	Alfanzina
PE24	10-08-2019	36º 52.8750 N	8º 36.7405 W	115.4	36º 55.0627 N	8º 36.7875 W	101.16	08:34	09:04	0:30	0:58	2.185	R19	Portimao
PE25	10-08-2019	36º 52.3045 N	8º 35.9494 W	114.11	36º 52.8616 N	8º 38.8939 W	117.34	11:35	12:09	0:34	1:04	2.427	R19	Portimao
PE26	10/08/2019	36º 56.9764 N	8º 46.7872 W	109.7	36º 55.4947 N	8º 46.7656 W	113.93	14:16	14:36	0:20	0:46	1.48	R20	Burgau
PE27	11/08/2019	36º 51.7239 N	8º 56.6149 W	145.45	36º 54.4681 N	8º 56.6929 W	116.09	7:22	8:01	0:38	1:09	2.741	R21	Ponta de Sagres

Table 3. *ECOCADIZ 2019-07* survey. Catches by species in number (upper panel) and weight (in kg, lower panel) from valid fishing stations.

CATCH IN NUMBERS																
Fishing station	**ANE**	**PIL**	**MAS**	**MAC**	**HOM**	**JAA**	**HMM**	**BOG**	**FIM**	**POA**	**WHB**	**BOC**	**SNS**	**MAV**	**OTHERS SPP**	**TOTAL**
01	0	0	6	0	3	0	0	0	0	0	0	334	4	0	16	**363**
02	1	0	27	1	658	6	646	0	0	76	0	8	0	0	80	**1503**
03	152	4431	0	4	2	0	0	1	0	14	0	0	0	0	269	**4873**
04	0	0	0	0	0	0	0	0	0	106	0	0	0	226417	2	**226525**
05	3695	12	6	13	2	0	0	0	7343	274	0	0	0	0	132	**11477**
06	6517	3229	0	0	1	0	15	0	1603	9	0	0	0	0	51	**11425**
07	6364	0	28	0	2	0	0	0	452	20	0	0	0	0	34	**6900**
08	551	3	1	105	0	0	0	0	2430	395	0	0	0	0	67	**3552**
09	5778	0	61	116	0	0	0	0	0	4	0	0	0	0	39	**5998**
10	6147	0	1	37	1	0	0	0	16	4	0	0	0	0	68	**6274**
11	2182	16	17	13	2	0	0	0	0	41	0	0	0	0	217	**2488**
12	34223	0	15	2	0	1	0	0	0	0	0	0	0	0	45	**34286**
13	53810	621	22	39	1	0	0	0	0	2	0	0	0	0	42	**54537**
14	16713	88584	2095	0	0	0	0	0	0	0	0	0	0	0	5	**107397**
15	188	109	1	21	5	0	0	14	0	0	0	0	0	0	138	**476**
16	1	59	7228	0	0	487	0	0	0	0	0	0	10	0	0	**7785**
17	8134	86254	34326	0	0	0	0	0	0	0	0	0	0	0	6	**128720**
18	0	29945	32	23	634	40	0	34	0	0	0	0	0	0	401	**31109**
19	353	12	3146	1	448	14	0	18	0	0	0	0	0	0	436	**4428**
20	0	3254	147256	0	49	0	0	0	0	0	0	0	0	0	0	**150559**
21	3	0	344	0	3194	88	0	20	0	0	0	0	0	0	97	**3746**
22	0	0	1839	0	30	810	0	0	0	0	0	824	22	0	62	**3587**
23	0	0	852	0	297	7	0	67	0	0	1	15	3	14	225	**1481**
24	0	0	1347	0	12	18	0	18	0	0	0	0	1	0	12	**1408**
25	0	0	101	0	14	211	0	13	0	0	0	40	28288	0	2	**28669**
26	0	0	1180	0	177	7	0	22	0	0	0	0	0	0	36	**1422**
27	0	0	23	0	34	36	0	9	0	0	0	0	0	0	22	**124**
TOTAL	**144812**	**216529**	**199954**	**375**	**5566**	**1725**	**661**	**216**	**11844**	**945**	**1**	**1221**	**28328**	**226431**	**2504**	**841112**

Table 3. *ECOCADIZ 2019-07* survey. Cont'd.

CATCH IN WEIGHT (kg)																
Fishing station	**ANE**	**PIL**	**MAS**	**MAC**	**HOM**	**JAA**	**HMM**	**BOG**	**FIM**	**POA**	**WHB**	**BOC**	**SNS**	**MAV**	**OTHERS SPP**	**TOTAL**
01	0	0	0,780	0	0,148	0	0	0	0	0	0	1,866	0,024	0	2,662	**5,480**
02	0,008	0	3,080	0,166	94,050	2,340	316,800	0	0	52,367	0	0,044	0	0	7,869	**476,724**
03	1,678	102,700	0	1,632	0,142	0	0	0,278	0	9,550	0	0	0	0	38,754	**154,734**
04	0	0	0	0	0	0	0	0	0	81,647	0	0	0	167,200	0,074	**248,921**
05	43,550	0,225	0,520	1,030	0,007	0	0	0	3,130	189,050	0	0	0	0	13,908	**251,420**
06	50,480	38,784	0	0	0,003	0	3,580	0	0,774	6,900	0	0	0	0	4,218	**104,739**
07	79,550	0	1,664	0	0,006	0	0	0	0,232	13,950	0	0	0	0	3,490	**98,892**
08	5,730	0,074	0,182	5,754	0	0	0	0	0,450	274,650	0	0	0	0	6,655	**293,495**
09	78,240	0	6,250	4,902	0	0	0	0	0	3,200	0	0	0	0	4,966	**97,558**
10	75,550	0	0,140	1,587	0,005	0	0	0	0,007	3,372	0	0	0	0	6,072	**86,733**
11	25,550	0,326	2,213	3,474	0,032	0	0	0	0	29,450	0	0	0	0	13,662	**74,707**
12	444,700	0	1,192	0,070	0	0,013	0	0	0	0	0	0	0	0	4,379	**450,354**
13	712,850	11,350	0,738	2,572	0,014	0	0	0	0	1,908	0	0	0	0	4,734	**734,166**
14	334,672	3218,545	137,601	0	0	0	0	0	0	0	0	0	0	0	1,720	**3692,538**
15	2,234	2,080	0,193	6,660	0,420	0	0	1,970	0	0	0	0	0	0	15,665	**29,222**
16	0,019	2,780	521,050	0	0	70,837	0	0	0	0	0	0	0,121	0	0	**594,807**
17	174,312	3739,108	2191,580	0	0	0	0	0	0	0	0	0	0	0	2,222	**6107,222**
18	0	1216,776	2,446	7,225	50,486	1,702	0	4,188	0	0	0	0	0	0	48,193	**1331,016**
19	7,410	0,462	315,480	0,326	55,150	0,834	0	2,728	0	0	0	0	0	0	97,366	**479,756**
20	0	165,162	8908,991	0	1,595	0	0	0	0	0	0	0	0	0	0	**9075,748**
21	0,098	0	37,300	0	390,500	6,654	0	2,640	0	0	0	0	0	0	5,570	**442,762**
22	0	0	201,850	0	3,696	80,950	0	0	0	0	0	4,830	0,227	0	8,728	**300,281**
23	0	0	74,750	0	31,300	0,300	0	7,285	0	0	0,022	0,084	0,032	0,014	31,472	**145,259**
24	0	0	120,600	0	1,316	1,690	0	1,028	0	0	0	0	0,010	0	1,072	**125,716**
25	0	0	10,470	0	0,761	15,350	0	1,355	0	0	0	0,662	204,050	0	54,096	**286,744**
26	0	0	117,250	0	20,200	0,454	0	2,137	0	0	0	0	0	0	6,884	**146,925**
27	0	0	2,480	0	4,351	3,552	0	1,041	0	0	0	0	0	0	6,270	**17,694**
TOTAL	**2036,631**	**8498,372**	**12658,800**	**35,398**	**654,182**	**184,676**	**320,380**	**24,650**	**4,593**	**666,044**	**0,022**	**7,486**	**204,464**	**167,214**	**390,701**	**25853,613**

Table 4. *ECOCADIZ 2019-07* survey. Parameters of the size-weight relationships for survey's target species. FAO codes for the species: ANE: *Engraulis encrasicolus*; PIL: *Sardina pilchardus*; MAS: *Scomber colias*; MAC: *Scomber scombrus*; HOM: *Trachurus trachurus*; JAA: *Trachurus picturatus;* HMM: *Trachurus mediterraneus*; BOG: *Boops boops*; FIM: *Aphia minuta*; POA: *Brama brama*: BOC: *Capros aper*; SNS: *Macrorhamphosus scolopax*; MAV: *Maurolicus muelleri*. (*) FIM's LW relationship parameters following Iglesias *et al*. (1997).

PARAMETER	ANE	PIL	MAS	MAC	HOM	JAA	HMM	BOG	FIM(*)	POA
Size range (mm)	92-173	108-202	132-343	158-381	66-336	121-384	282-463	193-297		358-517
n	723	469	766	229	408	320	65	167		388
a	0,002644	0,002409	0,003183	0,002395	0,008879	0,007130	0,029374	0,005556	0,004000	0,027261
b	3,356048	3,460818	3,286908	3,351769	2,974619	3,048874	2,630445	3,157324	3,690000	2,722180
r^2	0,95	0,95	0,96	0,99	0,94	0,99	0,97	0,84		0,71

PARAMETER	BOC	SNS	MAV
Size range (mm)	53-104	94-164	36-64
n	181	96	98
a	0,034164	0,003662	0,010578
b	2,743768	3,158905	2,869503
r^2	0,99	0,80	0,96

Table 5. *ECOCADIZ 2019-07* 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 20**.

***ECOCADIZ 2019-07* . *Engraulis encrasicolus* . ABUNDANCE (in numbers and million fish)**											
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	***n***			**Millions**		
						PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**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	75490733	0	75490733	75490733	0	75	75
9	0	0	0	0	320755985	0	320755985	320755985	0	321	321
9,5	0	0	0	0	339549037	0	339549037	339549037	0	340	340
10	0	30229	0	28787841	396246718	30229	425034559	425064788	0,03	425	425
10,5	0	88331	0	84121160	396246718	88331	480367878	480456209	0,1	480	480
11	0	296251	0	282131250	301962933	296251	584094183	584390434	0,3	584	584
11,5	0	684742	0	652106300	75490733	684742	727597033	728281775	1	728	728
12	526172	1027334	85251	978369750	94283785	1553506	1072738786	1074292292	2	1073	1074
12,5	4276461	727989	692874	693292319	56697682	5004450	750682875	755687325	5	751	756
13	12520921	423300	2028645	403124967	18793052	12944221	423946664	436890885	13	424	437
13,5	17191270	122965	2785336	117104394	0	17314235	119889730	137203965	17	120	137
14	18025661	57916	2920525	55155988	0	18083577	58076513	76160090	18	58	76
14,5	10746620	14341	1741172	13657314	0	10760961	15398486	26159447	11	15	26
15	5221908	5029	846056	4789252	0	5226937	5635308	10862245	5	6	11
15,5	3803656	2933	616270	2793205	0	3806589	3409475	7216064	4	3	7
16	1918459	2096	310830	1996047	0	1920555	2306877	4227432	2	2	4
16,5	1266905	0	205264	0	0	1266905	205264	1472169	1	0,2	1
17	633641	0	102663	0	0	633641	102663	736304	1	0,1	1
17,5	128131	0	20760	0	0	128131	20760	148891	0,1	0,02	0,1
18	0	0	0	0	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	76259805	3483456	12355646	3317429787	2075517376	79743261	5405302809	5485046070	**80**	**5405**	**5485**
Millions	**76**	**3**	**12**	**3317**	**2076**						

Table 5. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Cont'd.

ECOCADIZ 2019-07 . *Engraulis encrasicolus* . BIOMASS (t)								
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	**PORTUGAL**	**SPAIN**	**TOTAL**
6	0	0	0	0	0	**0**	**0**	**0**
6,5	0	0	0	0	0	**0**	**0**	**0**
7	0	0	0	0	0	**0**	**0**	**0**
7,5	0	0	0	0	0	**0**	**0**	**0**
8	0	0	0	0	0	**0**	**0**	**0**
8,5	0	0	0	0	288,531	**0**	**288,531**	**288,531**
9	0	0	0	0	1478,103	**0**	**1478,103**	**1478,103**
9,5	0	0	0	0	1868,042	**0**	**1868,042**	**1868,042**
10	0	0,197	0	187,412	2579,613	**0,197**	**2767,026**	**2767,222**
10,5	0	0,675	0	642,860	3028,146	**0,675**	**3671,007**	**3671,682**
11	0	2,638	0	2512,574	2689,189	**2,638**	**5201,763**	**5204,402**
11,5	0	7,059	0	6722,832	778,265	**7,059**	**7501,097**	**7508,156**
12	6,241	12,186	1,011	11605,228	1118,376	**18,427**	**12724,614**	**12743,042**
12,5	58,038	9,880	9,403	9409,065	769,477	**67,918**	**10187,945**	**10255,864**
13	193,418	6,539	31,338	6227,295	290,307	**199,957**	**6548,940**	**6748,896**
13,5	300,825	2,152	48,740	2049,178	0	**302,977**	**2097,917**	**2400,894**
14	355,721	1,143	57,634	1088,457	0	**356,864**	**1146,092**	**1502,956**
14,5	238,178	0,318	38,590	302,688	0	**238,496**	**341,278**	**579,774**
15	129,476	0,125	20,978	118,749	0	**129,601**	**139,727**	**269,328**
15,5	105,129	0,081	17,033	77,201	0	**105,210**	**94,234**	**199,444**
16	58,906	0,064	9,544	61,288	0	**58,970**	**70,832**	**129,802**
16,5	43,077	0	6,979	0	0	**43,077**	**6,979**	**50,057**
17	23,787	0	3,854	0	0	**23,787**	**3,854**	**27,641**
17,5	5,296	0	0,858	0	0	**5,296**	**0,858**	**6,154**
18	0	0	0	0	0	**0**	**0**	**0**
18,5	0	0	0	0	0	**0**	**0**	**0**
TOTAL	**1518,093**	**43,057**	**245,962**	**41004,828**	**14888,048**	**1561,150**	**56138,839**	**57699,989**

Table 6. *ECOCADIZ 2019-07* 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 20** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	PT	ES	TOTAL
	N	N	N	N	N	N	N	N
0	1873	713	304	679480	1638068	2587	2317852	2320439
I	60390	2661	9784	2534559	423530	63051	2967873	3030925
II	13997	109	2268	103390	13919	14105	119577	133683
III	0	0	0	0	0	0	0	0
TOTAL	76260	3483	12356	3317430	2075517	79743	5405303	5485046

Age class	POL01	POL02	POL03	POL04	POL05	PT	ES	TOTAL
	B	B	B	B	B	B	B	B
0	32	7	5	7025	10410	39	17440	17479
I	1149	34	186	32505	4336	1183	37027	38210
II	337	2	55	1475	142	339	1671	2010
III	0	0	0	0	0	0	0	0
TOTAL	1518	43	246	41005	14888	1561	56139	57700

Table 7. *ECOCADIZ 2019-07* 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 24**.

ECOCADIZ 2019-07 . *Sardina pilchardus* . ABUNDANCE (in numbers and million fish)														
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	**POL06**	**POL07**	***n***			**Millions**			
								PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**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	0	0	0	0	0	0	0	0	0
8	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
9	0	0	0	0	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	46134625	0	0	46134625	46134625	0	46	46
11	0	0	0	0	0	401738683	0	0	401738683	401738683	0	402	402
11,5	0	0	5287	344650	0	434808636	6533734	5287	441687020	441692307	0,01	442	442
12	0	0	123877	8075256	0	230673126	51803176	123877	290551558	290675435	0,1	291	291
12,5	0	0	477036	31096837	0	158000885	174544036	477036	363641758	364118794	0,5	364	364
13	0	0	623775	40662444	0	39602289	103373005	623775	183637738	184261513	1	184	184
13,5	0	689625	435540	28391856	12	0	103373005	1125165	131764873	132890038	1	132	133
14	0	0	263791	17195950	0	0	90538885	263791	107734835	107998626	0,3	108	108
14,5	0	5858790	173399	11303478	101	0	168010302	6032189	179313881	185346070	6	179	185
15	0	18549645	50371	3283575	320	0	168010302	18600016	171294197	189894213	19	171	190
15,5	0	55071293	15861	1033950	951	6532336	90538885	55087154	98106122	153193276	55	98	153
16	421819	77868987	0	0	1344	0	58103563	78290806	58104907	136395713	78	58	136
16,5	1068476	95100475	19899	1297138	1642	0	19367854	96188850	20666634	116855484	96	21	117
17	1522131	80488671	0	0	1390	0	0	82010802	1390	82012192	82	0,001	82
17,5	1619626	49191791	0	0	849	0	0	50811417	849	50812266	51	0,001	51
18	907309	20445846	0	0	353	408271	0	21353155	408624	21761779	21	0,4	22
18,5	712317	4423230	0	0	76	0	0	5135547	76	5135623	5	0,0001	5
19	161167	5773899	0	0	100	0	0	5935066	100	5935166	6	0,0001	6
19,5	31835	0	0	0	0	0	0	31835	0	31835	0,03	0	0,03
20	31835	0	0	0	0	0	0	31835	0	31835	0,03	0	0,03
20,5	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0
21,5	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	6476515	413462252	2188836	142685134	7138	1317898851	1034196747	422127603	2494787870	2916915473	**422**	**2495**	**2917**
Millions	**6**	**413**	**2**	**143**	**0,01**	**1318**	**1034**	**422**	**2495**	**2917**			

Table 7. *ECOCADIZ 2019-07* survey. Sardine (*S. pilchardus*). Cont'd.

ECOCADIZ 2019-07 . *Sardina pilchardus* . BIOMASS (t)										
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	**POL06**	**POL07**	**PORTUGAL**	**SPAIN**	**TOTAL**
6	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
10,5	0	0	0	0	0	412,386	0	0	412,386	412,385673
11	0	0	0	0	0	4202,917	0	0	4202,917	4202,91701
11,5	0	0	0,064	4,191	0	5287,667	79,456	0,064	5371,314	5371,37823
12	0	0	1,740	113,438	0	3240,392	727,708	1,740	4081,537	4083,27737
12,5	0	0	7,696	501,701	0	2549,110	2816,010	7,696	5866,822	5874,51786
13	0	0	11,497	749,442	0	729,902	1905,249	11,497	3384,593	3396,08951
13,5	0	14,449	9,125	594,856	0,0003	0	2165,834	23,574	2760,690	2784,2644
14	0	0	6,254	407,689	0	0	2146,535	6,254	2554,224	2560,47808
14,5	0	156,511	4,632	301,959	0,003	0	4488,197	161,143	4790,159	4951,30207
15	0	556,131	1,510	98,444	0,010	0	5037,059	557,641	5135,513	5693,15333
15,5	0	1846,099	0,532	34,660	0,032	218,977	3035,043	1846,631	3288,712	5135,34216
16	15,755	2908,488	0	0	0,050	0	2170,228	2924,243	2170,279	5094,52169
16,5	44,322	3944,889	0,825	53,807	0,068	0	803,403	3990,036	857,278	4847,31409
17	69,906	3696,548	0	0	0,064	0	0	3766,453	0,064	3766,51731
17,5	82,115	2494,022	0	0	0,043	0	0	2576,137	0,043	2576,18052
18	50,643	1141,211	0	0	0,020	22,788	0	1191,853	22,808	1214,66132
18,5	43,657	271,097	0	0	0,005	0	0	314,755	0,005	314,759189
19	10,820	387,623	0	0	0,007	0	0	398,443	0,007	398,449639
19,5	2,336	0	0	0	0	0	0	2,336	0	2,335535
20	2,547	0	0	0	0	0	0	2,547	0	2,546617
20,5	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
21,5	0	0	0	0	0	0	0	0	0	0
TOTAL	**322,100**	**17417,066**	**43,876**	**2860,187**	**0,301**	**16664,139**	**25374,722**	**17783,042**	**44899,349**	**62682,392**

Table 8. *ECOCADIZ 2019-07* 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 24** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	PT	ES	TOTAL
	N	N	N	N	N	N	N	N	N	N
0	41	8435	1329	86617	0,1	1272721	402704	9805	1762043	1771848
I	5686	396584	860	56068	7	45152	631493	403130	732719	1135849
II	661	7165	0	0	0,1	0	0	7826	0,1	7826
III	89	1278	0	0	0,02	26	0	1366	26	1392
TOTAL	6477	413462	2189	142685	7	1317899	1034197	422128	2494788	2916915

Age class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	PT	ES	TOTAL
	B	B	B	B	B	B	B	B	B	B
0	2	301	24	1569	0,01	15831	7423	326	24822	25149
I	274	16610	20	1292	0,3	832	17952	16904	20075	36980
II	41	435	0	0	0,01	0	0	475	0,01	475
III	6	71	0	0	0,001	1	0	77	1	78
TOTAL	322	17417	44	2860	0,3	16664	25375	17783	44899	62682

Table 9. *ECOCADIZ 2019-07* survey. Mackerel (*Scomber scombrus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 27**.

***ECOCADIZ 2019-07* . *Scomber scombrus* . ABUNDANCE (in numbers and million fish)**									
Size class	**POL01**	**POL02**	**POL03**	***n***			**Millions**		
				PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
14	0	0	0	0	0	0	0	0	0
14.5	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
15.5	13662	151087	65914	13662	217001	230663	0.01	0.2	0.2
16	50445	557880	243384	50445	801264	851709	0.1	1	1
16.5	208620	2307161	1006535	208620	3313696	3522316	0.2	3	4
17	358380	3963378	1729085	358380	5692463	6050843	0.4	6	6
17.5	321859	3559485	1552881	321859	5112366	5434225	0.3	5	5
18	143198	1583648	690891	143198	2274539	2417737	0.1	2	2
18.5	25258	279329	121862	25258	401191	426449	0.03	0.4	0.4
19	8169	90341	39413	8169	129754	137923	0.01	0.1	0.1
19.5	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
20.5	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0
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
23.5	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
24.5	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
25.5	0	0	0	0	0	0	0	0	0
26	13662	151087	65914	13662	217001	230663	0.01	0.2	0.2
26.5	22406	247792	108103	22406	355895	378301	0.02	0.4	0.4
27	10986	121493	53003	10986	174496	185482	0.01	0.2	0.2
27.5	15171	167776	73195	15171	240971	256142	0.02	0.2	0.3
28	20053	221765	96748	20053	318513	338566	0.02	0.3	0.3
28.5	28867	319249	139277	28867	458526	487393	0.03	0.5	0.5
29	0	0	0	0	0	0	0	0	0
29.5	14237	157451	68690	14237	226141	240378	0.01	0.2	0.2
30	0	0	0	0	0	0	0	0	0
30.5	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
31.5	0	0	0	0	0	0	0	0	0
32	3034	33555	14639	3034	48194	51228	0.003	0.05	0.1
32.5	8169	90341	39413	8169	129754	137923	0.01	0.1	0.1
33	8169	90341	39413	8169	129754	137923	0.01	0.1	0.1
33.5	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
TOTAL *n*	1274345	14093159	6148360	1274345	20241519	21515864	**1**	**20**	**22**
Millions	**1**	**14**	**6**						

Table 9. *ECOCADIZ 2019-07* survey. Mackerel (*Scomber scombrus*). Cont'd.

ECOCADIZ 2019-07 . *Scomber scombrus* . BIOMASS (t)						
Size class	**POL01**	**POL02**	**POL03**	**PORTUGAL**	**SPAIN**	**TOTAL**
14	0	0	0	0	0	0
14.5	0	0	0	0	0	0
15	0	0	0	0	0	0
15.5	0.338	3.734	1.629	0.338	5.363	5.701
16	1.384	15.308	6.678	1.384	21.986	23.370
16.5	6.336	70.071	30.570	6.336	100.641	106.977
17	12.012	132.838	57.953	12.012	190.791	202.803
17.5	11.871	131.287	57.276	11.871	188.563	200.434
18	5.797	64.108	27.968	5.797	92.076	97.873
18.5	1.119	12.379	5.401	1.119	17.780	18.899
19	0.395	4.373	1.908	0.395	6.281	6.676
19.5	0	0	0	0	0	0
20	0	0	0	0	0	0
20.5	0	0	0	0	0	0
21	0	0	0	0	0	0
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
23.5	0	0	0	0	0	0
24	0	0	0	0	0	0
24.5	0	0	0	0	0	0
25	0	0	0	0	0	0
25.5	0	0	0	0	0	0
26	1.869	20.672	9.019	1.869	29.691	31.560
26.5	3.266	36.116	15.756	3.266	51.872	55.138
27	1.704	18.841	8.220	1.704	27.061	28.765
27.5	2.501	27.653	12.064	2.501	39.717	42.218
28	3.509	38.806	16.929	3.509	55.735	59.244
28.5	5.357	59.246	25.847	5.357	85.093	90.450
29	0	0	0	0	0	0
29.5	2.963	32.766	14.295	2.963	47.061	50.024
30	0	0	0	0	0	0
30.5	0	0	0	0	0	0
31	0	0	0	0	0	0
31.5	0	0	0	0	0	0
32	0.827	9.150	3.992	0.827	13.142	13.969
32.5	2.346	25.939	11.316	2.346	37.255	39.601
33	2.468	27.290	11.906	2.468	39.196	41.664
33.5	0	0	0	0	0	0
34	0	0	0	0	0	0
TOTAL	**66.062**	**730.577**	**318.727**	**66.062**	**1049.304**	**1115.366**

Table 10. *ECOCADIZ 2019-07* 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 29**.

***ECOCADIZ 2019-07* . *Scomber colias* . ABUNDANCE (in numbers and million fish)**											
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	***n***			**Millions**		
						PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
14	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
16,5	0	0	77681	59963	0	137644	0	137644	0,1	0	0,1
17	0	0	0	246882	0	246882	0	246882	0,2	0	0,2
17,5	1300	3129413	392794	609828	0	4133335	0	4133335	4	0	4
18	14944	35976560	1290155	1344685	0	38626344	0	38626344	39	0	39
18,5	12345	29719859	605556	1229431	0	31567191	0	31567191	32	0	32
19	17544	42235385	372795	2174674	0	44800398	0	44800398	45	0	45
19,5	25341	61005487	638051	3094861	0	64763740	0	64763740	65	0	65
20	23392	56312430	532860	4631120	0	61499802	0	61499802	61	0	61
20,5	19493	46926317	2146888	8474131	0	57566829	0	57566829	58	0	58
21	8447	20335870	4786827	5736797	0	30867941	0	30867941	31	0	31
21,5	5848	14079170	8587093	3710154	564893	26382265	564893	26947158	26	1	27
22	1300	3129413	10340636	1568805	1506382	15040154	1506382	16546536	15	2	17
22,5	0	0	13177806	893268	753191	14071074	753191	14824265	14	1	15
23	0	0	14085391	773343	2824466	14858734	2824466	17683200	15	3	18
23,5	0	0	15833475	623566	2071275	16457041	2071275	18528316	16	2	19
24	0	0	10953874	79489	2447871	11033363	2447871	13481234	11	2	13
24,5	0	0	8232993	39744	753191	8272737	753191	9025928	8	1	9
25	0	0	5789958	0	188298	5789958	188298	5978256	6	0,2	6
25,5	0	0	3752320	583821	188298	4336141	188298	4524439	4	0,2	5
26	0	0	1602233	0	0	1602233	0	1602233	2	0	2
26,5	0	0	678786	0	0	678786	0	678786	1	0	1
27	0	0	765255	34523	0	799778	0	799778	1	0	1
27,5	0	0	70230	0	0	70230	0	70230	0,1	0	0,1
28	0	0	0	0	0	0	0	0	0	0	0
28,5	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	129954	312849904	104713657	35909085	11297865	453602600	11297865	464900465	**454**	**11**	**465**
Millions	**0,1**	**313**	**105**	**36**	**11**						

Table 10. *ECOCADIZ 2019-07* survey. Chub mackerel (*S. colias*). Cont'd.

ECOCADIZ 2019-07 . *Scomber colias* . BIOMASS (t)								
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	**PORTUGAL**	**SPAIN**	**TOTAL**
14	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
16,5	0	0	2,608	2,013	0	4,621	0	4,621
17	0	0	0	9,131	0	9,131	0	9,131
17,5	0,053	127,133	15,957	24,774	0	167,917	0	167,917
18	0,665	1601,288	57,424	59,851	0	1719,228	0	1719,228
18,5	0,601	1445,705	29,457	59,805	0	1535,568	0	1535,568
19	0,931	2240,150	19,773	115,344	0	2376,197	0	2376,197
19,5	1,462	3520,251	36,818	178,585	0	3737,117	0	3737,117
20	1,465	3527,752	33,382	290,121	0	3852,721	0	3852,721
20,5	1,323	3185,141	145,721	575,185	0	3907,370	0	3907,370
21	0,620	1492,672	351,358	421,086	0	2265,736	0	2265,736
21,5	0,463	1115,520	680,372	293,963	44,758	2090,319	44,758	2135,076
22	0,111	267,182	882,860	133,941	128,612	1284,095	128,612	1412,706
22,5	0	0	1210,350	82,045	69,179	1292,395	69,179	1361,573
23	0	0	1389,538	76,291	278,636	1465,829	278,636	1744,465
23,5	0	0	1675,139	65,972	219,135	1741,111	219,135	1960,246
24	0	0	1241,031	9,006	277,334	1250,037	277,334	1527,371
24,5	0	0	997,484	4,815	91,254	1002,300	91,254	1093,554
25	0	0	749,160	0	24,364	749,160	24,364	773,524
25,5	0	0	517,833	80,569	25,986	598,402	25,986	624,388
26	0	0	235,542	0	0	235,542	0	235,542
26,5	0	0	106,172	0	0	106,172	0	106,172
27	0	0	127,209	5,739	0	132,948	0	132,948
27,5	0	0	12,393	0	0	12,393	0	12,393
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
TOTAL	**7,694**	**18522,796**	**10517,581**	**2488,236**	**1159,258**	**31536,307**	**1159,258**	**32695,565**

Table 11. *ECOCADIZ 2019-07* survey. Chub mackerel (*S. colias*). Estimated abundance (thousands of individuals) and biomass (tonnes) by age group. Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 29** and ordered from west to east.

Age class	POL01	POL02	POL03	POL04	POL05	PT	ES	TOTAL
	N	N	N	N	N	N	N	N
0	61	145896	4695	9637	104	160289	104	160392
I	63	152817	49677	20990	5453	223548	5453	229002
II	6	14136	49246	5241	5723	68630	5723	74353
III	0	0	1095	41	17	1136	17	1153
TOTAL	130	312850	104714	35909	11298	453603	11298	464900

Age class	POL01	POL02	POL03	POL04	POL05	PT	ES	TOTAL
	B	B	B	B	B	B	B	B
0	3	7813	280	546	9	8643	9	8652
I	4	9796	4782	1498	546	16079	546	16626
II	0.4	1060	5302	452	602	6815	602	7417
III	0	0	158	6	2	164	2	167
TOTAL	8	18669	10522	2502	1160	31701	1160	32861

Table 12. *ECOCADIZ 2019-07* survey. Blue jack mackerel (*Trachurus 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 32**.

***ECOCADIZ 2019-07* . *Trachurus picturatus* . ABUNDANCE (in numbers and million fish)**											
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	***n***			**Millions**		
						PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
12	0	0	0	0	0	0	0	0	0	0	0
12.5	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
13.5	0	0	59854	82	4984	59854	5066	64920	0.1	0.01	0.1
14	220233	2586	551283	755	45903	774102	46658	820760	1	0.05	1
14.5	192704	0	1193921	1635	99413	1386625	101048	1487673	1	0.1	1
15	573107	3879	1590845	2179	132464	2167831	134643	2302474	2	0.1	2
15.5	391665	6465	1162419	1592	96790	1560549	98382	1658931	2	0.1	2
16	297815	2586	979709	1342	81577	1280110	82919	1363029	1	0.1	1
16.5	579297	3879	519781	712	43280	1102957	43992	1146949	1	0.04	1
17	750795	3879	551283	755	45903	1305957	46658	1352615	1	0.05	1
17.5	792240	6465	182711	250	15214	981416	15464	996880	1	0.02	1
18	498103	6465	59854	82	4984	564422	5066	569488	1	0.01	1
18.5	554489	10344	0	0	0	564833	0	564833	1	0	1
19	95177	3879	31502	43	2623	130558	2666	133224	0.1	0.003	0.1
19.5	85242	0	0	0	0	85242	0	85242	0.1	0	0.1
20	378671	0	0	0	0	378671	0	378671	0.4	0	0.4
20.5	192704	0	0	0	0	192704	0	192704	0.2	0	0.2
21	514990	0	0	0	0	514990	0	514990	1	0	1
21.5	1839264	0	0	0	0	1839264	0	1839264	2	0	2
22	2893353	0	0	0	0	2893353	0	2893353	3	0	3
22.5	3677390	0	0	0	0	3677390	0	3677390	4	0	4
23	4474774	0	0	0	0	4474774	0	4474774	4	0	4
23.5	2480729	0	0	0	0	2480729	0	2480729	2	0	2
24	968857	0	0	0	0	968857	0	968857	1	0	1
24.5	446252	0	0	0	0	446252	0	446252	0.4	0	0.4
25	122639	0	0	0	0	122639	0	122639	0.1	0	0.1
25.5	324232	0	3150	4	262	327382	266	327648	0.3	0.0003	0.3
26	0	0	0	0	0	0	0	0	0	0	0
26.5	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0
27.5	0	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	23344722	50427	6886312	9431	573397	30281461	582828	30864289	**30**	**1**	**31**
Millions	**23**	**0.1**	**7**	**0.01**	**1**						

Table 12. *ECOCADIZ 2019-07* survey. Blue jack mackerel (*Trachurus picturatus*). Cont'd.

ECOCADIZ 2019-07 . *Trachurus picturatus* . BIOMASS (t)								
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**POL05**	**PORTUGAL**	**SPAIN**	**TOTAL**
12	0	0	0	0	0	0	0	0
12.5	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
13.5	0	0	1.271	0.002	0.106	1.271	0.108	1.379
14	5.214	0.061	13.051	0.018	1.087	18.326	1.105	19.431
14.5	5.065	0	31.383	0.043	2.613	36.448	2.656	39.104
15	16.668	0.113	46.268	0.063	3.853	63.049	3.916	66.965
15.5	12.563	0.207	37.285	0.051	3.105	50.055	3.156	53.211
16	10.503	0.091	34.551	0.047	2.877	45.145	2.924	48.069
16.5	22.398	0.150	20.097	0.028	1.673	42.645	1.701	44.346
17	31.739	0.164	23.305	0.032	1.940	55.208	1.972	57.180
17.5	36.525	0.298	8.423	0.012	0.701	45.246	0.713	45.959
18	24.984	0.324	3.002	0.004	0.250	28.310	0.254	28.564
18.5	30.190	0.563	0.000	0.000	0.000	30.753	0	30.753
19	5.613	0.229	1.858	0.003	0.155	7.700	0.158	7.858
19.5	5.434	0	0	0	0	5.434	0	5.434
20	26.041	0	0	0	0	26.041	0	26.041
20.5	14.270	0	0	0	0	14.270	0	14.270
21	40.994	0	0	0	0	40.994	0	40.994
21.5	157.116	0	0	0	0	157.116	0	157.116
22	264.809	0	0	0	0	264.809	0	264.809
22.5	360.048	0	0	0	0	360.048	0	360.048
23	467.998	0	0	0	0	467.998	0	467.998
23.5	276.755	0	0	0	0	276.755	0	276.755
24	115.142	0	0	0	0	115.142	0	115.142
24.5	56.423	0	0	0	0	56.423	0	56.423
25	16.476	0	0	0	0	16.476	0	16.476
25.5	46.231	0	0.449	0.001	0.037	46.680	0.038	46.718
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
TOTAL	**2049.199**	**2.200**	**220.943**	**0.304**	**18.397**	**2272.342**	**18.701**	**2291.043**

Table 13. *ECOCADIZ 2019-07* 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 34**.

ECOCADIZ 2019-07 . *Trachurus trachurus* . ABUNDANCE (in numbers and million fish)										
Size class	POL01	POL02	POL03	POL04	*n*			Millions		
					PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0	0
14.5	486424	0	0	0	486424	0	486424	0.5	0	0.5
15	0	0	4314	0	4314	0	4314	0.004	0	0.004
15.5	486424	0	7190	0	493614	0	493614	0.5	0	0.5
16	0	0	21570	0	21570	0	21570	0.02	0	0.02
16.5	486424	0	47453	0	533877	0	533877	1	0	1
17	0	0	76213	0	76213	0	76213	0.1	0	0.1
17.5	0	247635	54643	0	302278	0	302278	0.3	0	0.3
18	0	0	25884	0	25884	0	25884	0.03	0	0.03
18.5	0	41854	14380	0	56234	0	56234	0.1	0	0.1
19	0	131681	25884	0	157565	0	157565	0.2	0	0.2
19.5	0	104121	47453	69130	151574	69130	220704	0.2	0.1	0.2
20	0	214875	66147	0	281022	0	281022	0.3	0	0.3
20.5	0	682477	73337	69130	755814	69130	824944	1	0.1	1
21	0	327659	87716	69130	415375	69130	484505	0.4	0.1	0.5
21.5	0	787688	51767	120978	839455	120978	960433	1	0.1	1
22	0	1445795	61833	120978	1507628	120978	1628606	2	0.1	2
22.5	0	2040512	73337	241957	2113849	241957	2355806	2	0.2	2
23	0	4159331	76213	915979	4235544	915979	5151523	4	1	5
23.5	0	3662512	51767	985109	3714279	985109	4699388	4	1	5
24	0	4984986	25884	915979	5010870	915979	5926849	5	1	6
24.5	0	4702223	18694	1296196	4720917	1296196	6017113	5	1	6
25	0	5371279	4314	1348044	5375593	1348044	6723637	5	1	7
25.5	0	2040649	0	1175218	2040649	1175218	3215867	2	1	3
26	0	2914523	0	1036957	2914523	1036957	3951480	3	1	4
26.5	0	1298862	0	915979	1298862	915979	2214841	1	1	2
27	0	851237	0	743153	851237	743153	1594390	1	1	2
27.5	0	110240	0	432065	110240	432065	542305	0.1	0.4	1
28	0	614956	0	311087	614956	311087	926043	1	0.3	1
28.5	0	0	0	69130	0	69130	69130	0	0.1	0.1
29	0	41340	0	311087	41340	311087	352427	0.04	0.3	0.4
29.5	0	41340	0	0	41340	0	41340	0.04	0	0.04
30	0	222912	0	69130	222912	69130	292042	0.2	0.1	0.3
30.5	0	0	0	0	0	0	0	0	0	0
31	0	0	0	120978	0	120978	120978	0	0	0.1
31.5	0	0	0	69130	0	69130	69130	0	0	0.1
32	0	0	0	0	0	0	0	0	0	0
TOTAL *n*	1459272	37040687	915993	11406524	39415952	11406524	50822476	**39**	**11**	**51**
Millions	**1**	**37**	**1**	**11**						

Table 13. *ECOCADIZ 2019-07* survey. Horse mackerel (*T. trachurus*). Cont'd.

ECOCADIZ 2019-07 . *Trachurus trachurus* . BIOMASS (t)							
Size class	**POL01**	**POL02**	**POL03**	**POL04**	**PORTUGAL**	**SPAIN**	**TOTAL**
14	0	0	0	0	0	0	0
14.5	12.945	0	0	0	12.945	0	12.945
15	0	0	0.127	0	0.127	0	0.127
15.5	15.734	0	0.233	0	15.967	0	15.967
16	0	0	0.766	0	0.766	0	0.766
16.5	18.896	0	1.843	0	20.739	0	20.739
17	0	0	3.231	0	3.231	0	3.231
17.5	0	11.431	2.522	0	13.953	0	13.953
18	0	0	1.298	0	1.298	0	1.298
18.5	0	2.274	0.781	0	3.055	0	3.055
19	0	7.737	1.521	0	9.258	0	9.258
19.5	0	6.603	3.009	4.384	9.612	4.384	13.996
20	0	14.678	4.519	0	19.197	0	19.197
20.5	0	50.129	5.387	5.078	55.516	5.078	60.594
21	0	25.834	6.916	5.450	32.750	5.450	38.200
21.5	0	66.552	4.374	10.221	70.926	10.221	81.147
22	0	130.700	5.590	10.936	136.290	10.936	147.226
22.5	0	197.069	7.083	23.368	204.152	23.368	227.520
23	0	428.536	7.852	94.373	436.388	94.373	530.761
23.5	0	402.004	5.682	108.127	407.686	108.127	515.813
24	0	582.144	3.023	106.967	585.167	106.967	692.134
24.5	0	583.492	2.320	160.843	585.812	160.843	746.655
25	0	707.371	0.568	177.531	707.939	177.531	885.470
25.5	0	284.885	0	164.066	284.885	164.066	448.951
26	0	430.837	0	153.287	430.837	153.287	584.124
26.5	0	203.088	0	143.221	203.088	143.221	346.309
27	0	140.636	0	122.779	140.636	122.779	263.415
27.5	0	19.225	0	75.350	19.225	75.350	94.575
28	0	113.096	0	57.212	113.096	57.212	170.308
28.5	0	0	0	13.395	0.000	13.395	13.395
29	0	8.432	0	63.449	8.432	63.449	71.881
29.5	0	8.868	0	0	8.868	0	8.868
30	0	50.246	0	15.582	50.246	15.582	65.828
30.5	0	0	0	0.000	0	0	0
31	0	0	0	30.039	0	30.039	30.039
31.5	0	0	0	17.995	0	17.995	17.995
32	0	0	0	0	0	0	0
TOTAL	**47.575**	**4475.867**	**68.645**	**1563.653**	**4592.087**	**1563.653**	**6155.740**

Table 14. *ECOCADIZ 2019-07* 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 36**.

ECOCADIZ 2019-07 . *Trachurus mediterraneus* . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	*n*			Millions		
			PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
30	0	0	0	0	0	0	0	0
30.5	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
31.5	0	0	0	0	0	0	0	0
32	14879	54325	0	69204	69204	0	0.1	0.1
32.5	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
33.5	0	0	0	0	0	0	0	0
34	14879	54325	0	69204	69204	0	0.1	0.1
34.5	14879	54325	0	69204	69204	0	0.1	0.1
35	0	0	0	0	0	0	0	0
35.5	29759	108649	0	138408	138408	0	0.1	0.1
36	44638	162974	0	207612	207612	0	0.2	0.2
36.5	173593	633787	0	807380	807380	0	1	1
37	173593	633787	0	807380	807380	0	1	1
37.5	213271	778653	0	991924	991924	0	1	1
38	257910	941627	0	1199537	1199537	0	1	1
38.5	312467	1140817	0	1453284	1453284	0	1	1
39	312467	1140817	0	1453284	1453284	0	1	1
39.5	272789	995951	0	1268740	1268740	0	1	1
40	287668	1050276	0	1337944	1337944	0	1	1
40.5	158714	579463	0	738177	738177	0	1	1
41	143834	525138	0	668972	668972	0	1	1
41.5	128955	470813	0	599768	599768	0	1	1
42	183513	670004	0	853517	853517	0	1	1
42.5	143834	525138	0	668972	668972	0	1	1
43	128955	470813	0	599768	599768	0	1	1
43.5	59518	217298	0	276816	276816	0	0.3	0.3
44	69437	253515	0	322952	322952	0	0.3	0.3
44.5	14879	54325	0	69204	69204	0	0.1	0.1
45	29759	108649	0	138408	138408	0	0.1	0.1
45.5	0	0	0	0	0	0	0	0
46	29759	108649	0	138408	138408	0	0.1	0.1
46.5	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0
TOTAL *n*	3213949	11734118	0	14948067	14948067	**0**	**15**	**15**
Millions	**3**	**12**	**0**					

Table 14. *ECOCADIZ 2019-07* survey. Mediterranean horse mackerel (*T. mediterraneus*). Cont'd.

ECOCADIZ 2019-07 . *Trachurus mediterraneus* . BIOMASS (t)					
Size class	**POL01**	**POL02**	**PORTUGAL**	**SPAIN**	**TOTAL**
30	0	0	0	0	0
30.5	0	0	0	0	0
31	0	0	0	0	0
31.5	0	0	0	0	0
32	4.061	14.828	0	18.889	18.889
32.5	0	0	0	0	0
33	0	0	0	0	0
33.5	0	0	0	0	0
34	4.758	17.370	0	22.128	22.128
34.5	4.942	18.045	0	22.987	22.987
35	0	0	0	0	0
35.5	10.651	38.887	0	49.538	49.538
36	16.571	60.501	0	77.072	77.072
36.5	66.807	243.913	0	310.720	310.720
37	69.225	252.739	0	321.964	321.964
37.5	88.083	321.592	0	409.675	409.675
38	110.271	402.599	0	512.870	512.870
38.5	138.240	504.715	0	642.955	642.955
39	142.982	522.026	0	665.008	665.008
39.5	129.052	471.167	0	600.219	600.219
40	140.640	513.476	0	654.116	654.116
40.5	80.156	292.648	0	372.804	372.804
41	75.009	273.858	0	348.867	348.867
41.5	69.415	253.434	0	322.849	322.849
42	101.926	372.129	0	474.055	474.055
42.5	82.398	300.836	0	383.234	383.234
43	76.169	278.092	0	354.261	354.261
43.5	36.234	132.290	0	168.524	168.524
44	43.556	159.022	0	202.578	202.578
44.5	9.613	35.098	0	44.711	44.711
45	19.797	72.278	0	92.075	92.075
45.5	0	0	0	0	0
46	20.969	76.556	0	97.525	97.525
46.5	0	0	0	0	0
47	0	0	0	0	0
TOTAL	**1541.525**	**5628.099**	**0**	**7169.624**	**7169.624**

Table 15. *ECOCADIZ 2019-07* survey. Bogue (*Boops boops*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 38**.

***ECOCADIZ 2019-07* . *Boops boops* . ABUNDANCE (in numbers and million fish)**								
Size class	**POL01**	**POL02**	***n***			**Millions**		
			PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
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	53604	2641	53604	2641	56245	0.1	0.003	0.1
19.5	0	0	0	0	0	0	0	0
20	53604	2641	53604	2641	56245	0.1	0.003	0.1
20.5	264868	13048	264868	13048	277916	0.3	0.01	0.3
21	53604	2641	53604	2641	56245	0.1	0.003	0.1
21.5	214417	10563	214417	10563	224980	0.2	0.01	0.2
22	1592364	78444	1592364	78444	1670808	2	0.1	2
22.5	1488308	73318	1488308	73318	1561626	1	0.1	2
23	1278621	62988	1278621	62988	1341609	1	0.1	1
23.5	586494	28892	586494	28892	615386	1	0.03	1
24	268022	13203	268022	13203	281225	0.3	0.01	0.3
24.5	745731	36737	745731	36737	782468	1	0.04	1
25	53604	2641	53604	2641	56245	0.1	0.003	0.1
25.5	264868	13048	264868	13048	277916	0.3	0.01	0.3
26	264868	13048	264868	13048	277916	0.3	0.01	0.3
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
TOTAL *n*	7182977	353853	7182977	353853	7536830	**7**	**0.4**	**8**
Millions	**7**	**0.4**						

Table 15. *ECOCADIZ 2019-07* survey. Bogue (*Boops boops*). Cont'd.

ECOCADIZ 2019-07 . *Boops boops* . BIOMASS (t)					
Size class	**POL01**	**POL02**	**PORTUGAL**	**SPAIN**	**TOTAL**
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	3.383	0.167	3.383	0.167	3.550
19.5	0	0	0	0	0
20	3.970	0.196	3.970	0.196	4.166
20.5	21.187	1.044	21.187	1.044	22.231
21	4.623	0.228	4.623	0.228	4.851
21.5	19.900	0.980	19.900	0.980	20.880
22	158.780	7.822	158.780	7.822	166.602
22.5	159.191	7.842	159.191	7.842	167.033
23	146.480	7.216	146.480	7.216	153.696
23.5	71.858	3.540	71.858	3.540	75.398
24	35.071	1.728	35.071	1.728	36.799
24.5	104.075	5.127	104.075	5.127	109.202
25	7.969	0.393	7.969	0.393	8.362
25.5	41.890	2.064	41.890	2.064	43.954
26	44.512	2.193	44.512	2.193	46.705
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
TOTAL	**822.889**	**40.540**	**822.889**	**40.540**	**863.429**

Table 16. *ECOCADIZ 2019-07* survey. Transparent goby (*Aphia minuta*). 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 40**.

ECOCADIZ 2019-07 . *Aphia minuta* . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	*n*			Millions		
			PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
0	0	0	0	0	0	0	0	0
0.5	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
1.5	0	0	0	0	0	0	0	0
2	2661545	12333851	0	14995396	14995396	0	15	15
2.5	23953907	11553762	0	35507669	35507669	0	36	36
3	27946225	156302835	0	184249060	184249060	0	184	184
3.5	14638499	418416273	0	433054772	433054772	0	433	433
4	2661545	439347706	0	442009251	442009251	0	442	442
4.5	0	815291412	0	815291412	815291412	0	815	815
5	0	222005100	0	222005100	222005100	0	222	222
5.5	0	45730865	0	45730865	45730865	0	46	46
6	0	0	0	0	0	0	0	0
6.5	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
7.5	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
TOTAL *n*	71861721	2120981804	0	2192843525	2192843525	**0**	**2193**	**2193**
Millions	**72**	**2121**						

ECOCADIZ 2019-07 . *Aphia minuta* . BIOMASS (t)					
Size class	POL01	POL02	PORTUGAL	SPAIN	TOTAL
0	0	0	0	0	0
0.5	0	0	0	0	0
1	0	0	0	0	0
1.5	0	0	0	0	0
2	0.021	0.098	0	0.119	0.119
2.5	0.400	0.193	0	0.593	0.593
3	0.865	4.840	0	5.705	5.705
3.5	0.769	21.971	0	22.740	22.740
4	0.222	36.612	0	36.834	36.834
4.5	0	102.417	0	102.417	102.417
5	0	40.347	0	40.347	40.347
5.5	0	11.626	0	11.626	11.626
6	0	0	0	0	0
6.5	0	0	0	0	0
7	0	0	0	0	0
7.5	0	0	0	0	0
8	0	0	0	0	0
TOTAL	**2**	**218**	**0**	**220**	**220**

Table 17. *ECOCADIZ 2019-07* survey. Atlantic pomfret (*Brama brama*). 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 42**.

***ECOCADIZ 2019-07* . *Brama brama* . ABUNDANCE (in numbers and million fish)**							
Size class	**POL01**	***n***			**Millions**		
		PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
32	0	0	0	0	0	0	0
32.5	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0
33.5	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0
34.5	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0
35.5	231316	0	231316	231316	0	0.2	0.2
36	0	0	0	0	0	0	0
36.5	231316	0	231316	231316	0	0.2	0.2
37	596210	0	596210	596210	0	1	1
37.5	267716	0	267716	267716	0	0.3	0.3
38	2107910	0	2107910	2107910	0	2	2
38.5	1665824	0	1665824	1665824	0	2	2
39	2942393	0	2942393	2942393	0	3	3
39.5	6244919	0	6244919	6244919	0	6	6
40	8545465	0	8545465	8545465	0	9	9
40.5	10109583	0	10109583	10109583	0	10	10
41	9371484	0	9371484	9371484	0	9	9
41.5	11495967	0	11495967	11495967	0	11	11
42	7734935	0	7734935	7734935	0	8	8
42.5	5509642	0	5509642	5509642	0	6	6
43	5909669	0	5909669	5909669	0	6	6
43.5	5942562	0	5942562	5942562	0	6	6
44	2083677	0	2083677	2083677	0	2	2
44.5	1631460	0	1631460	1631460	0	2	2
45	1671034	0	1671034	1671034	0	2	2
45.5	886809	0	886809	886809	0	1	1
46	852878	0	852878	852878	0	1	1
46.5	518020	0	518020	518020	0	1	1
47	0	0	0	0	0	0	0
47.5	89239	0	89239	89239	0	0.1	0.1
48	0	0	0	0	0	0	0
48.5	0	0	0	0	0	0	0
49	231316	0	231316	231316	0	0.2	0.2
49.5	566174	0	566174	566174	0	1	1
50	0	0	0	0	0	0	0
50.5	231316	0	231316	231316	0	0.2	0.2
51	0	0	0	0	0	0	0
51.5	231316	0	231316	231316	0	0.2	0.2
52	0	0	0	0	0	0	0
52.5	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0
53.5	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0
54.5	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0
TOTAL *n*	87900150	0	87900150	87900150	**0**	**88**	**88**
Millions	**88**						

Table 17. *ECOCADIZ 2019-07* survey. Atlantic pomfret (*Brama brama*). Cont'd.

ECOCADIZ 2019-07 . Brama brama . BIOMASS (t)				
Size class	**POL01**	**PORTUGAL**	**SPAIN**	**TOTAL**
32	0	0	0	0
32.5	0	0	0	0
33	0	0	0	0
33.5	0	0	0	0
34	0	0	0	0
34.5	0	0	0	0
35	0	0	0	0
35.5	103.684	0	103.684	103.684
36	0	0	0	0
36.5	112.414	0	112.414	112.414
37	301.447	0	301.447	301.447
37.5	140.752	0	140.752	140.752
38	1151.797	0	1151.797	1151.797
38.5	945.540	0	945.540	945.540
39	1734.071	0	1734.071	1734.071
39.5	3819.458	0	3819.458	3819.458
40	5421.483	0	5421.483	5421.483
40.5	6650.077	0	6650.077	6650.077
41	6388.828	0	6388.828	6388.828
41.5	8118.780	0	8118.780	8118.780
42	5656.552	0	5656.552	5656.552
42.5	4170.520	0	4170.520	4170.520
43	4628.364	0	4628.364	4628.364
43.5	4813.551	0	4813.551	4813.551
44	1744.952	0	1744.952	1744.952
44.5	1411.979	0	1411.979	1411.979
45	1494.091	0	1494.091	1494.091
45.5	818.854	0	818.854	818.854
46	813.010	0	813.010	813.010
46.5	509.611	0	509.611	509.611
47	0	0	0	0
47.5	93.407	0	93.407	93.407
48	0	0	0	0
48.5	0	0	0	0
49	265.090	0	265.090	265.090
49.5	668.331	0	668.331	668.331
50	0	0	0	0
50.5	289.450	0	289.450	289.450
51	0	0	0	0
51.5	306.482	0	306.482	306.482
52	0	0	0	0
52.5	0	0	0	0
53	0	0	0	0
53.5	0	0	0	0
54	0	0	0	0
54.5	0	0	0	0
55	0	0	0	0
TOTAL	**62572.575**	**0**	**62572.575**	**62572.575**

Table 18. *ECOCADIZ 2019-07* survey. Longspine snipefish (*Macroramphosus scolopax*). 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 44**.

ECOCADIZ 2019-07 . *Macroramphosus scolopax* . ABUNDANCE (in numbers and million fish)									
Size class	POL01	POL02	POL03	*n*			Millions		
				PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
8	0	0	0	0	0	0	0	0	0
8.5	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
9.5	0	0	0	0	0	0	0	0	0
10	234469295	101	31764	234469396	31764	234501160	234	0.03	235
10.5	781529781	336	105876	781530117	105876	781635993	782	0.1	782
11	1094224582	471	148238	1094225053	148238	1094373291	1094	0.1	1094
11.5	625285991	269	84709	625286260	84709	625370969	625	0.1	625
12	117286453	50	15889	117286503	15889	117302392	117	0.02	117
12.5	78121895	34	10583	78121929	10583	78132512	78	0.01	78
13	0	0	0	0	0	0	0	0	0
13.5	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
14.5	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
TOTAL *n*	2930917997	1261	397059	2930919258	397059	2931316317	**2931**	**0.4**	**2931**
Millions	**2931**	**0.001**	**0.4**						

ECOCADIZ 2019-07 . *Macroramphosus scolopax* . BIOMASS (t)						
Size class	POL01	POL02	POL03	PORTUGAL	SPAIN	TOTAL
8	0	0	0	0	0	0
8.5	0	0	0	0	0	0
9	0	0	0	0	0	0
9.5	0	0	0	0	0	0
10	1338.417	0.001	0.181	1338.418	0.181	1338.599
10.5	5185.511	0.002	0.702	5185.513	0.702	5186.215
11	8381.506	0.004	1.135	8381.510	1.135	8382.645
11.5	5494.793	0.002	0.744	5494.795	0.744	5495.539
12	1175.685	0.001	0.159	1175.686	0.159	1175.845
12.5	888.585	0	0.120	888.585	0.120	888.705
13	0	0	0	0	0	0
13.5	0	0	0	0	0	0
14	0	0	0	0	0	0
14.5	0	0	0	0	0	0
15	0	0	0	0	0	0
TOTAL	**22464.497**	**0.010**	**3.041**	**22464.507**	**3.041**	**22467.548**

Table 19. *ECOCADIZ 2019-07* survey. Pearlside (*Maurolicus muelleri*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 46**.

***ECOCADIZ 2019-07* . *Maurolicus muelleri* . ABUNDANCE (in numbers and million fish)**									
Size class	**POL01**	**POL02**	**POL03**	***n***			**Millions**		
				PORTUGAL	**SPAIN**	**TOTAL**	**PORTUGAL**	**SPAIN**	**TOTAL**
0	0	0	0	0	0	0	0	0	0
0.5	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1.5	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0.00	0
2.5	0	0	0	0	0	0	0	0.0	0
3	138484	6099031	135781454	6237515	135781454	142018969	6	135.8	142
3.5	1038582	45740545	1018312180	46779127	1018312180	1065091307	47	1018.3	1065
4	2077164	91481090	2036624360	93558254	2036624360	2130182614	94	2036.62	2130
4.5	692381	30493405	678868290	31185786	678868290	710054076	31	678.87	710
5	346201	15247140	339443890	15593341	339443890	355037231	16	339	355
5.5	207716	9148109	203662436	9355825	203662436	213018261	9	204	213
6	0	0	0	0	0	0	0	0	0
6.5	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
TOTAL *n*	4500528	198209320	4412692610	202709848	4412692610	4615402458	**203**	**4413**	**4615**
Millions	**5**	**198**	**4413**						

***ECOCADIZ 2019-07* . *Maurolicus muelleri* . BIOMASS (t)**						
Size class	**POL01**	**POL02**	**POL03**	**PORTUGAL**	**SPAIN**	**TOTAL**
0	0	0	0	0	0	0
0.5	0	0	0	0	0	0
1	0	0	0	0	0	0
1.5	0	0	0	0	0	0
2	0	0	0	0	0	0
2.5	0	0	0	0	0	0
3	0.043	1.899	42.275	1.942	42.275	44.217
3.5	0.488	21.472	478.036	21.960	478.036	499.996
4	1.396	61.502	1369.211	62.898	1369.211	1432.109
4.5	0.640	28.208	627.994	28.848	627.994	656.842
5	0.427	18.797	418.468	19.224	418.468	437.692
5.5	0.332	14.642	325.968	14.974	325.968	340.942
6	0	0	0	0	0	0
6.5	0	0	0	0	0	0
7	0	0	0	0	0	0
TOTAL	**3.326**	**146.520**	**3261.952**	**149.846**	**3261.952**	**3411.798**

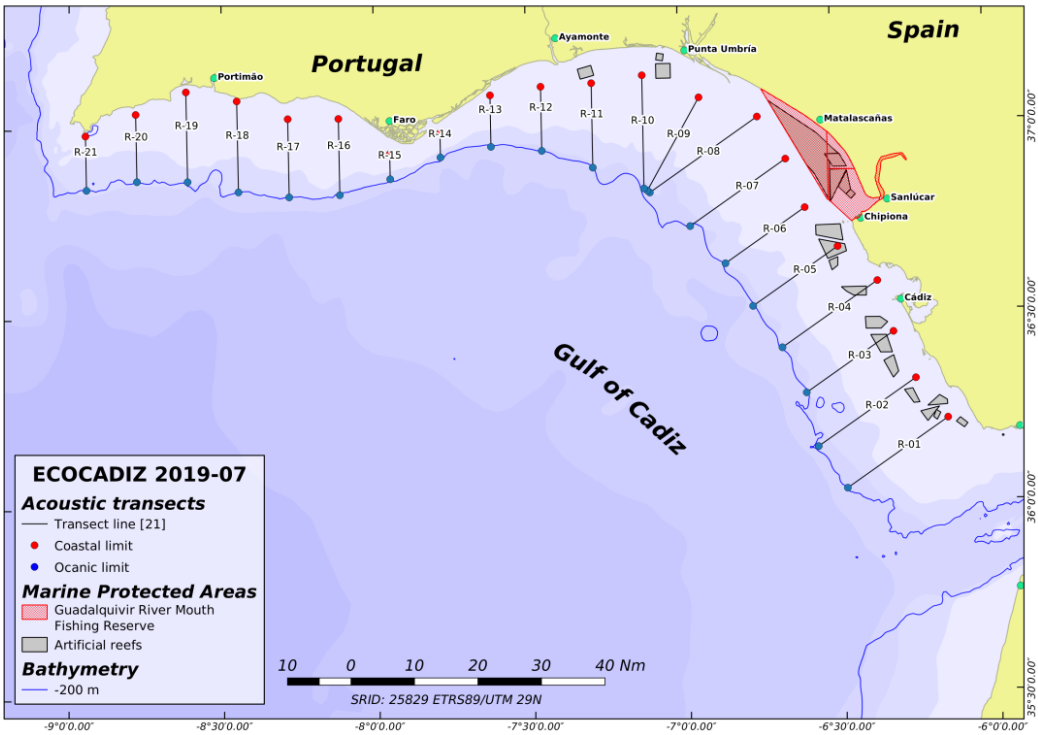


Figure 1. *ECOCADIZ 2019-07* survey. Location of the acoustic transects sampled during the survey. The different protected areas inside the Guadalquivir river mouth Fishing Reserve and artificial reef polygons are also shown.

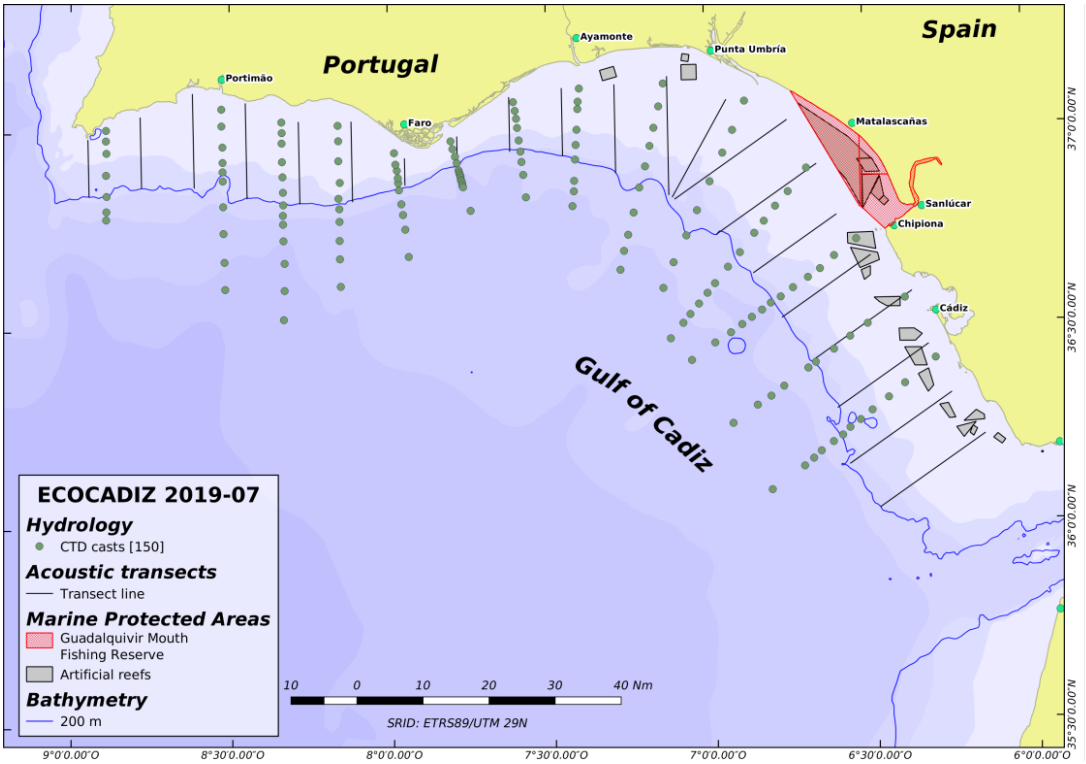


Figure 2. *ECOCADIZ 2019-07* survey. Location of CTD-LADCP stations.

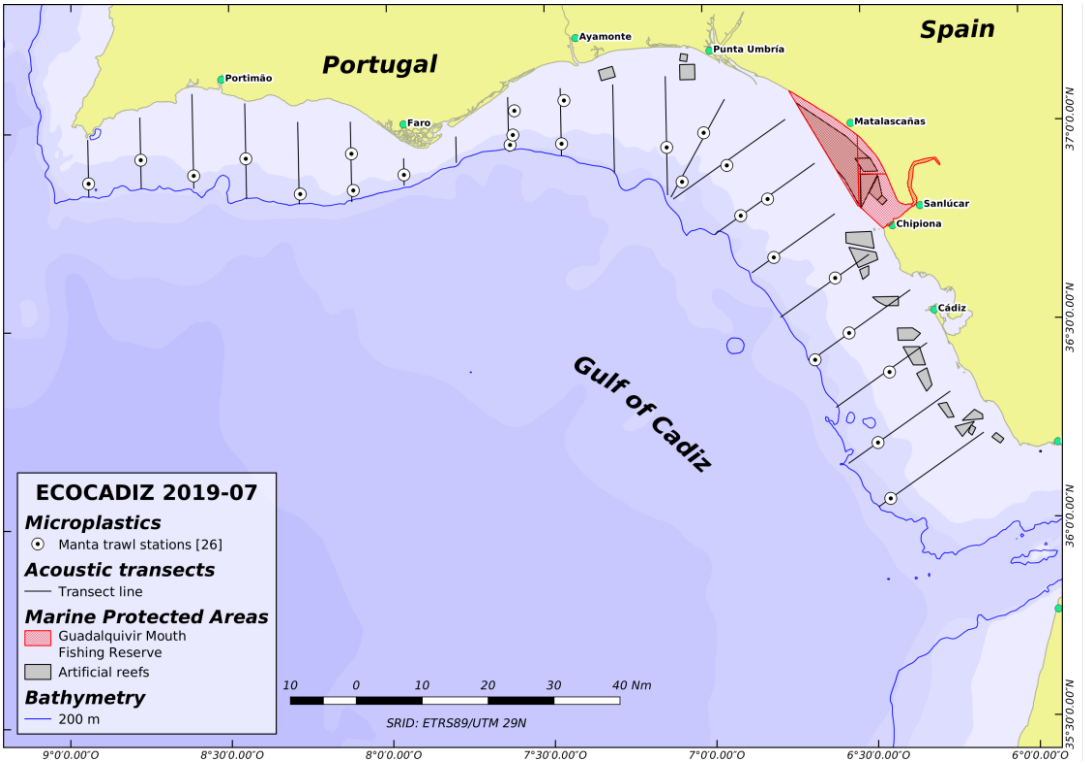


Figure 3. *ECOCADIZ 2019-07* survey. Location of Manta trawl hauls (micro-plastics).

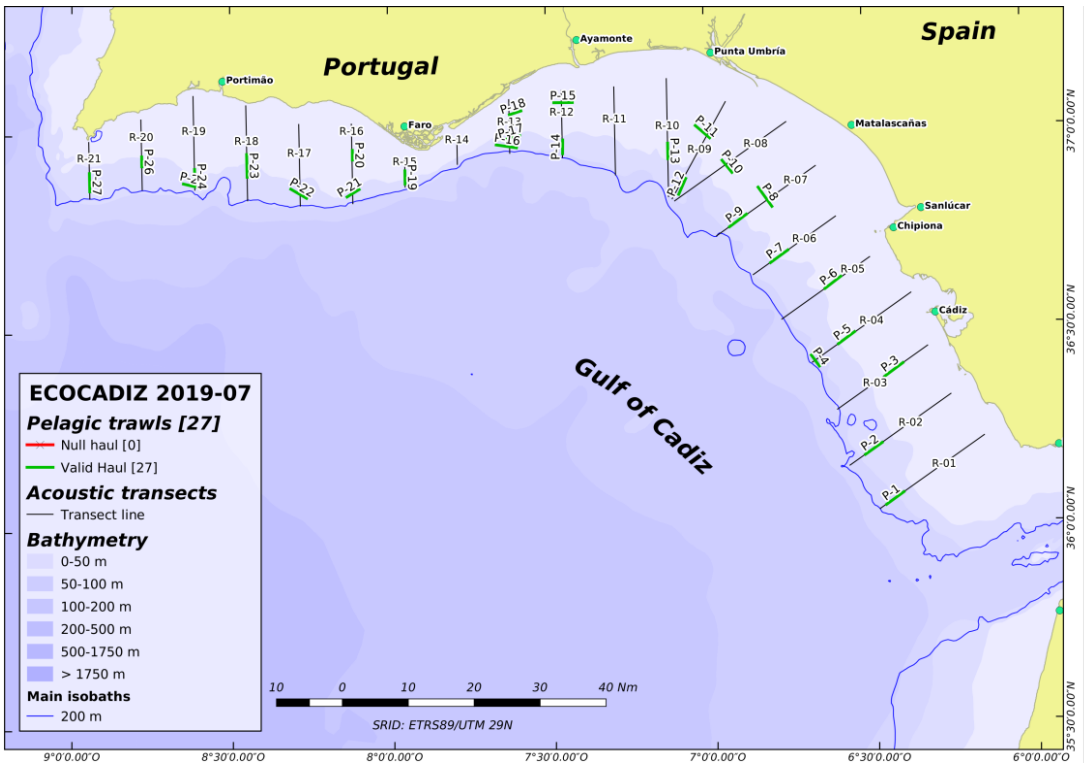


Figure 4. *ECOCADIZ 2019-07* survey. Location of ground-truthing fishing hauls.

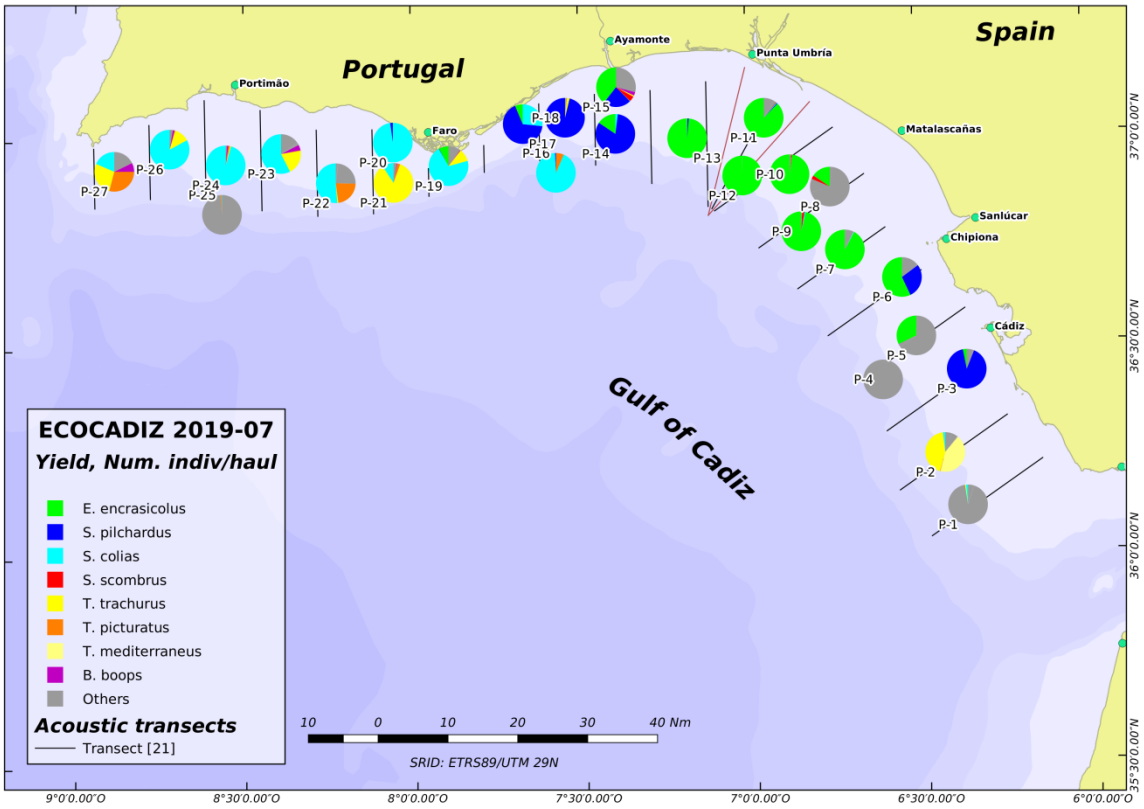


Figure 5. *ECOCADIZ 2019-07* survey. Species composition (percentages in number) in fishing hauls.

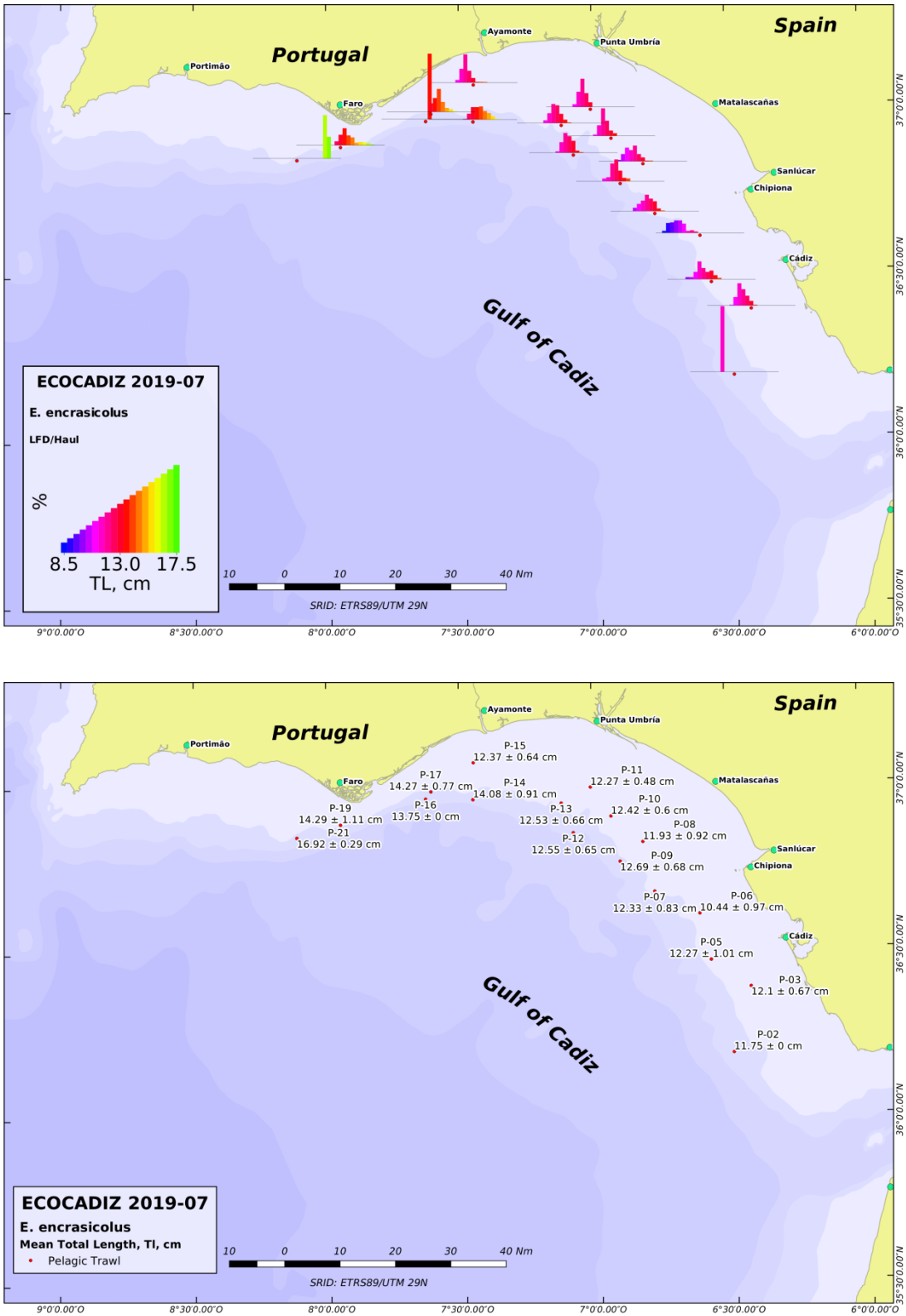


Figure 6. *ECOCADIZ 2019-07* survey. *Engraulis encrasicolus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

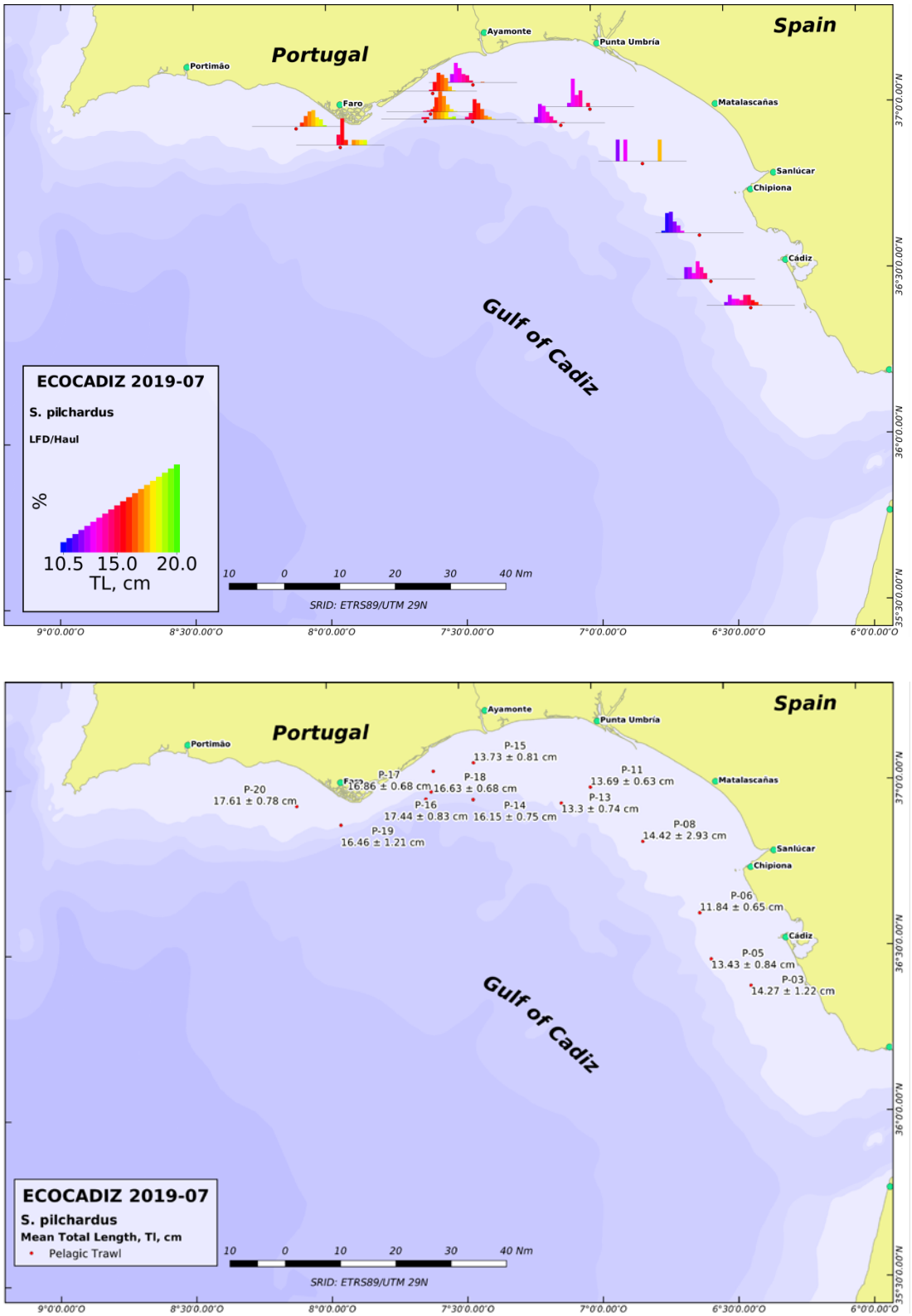


Figure 7. *ECOCADIZ 2019-07* survey. *Sardina pilchardus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

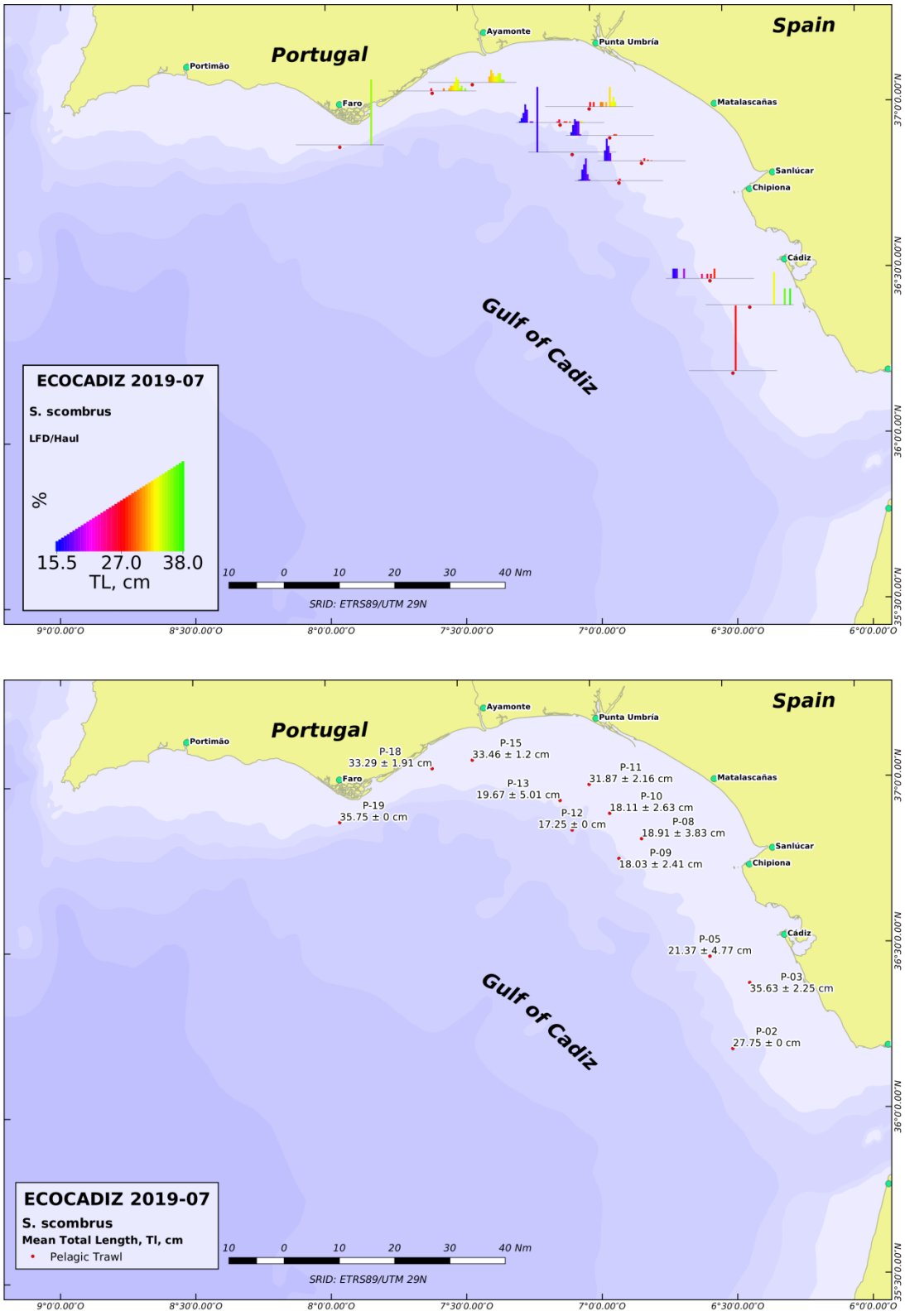


Figure 8. *ECOCADIZ 2019-07* survey. *Scomber scombrus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

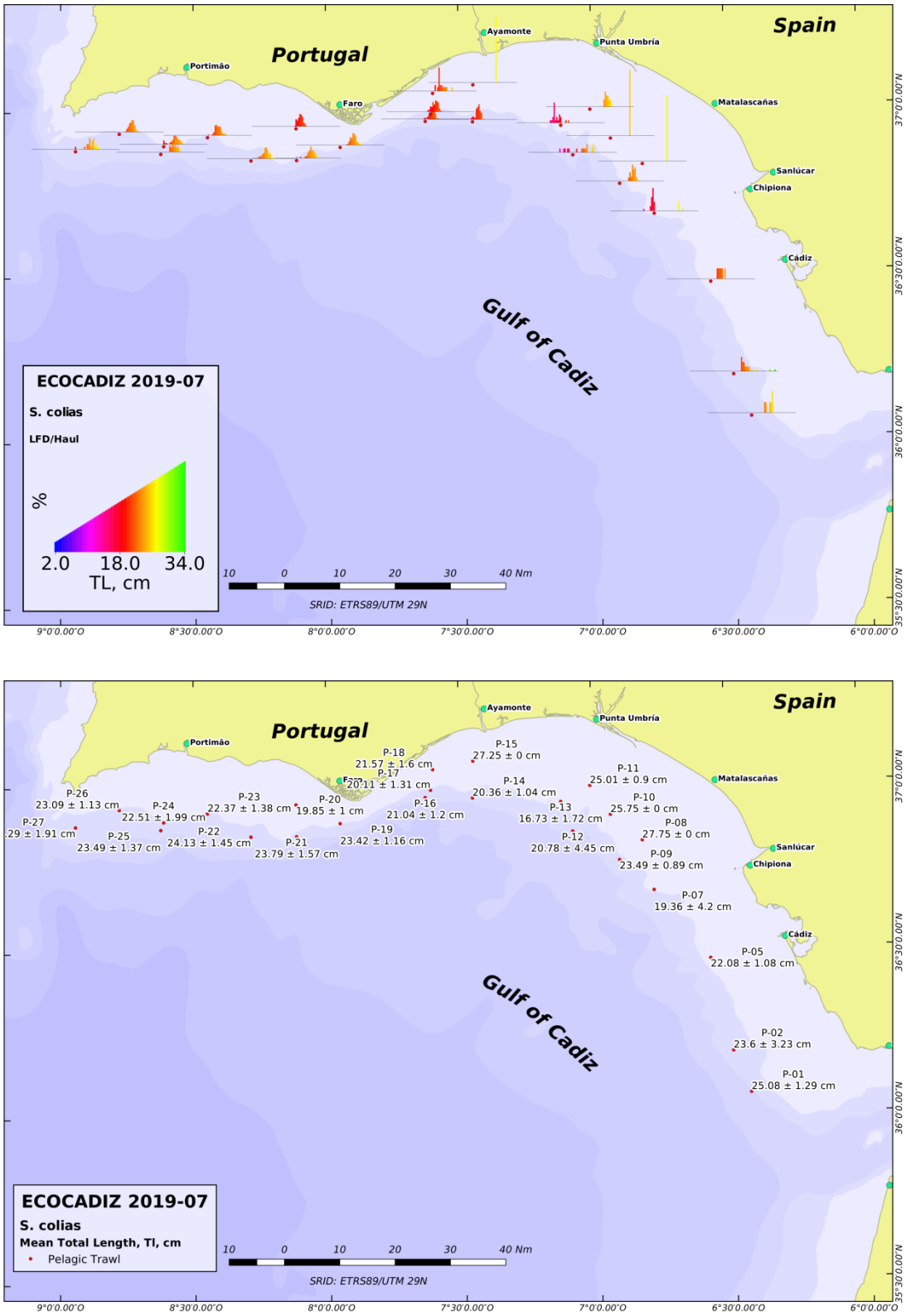


Figure 9. *ECOCADIZ 2019-07* survey. *Scomber colias*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

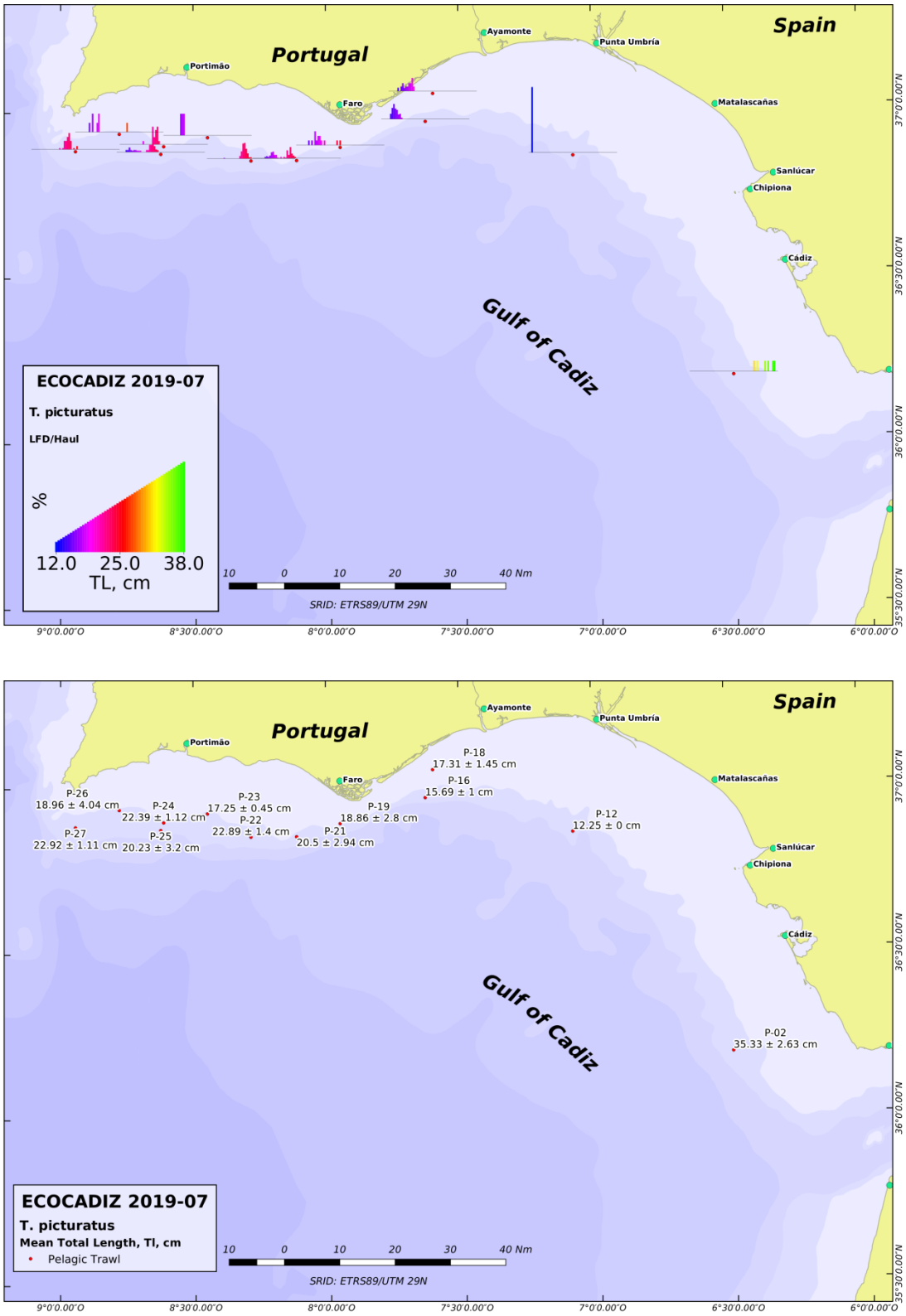


Figure 10. *ECOCADIZ 2019-07* survey. *Trachurus picturatus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

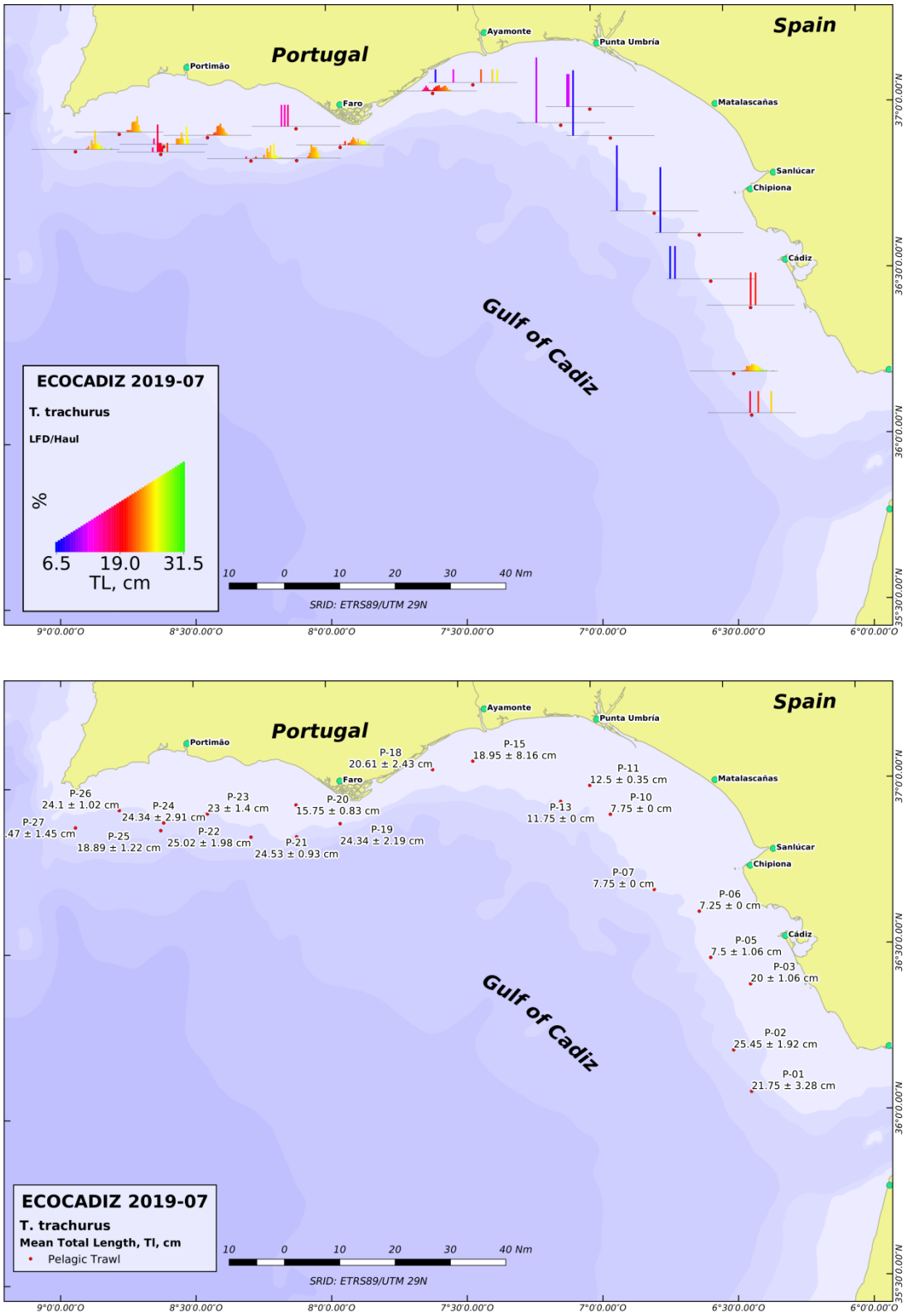


Figure 11. *ECOCADIZ 2019-07* survey. *Trachurus trachurus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

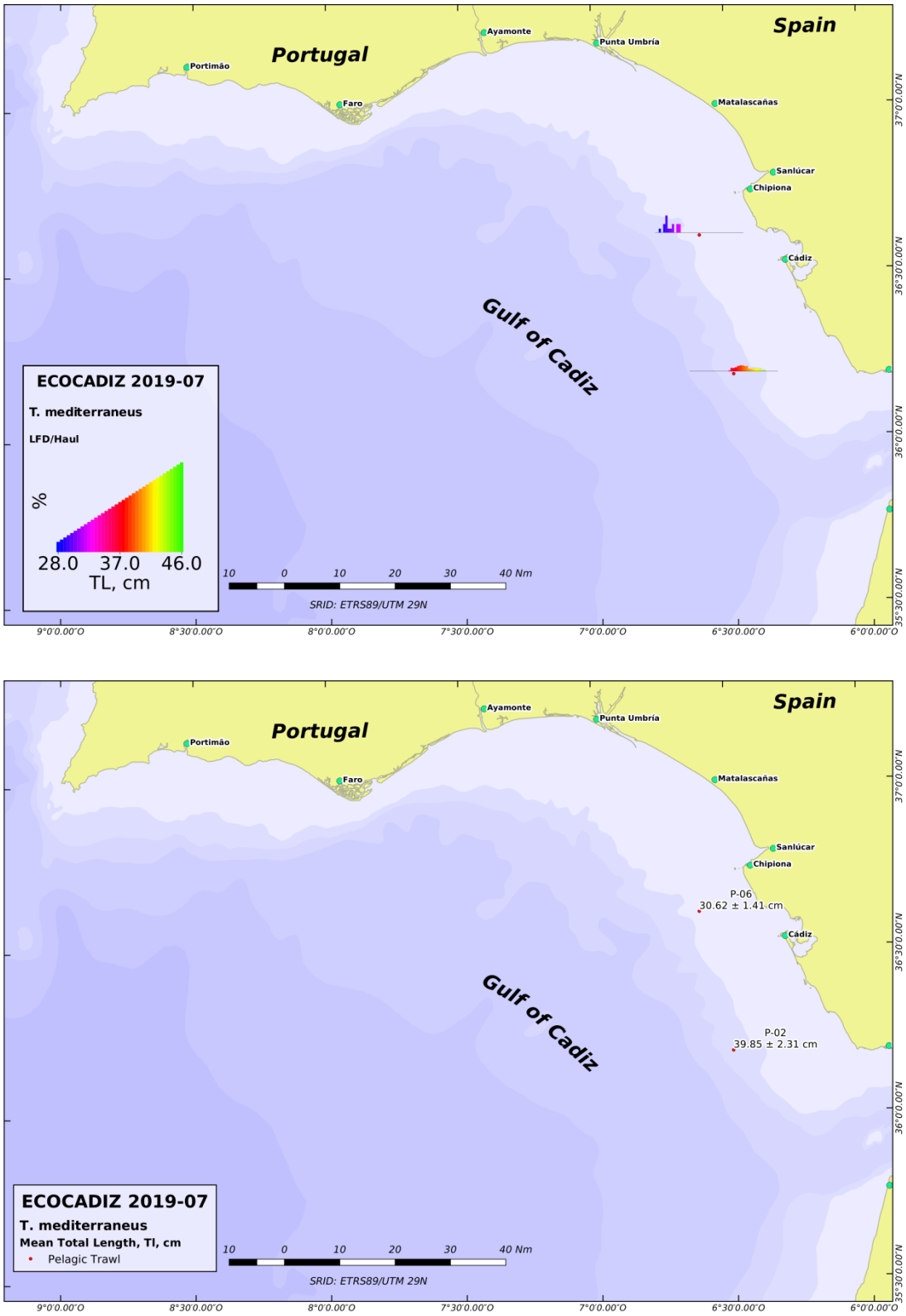


Figure 12. *ECOCADIZ 2019-07* survey. *Trachurus mediterraneus*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

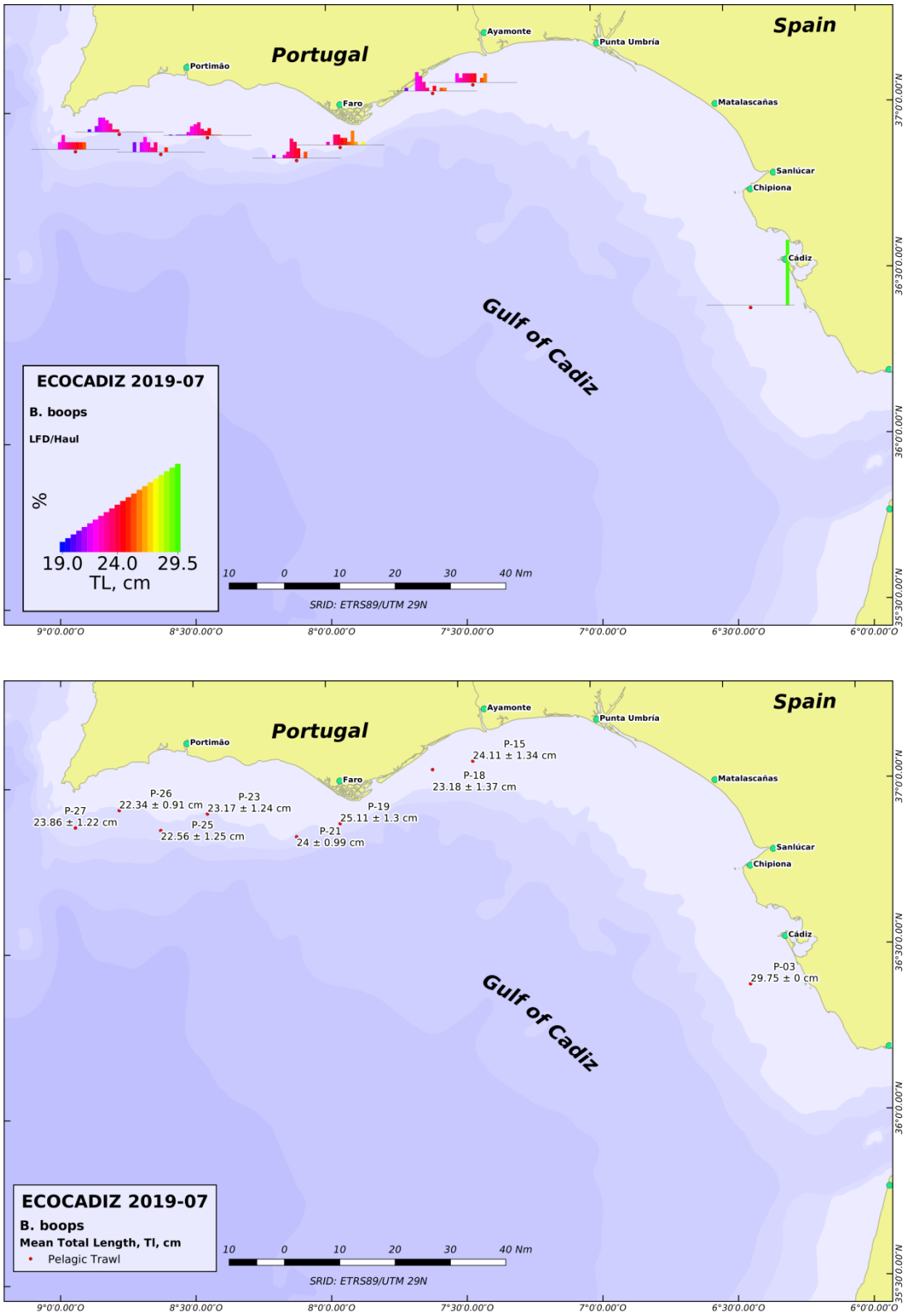


Figure 13. *ECOCADIZ 2019-07* survey. *Boops boops*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

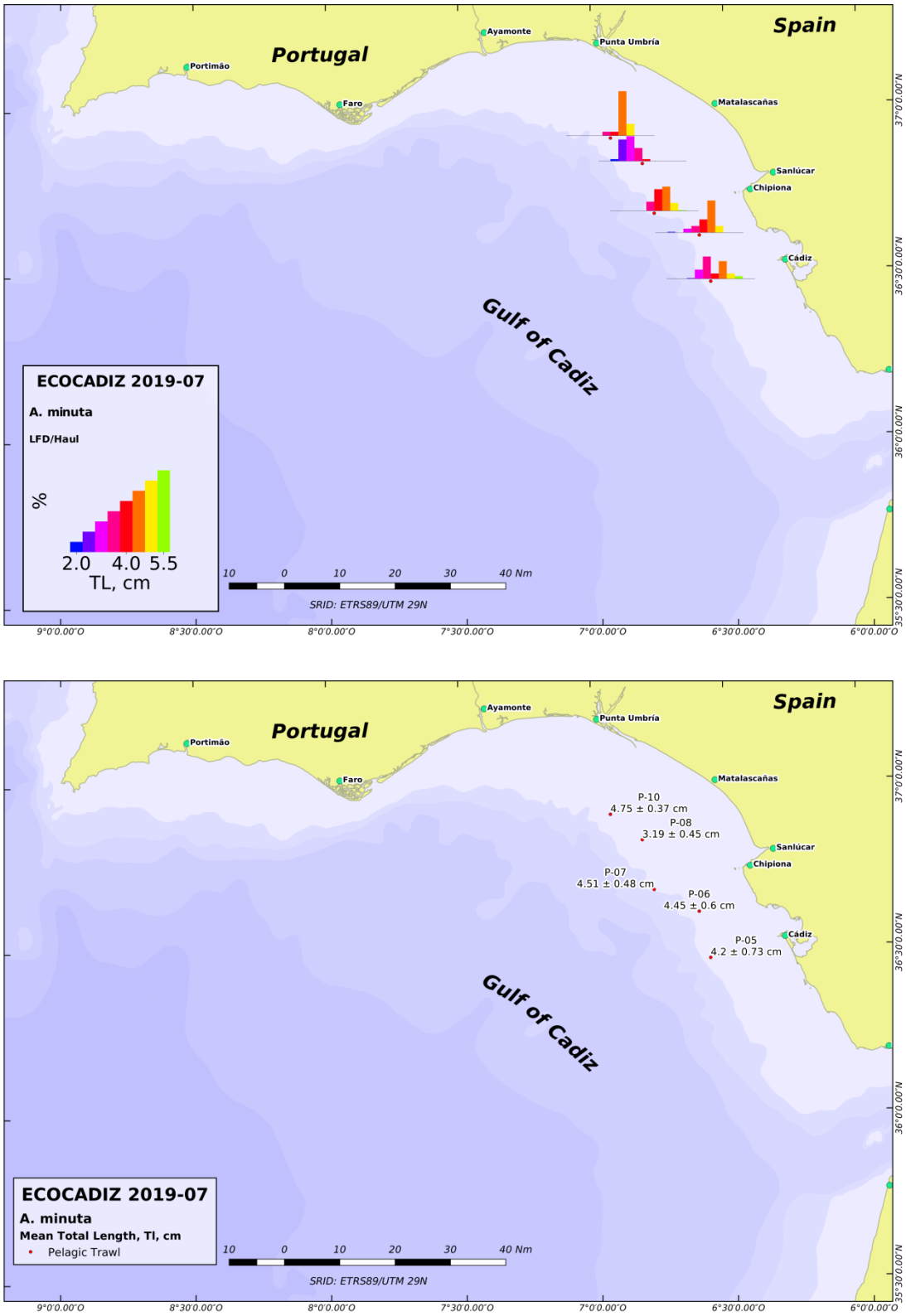


Figure 14. *ECOCADIZ 2019-07* survey. *Aphia minuta*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

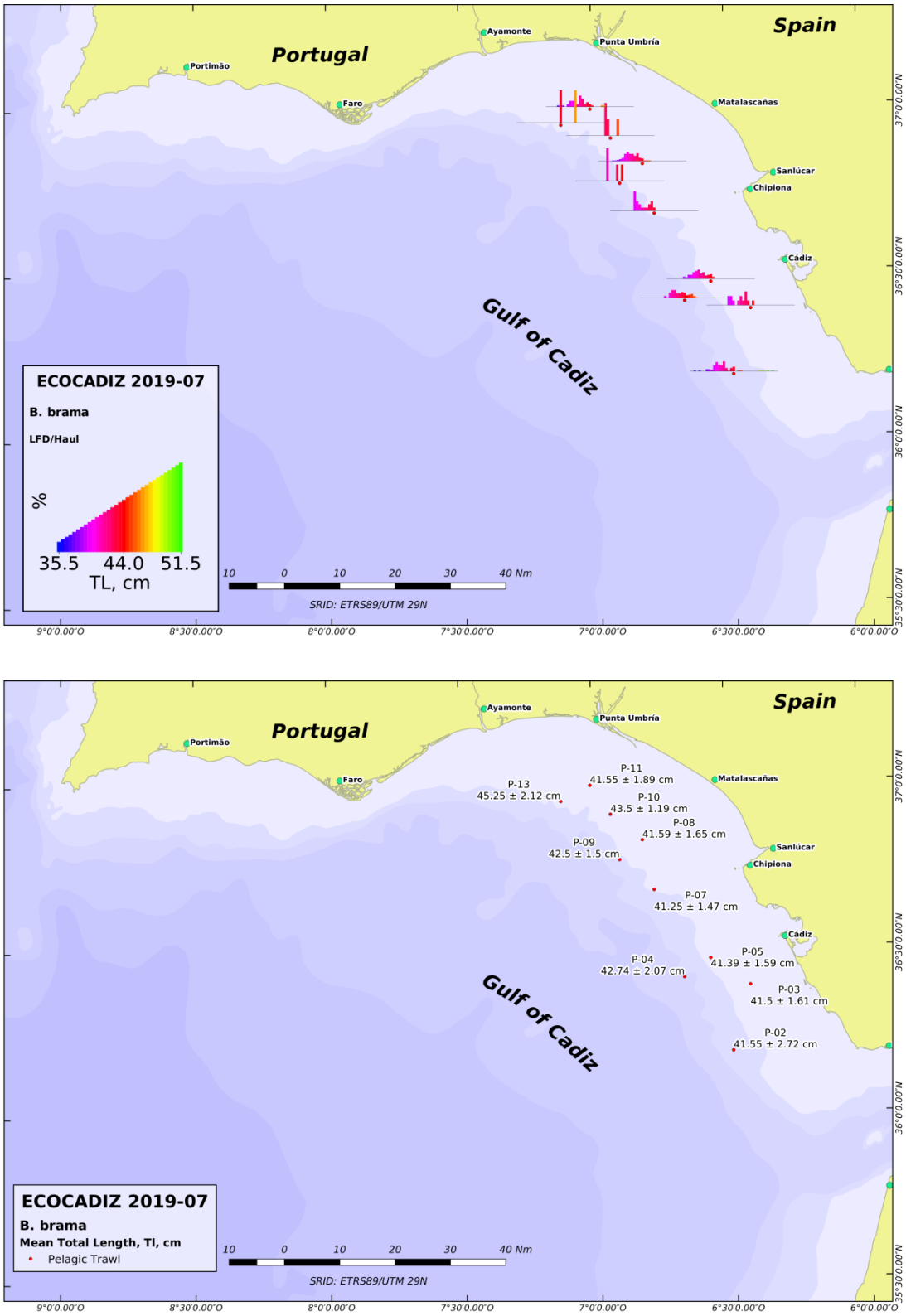


Figure 15. *ECOCADIZ 2019-07* survey. *Brama brama*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

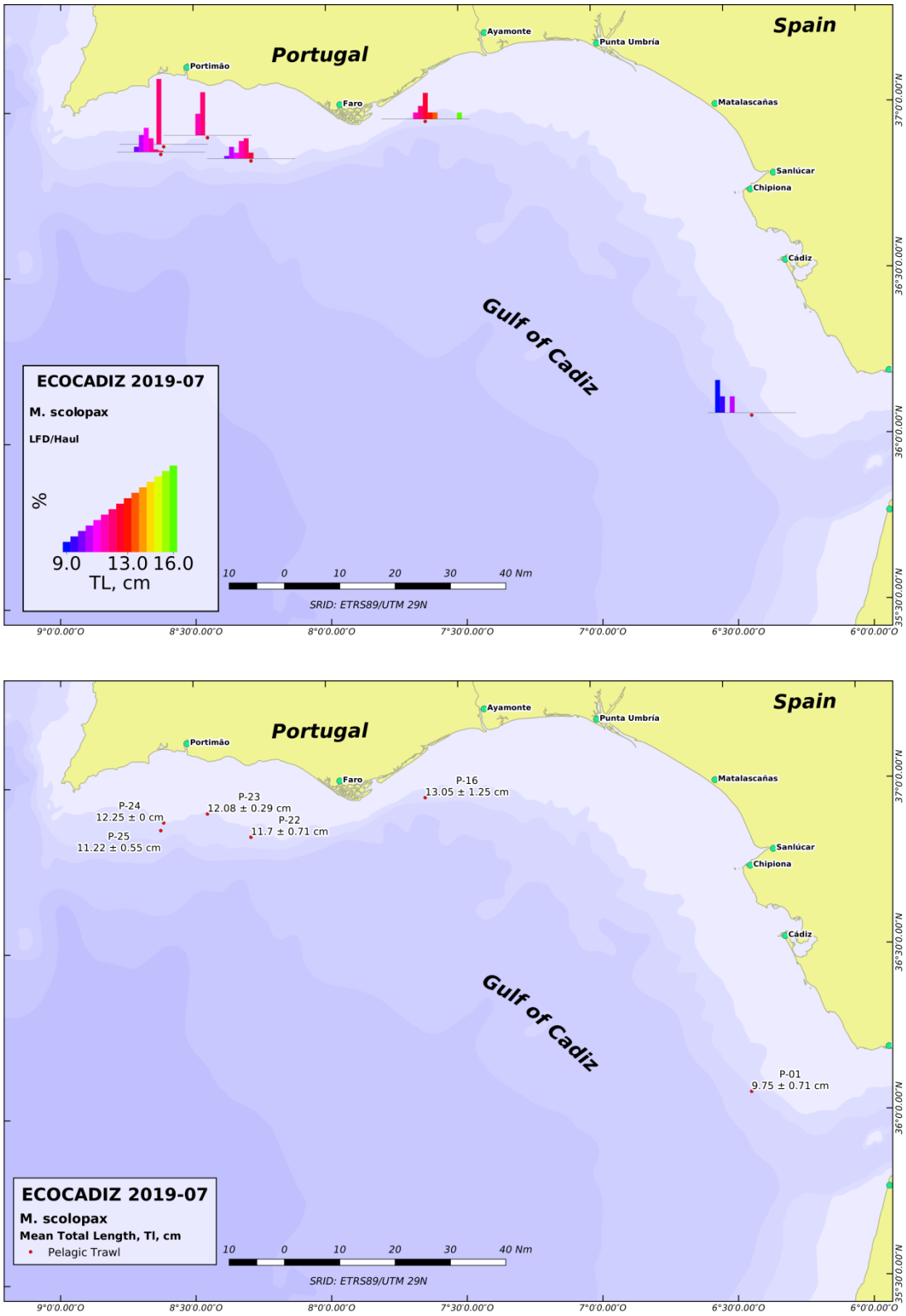


Figure 16. *ECOCADIZ 2019-07* survey. *Macrorhamphosus scolopax*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

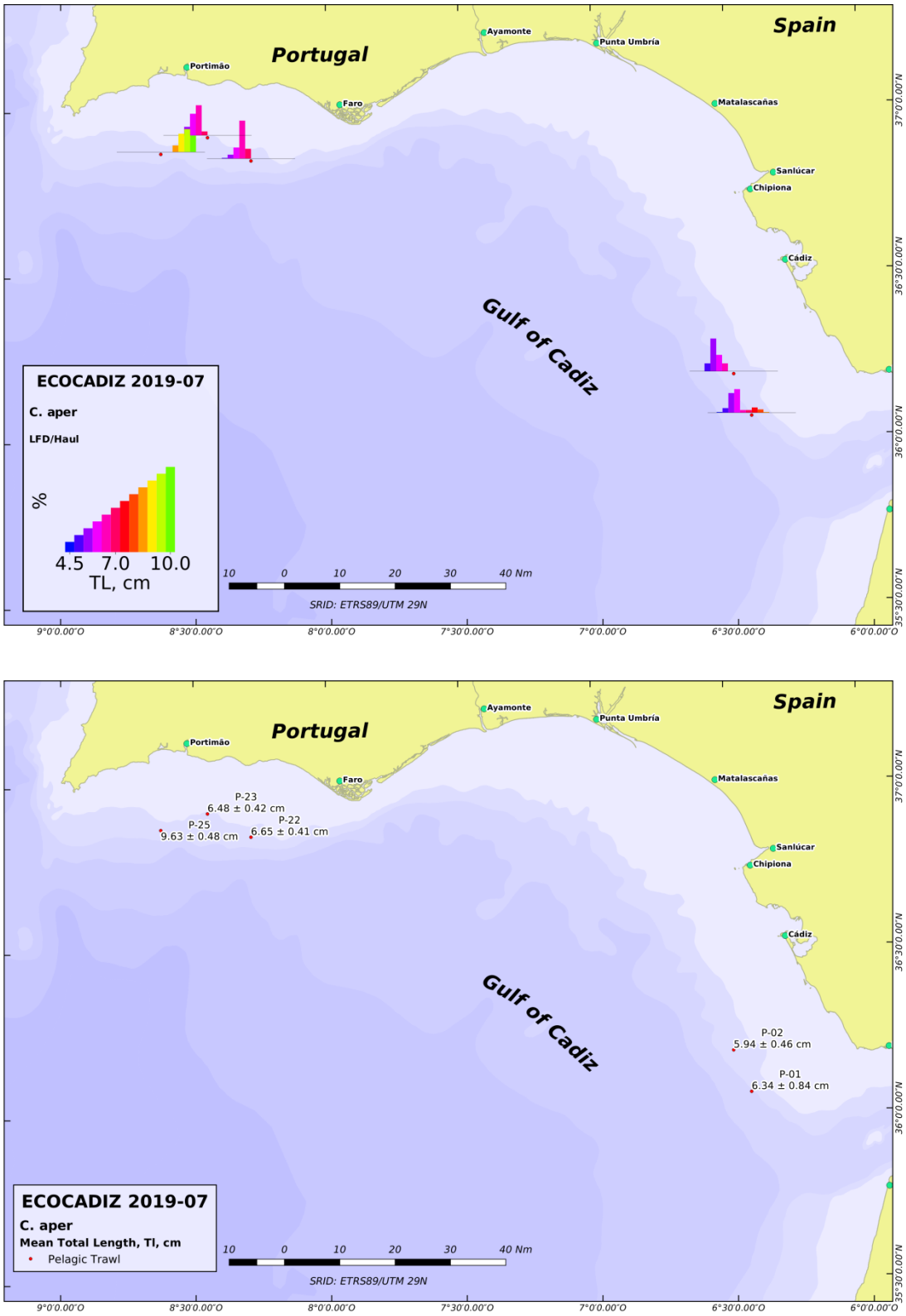


Figure 17. *ECOCADIZ 2019-07* survey. *Capros aper*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

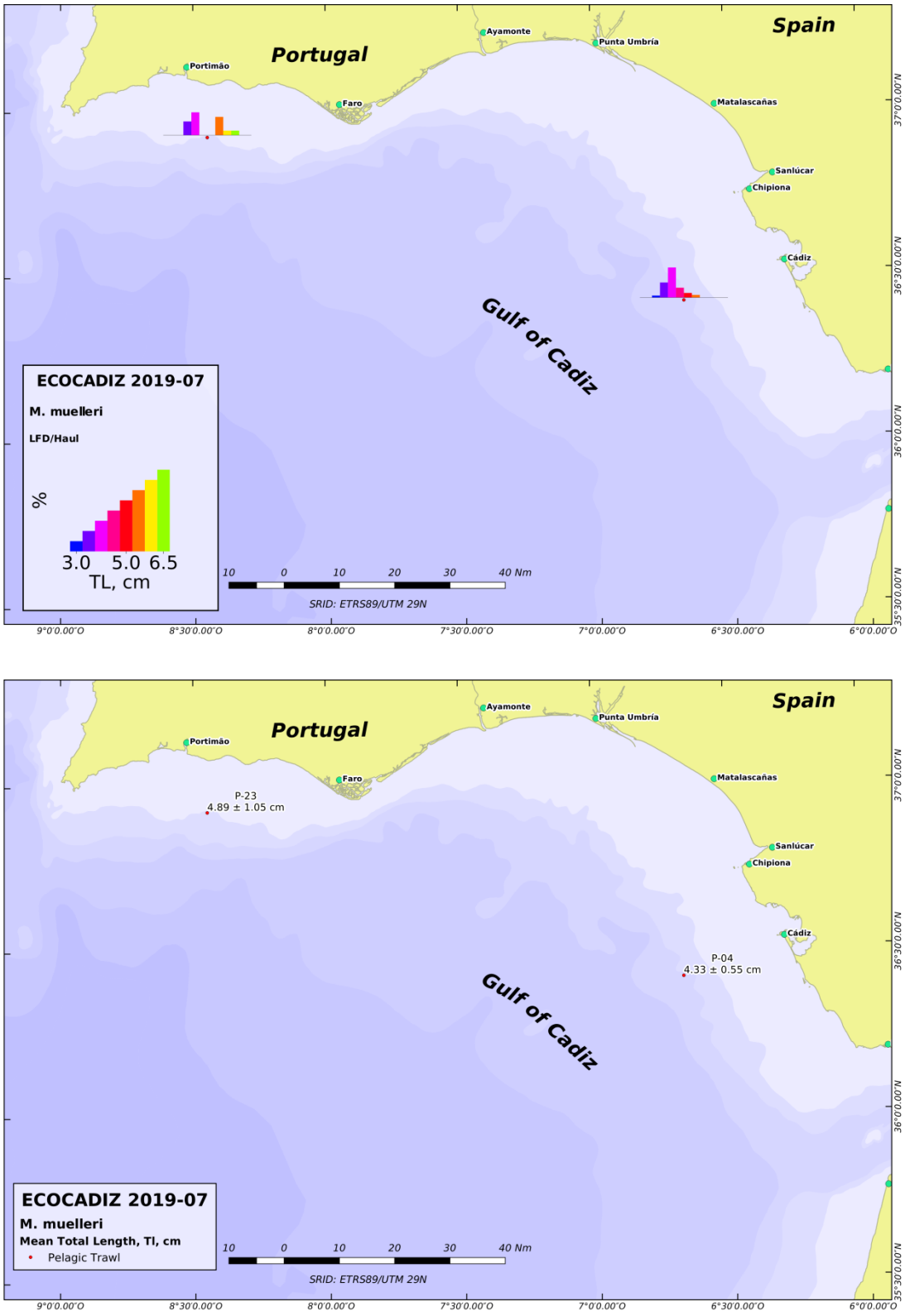


Figure 18. *ECOCADIZ 2019-07* survey. *Maurolicus muelleri*. Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

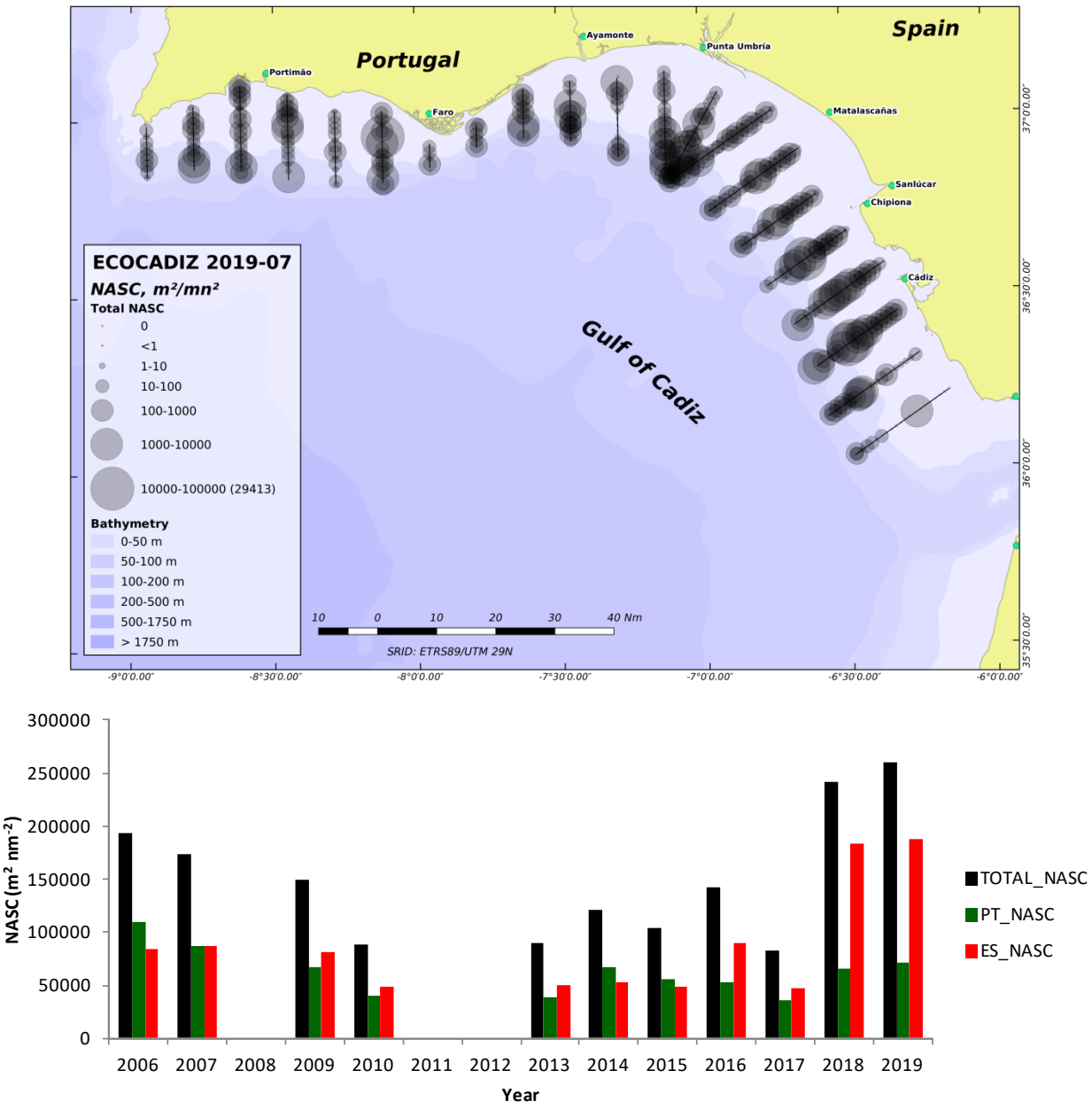


Figure 19. *ECOCADIZ 2019-07* survey. Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the pelagic fish species assemblage. Bottom: time-series of total NASC estimates per survey.

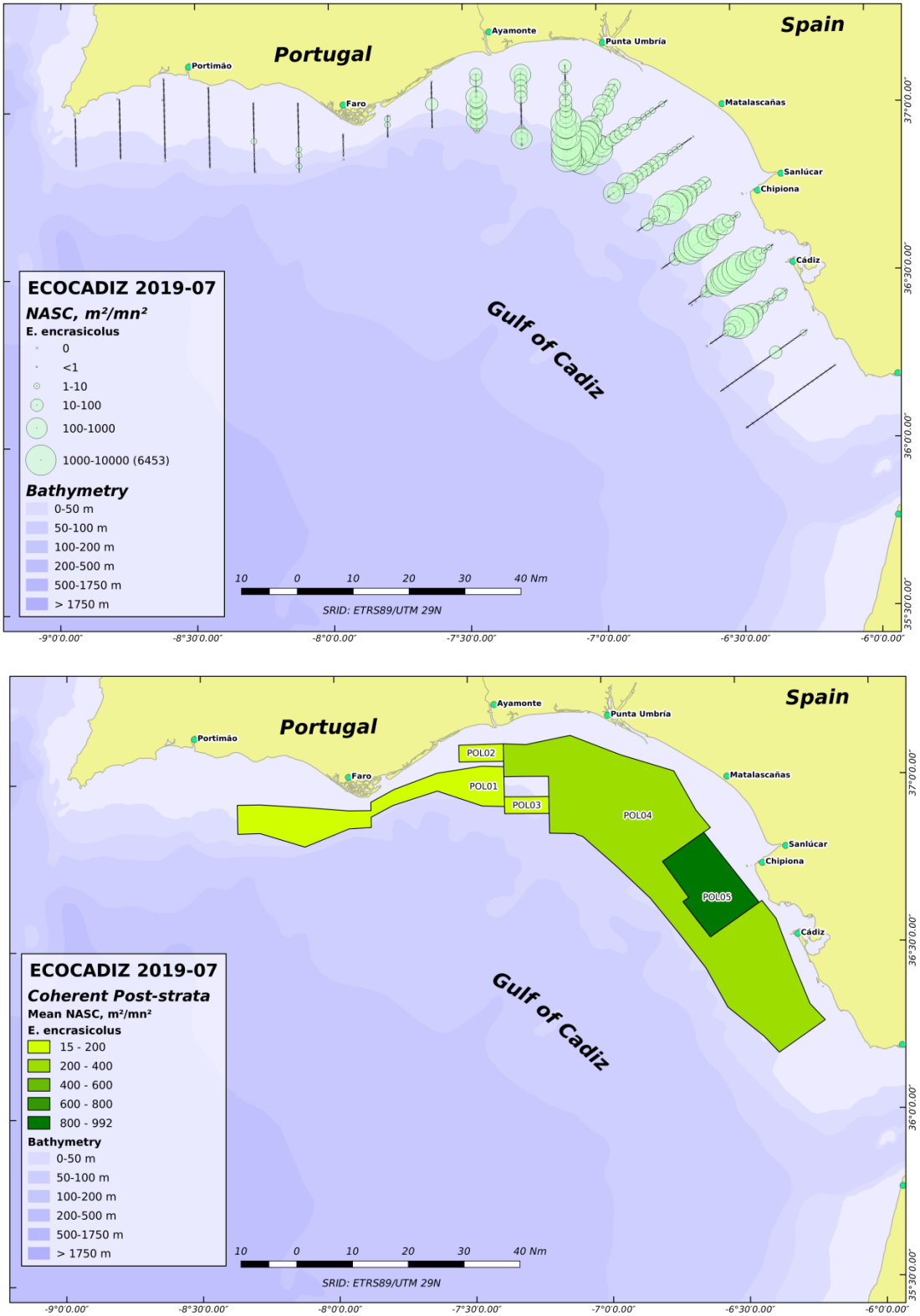


Figure 20. *ECOCADIZ 2019-07* survey. Anchovy (*Engraulis encrasicolus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

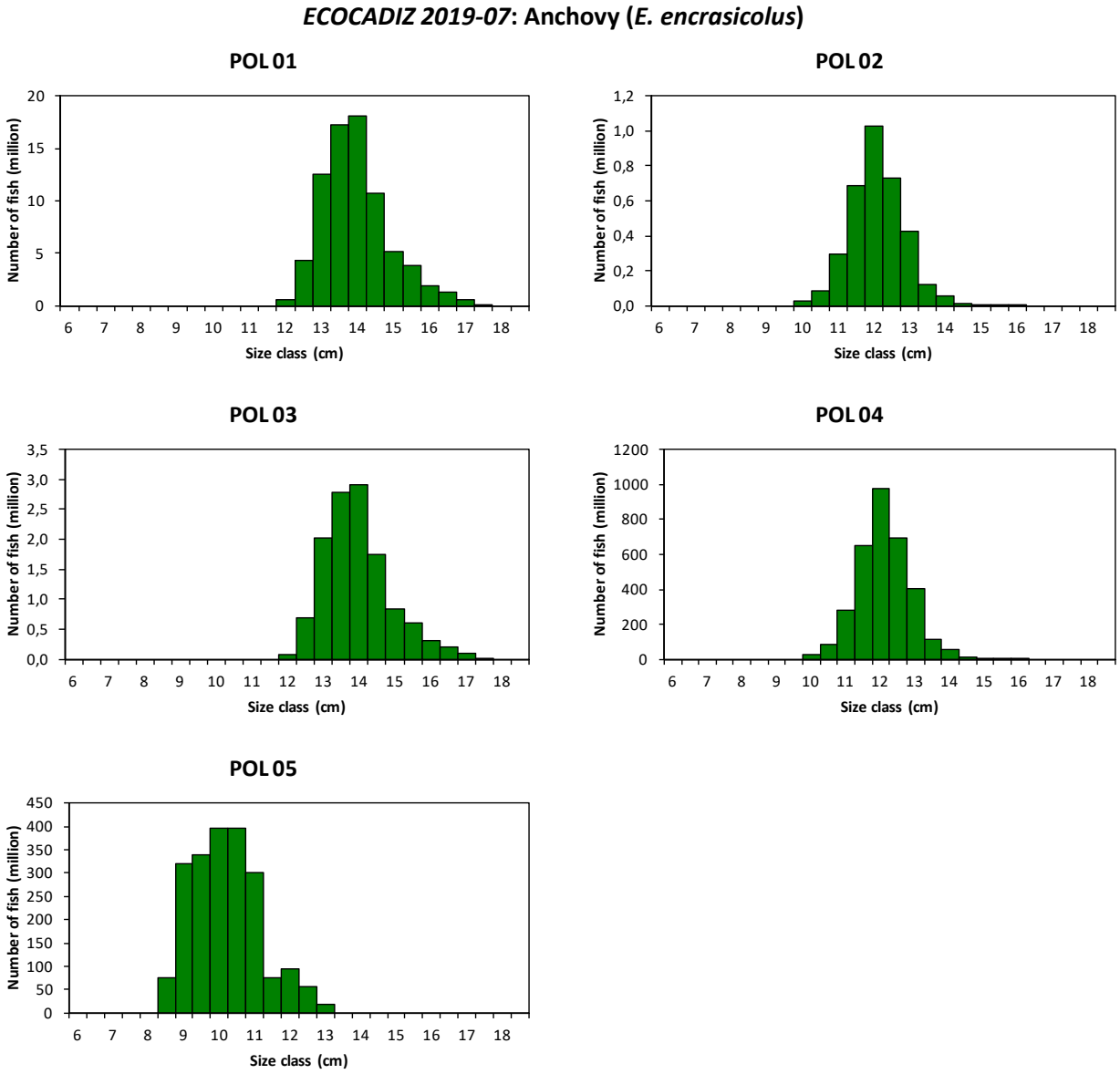


Figure 21. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 20**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

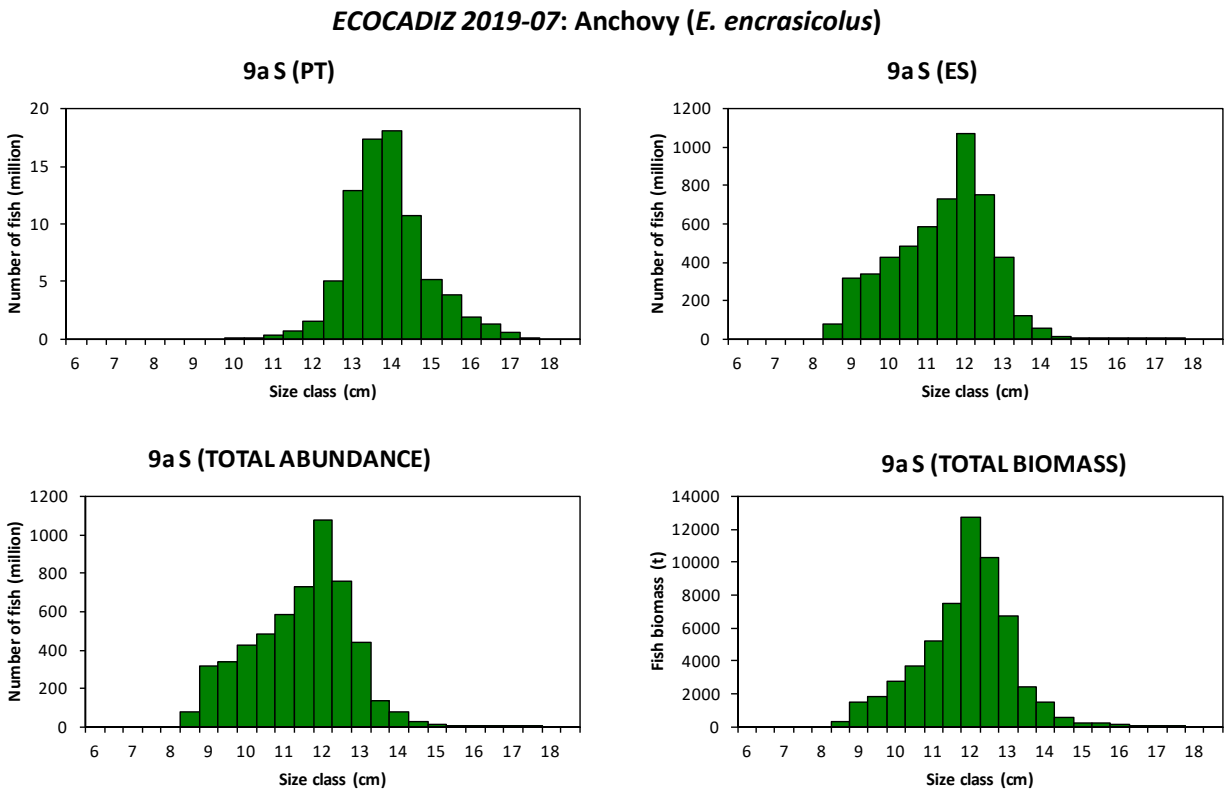


Figure 21. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Cont'd.

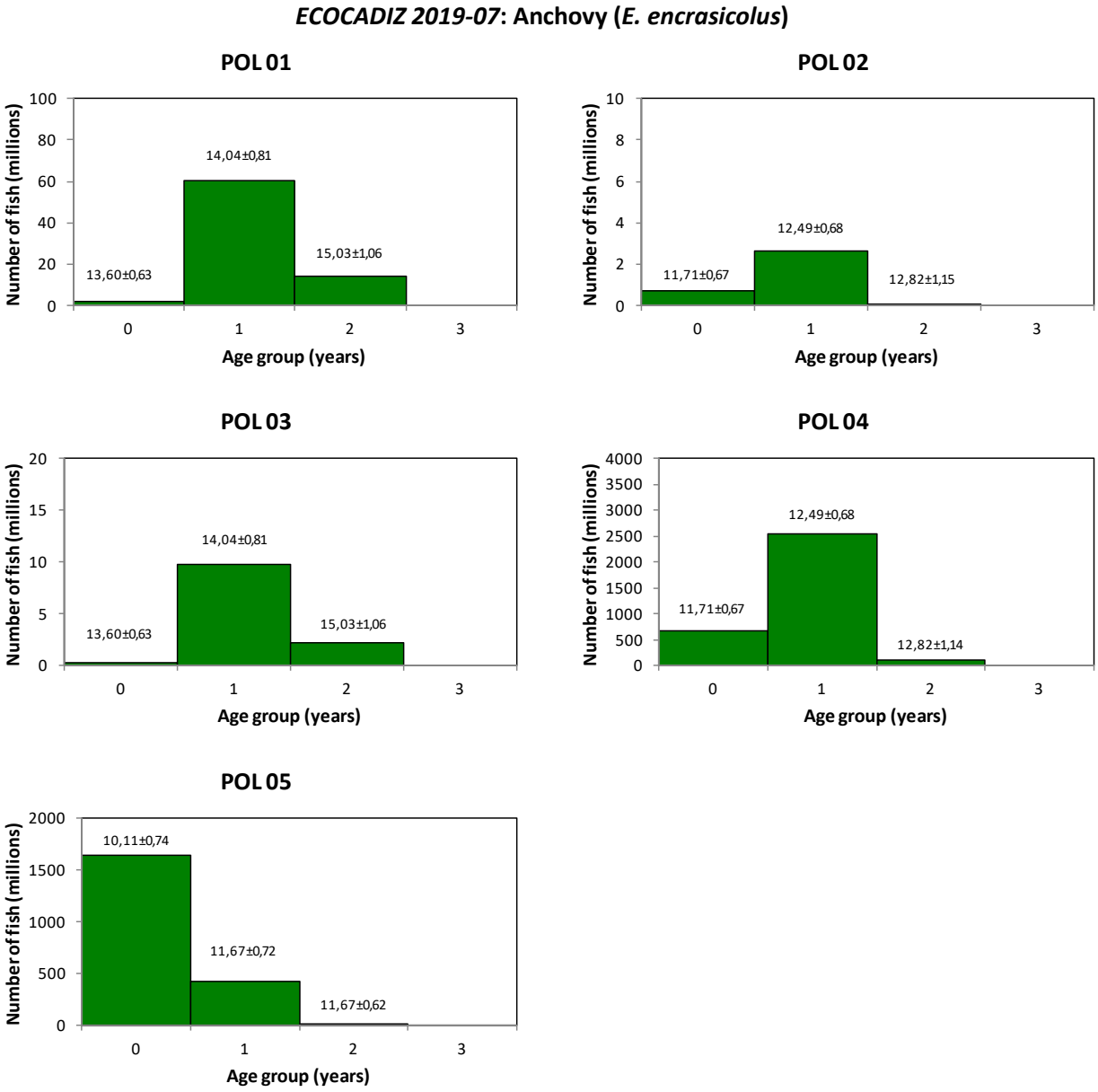


Figure 22. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 20**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

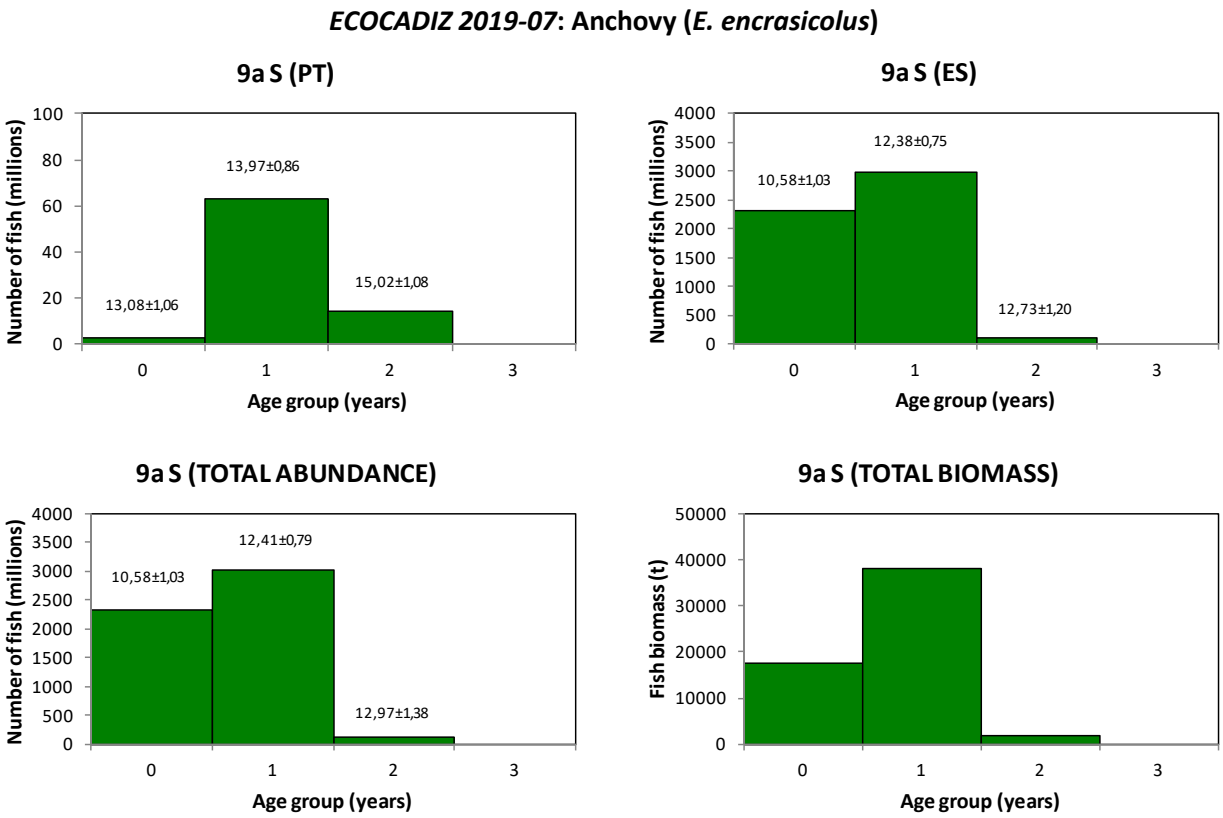
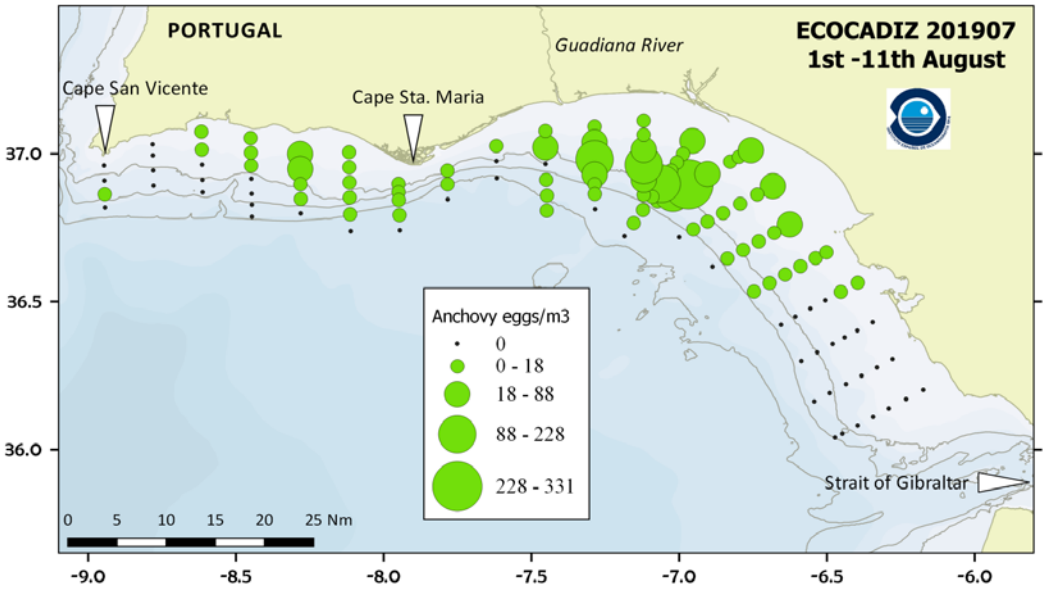
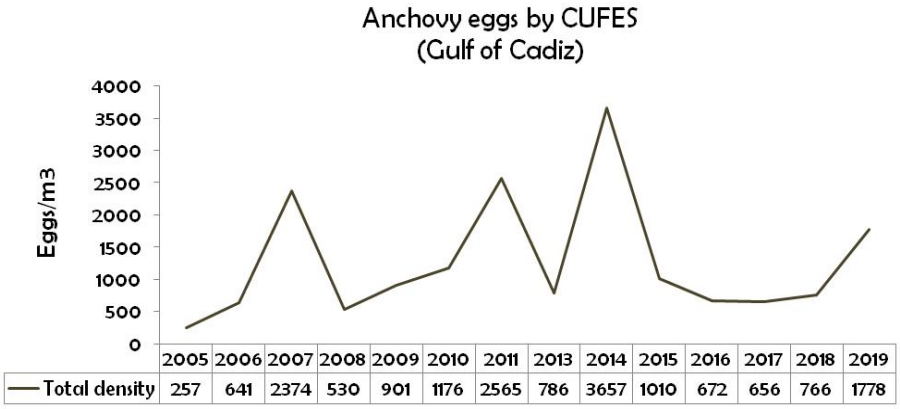


Figure 22. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Cont'd.



ECOCADIZ 2019-07	
CUFES st	121
Positive anchovy st8	73 (60.3 %)
Max number eggs by st	3599
Total anchovy eggs (in number)	19031
Max density by st (eggs/m^3)	331.4
Total density (eggs/m^3)	1778

Figure 23. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Top: distribution of anchovy egg densities sampled by CUFES (eggs m^{-3}). Bottom: main descriptors of the CUFES sampling.



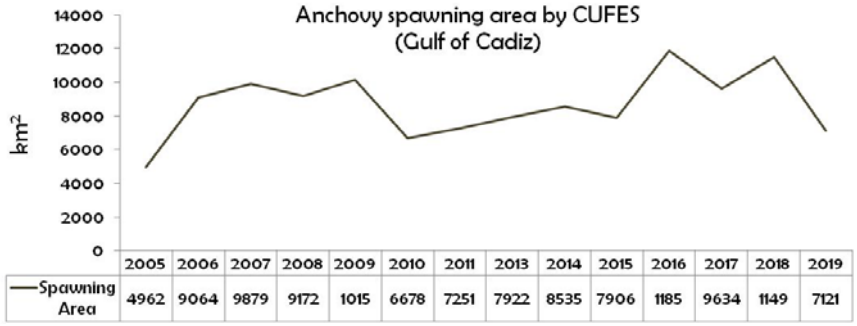


Figure 23. *ECOCADIZ 2019-07* survey. Anchovy (*E. encrasicolus*). Cont'd. Top: historical series of GoC anchovy egg total densities (eggs * m^{-3}) sampled by CUFES. Bottom: historical series of estimates of the extension of the GoC anchovy spawning area (in km^2).

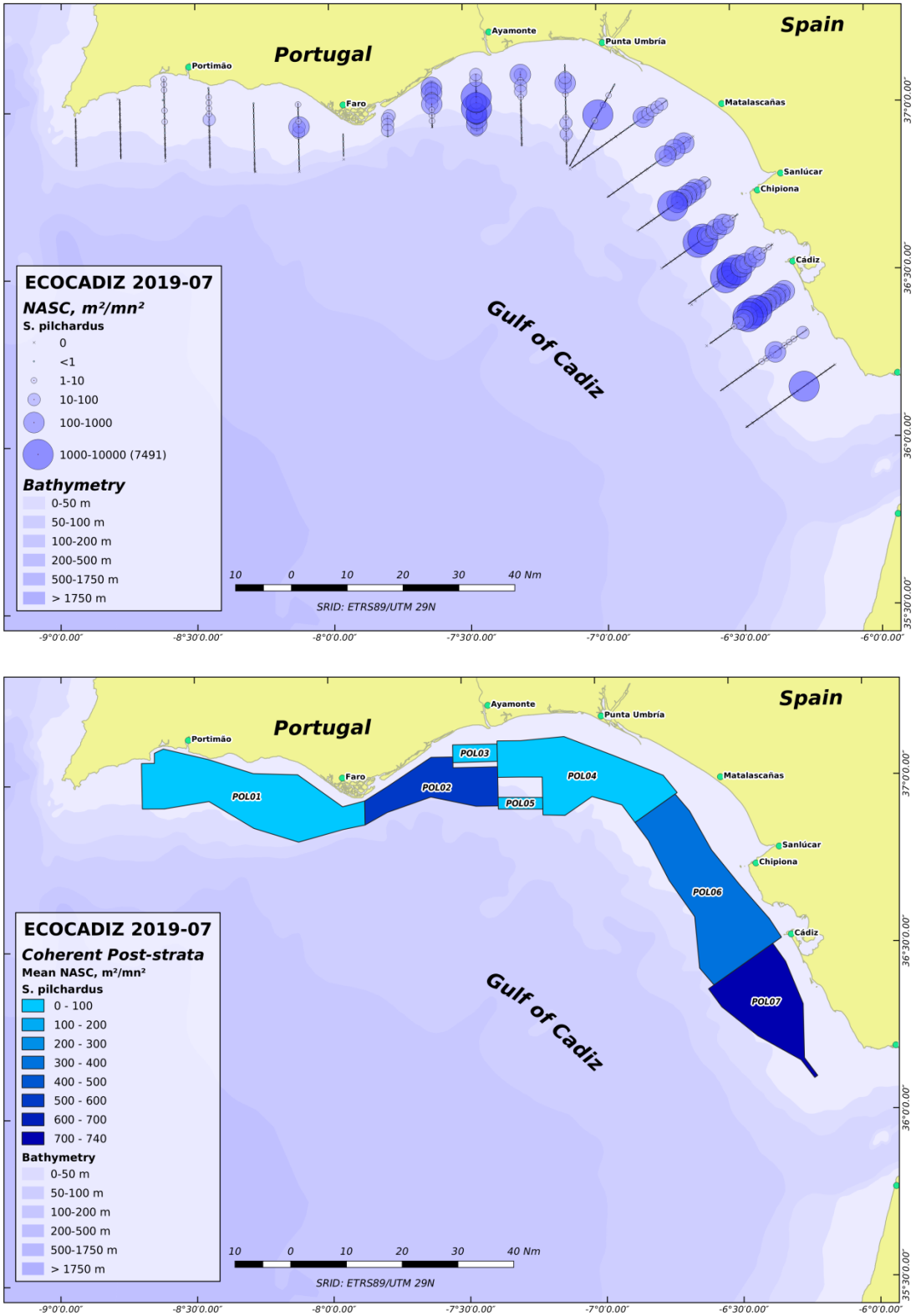


Figure 24. *ECOCADIZ 2019-07* survey. Sardine (*Sardina pilchardus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

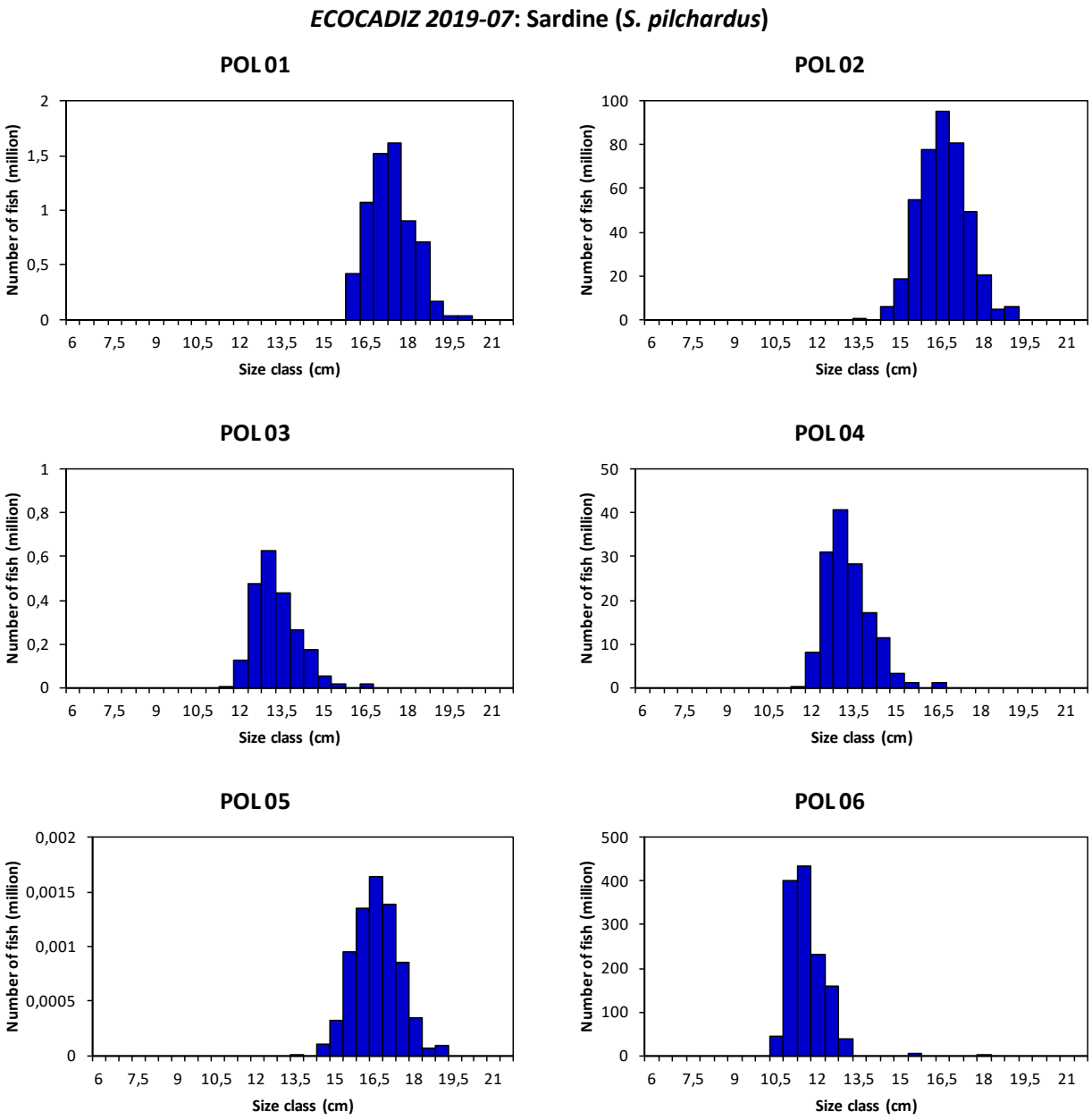


Figure 25. *ECOCADIZ 2019-07* survey. Sardine (*S. pilchardus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 24**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

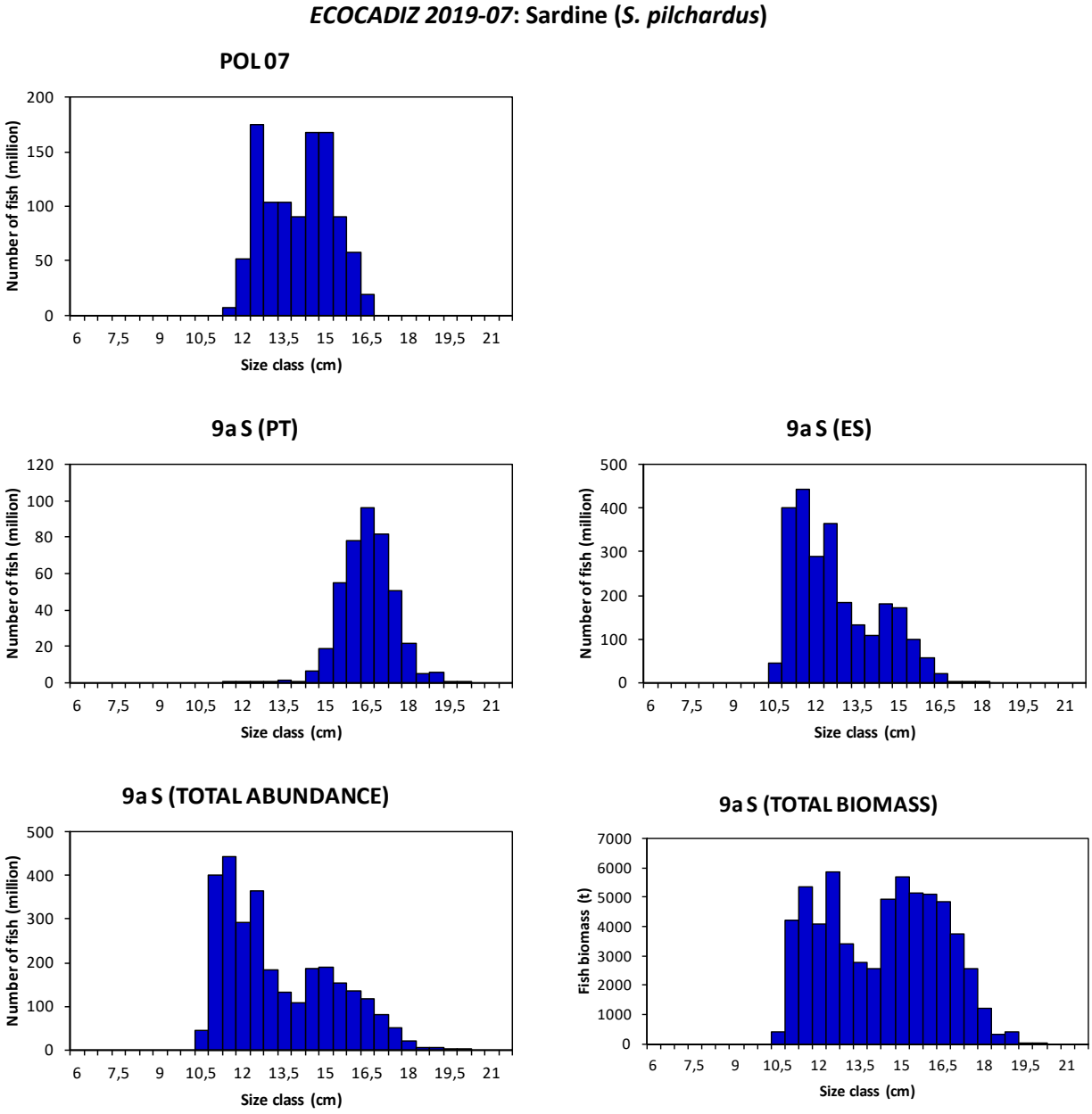


Figure 25. *ECOCADIZ 2019-07* survey. Sardine (*S. pilchardus*). Cont'd.

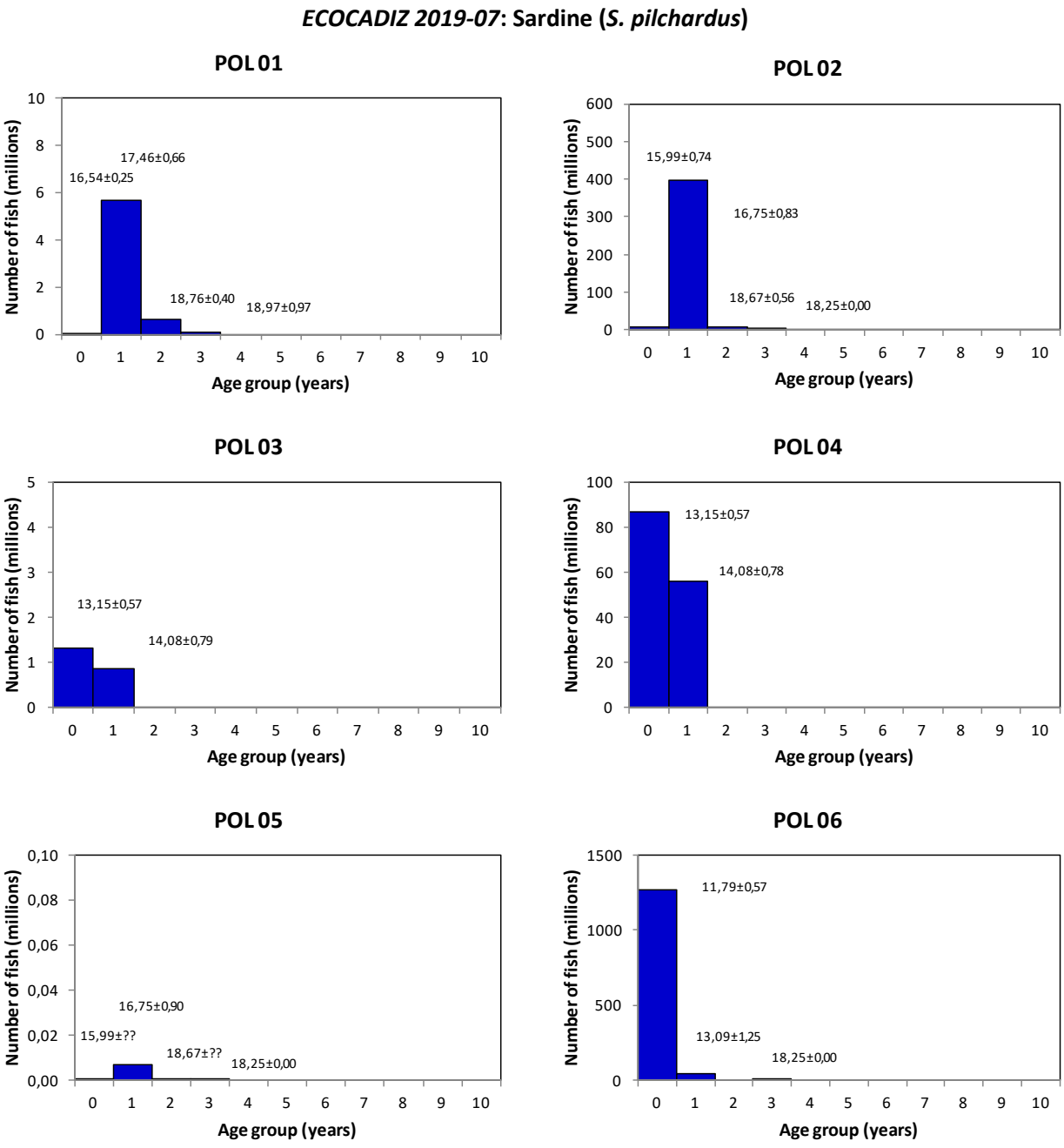


Figure 26. *ECOCADIZ 2019-07* survey. Sardine (*S. pilchardus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 24**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

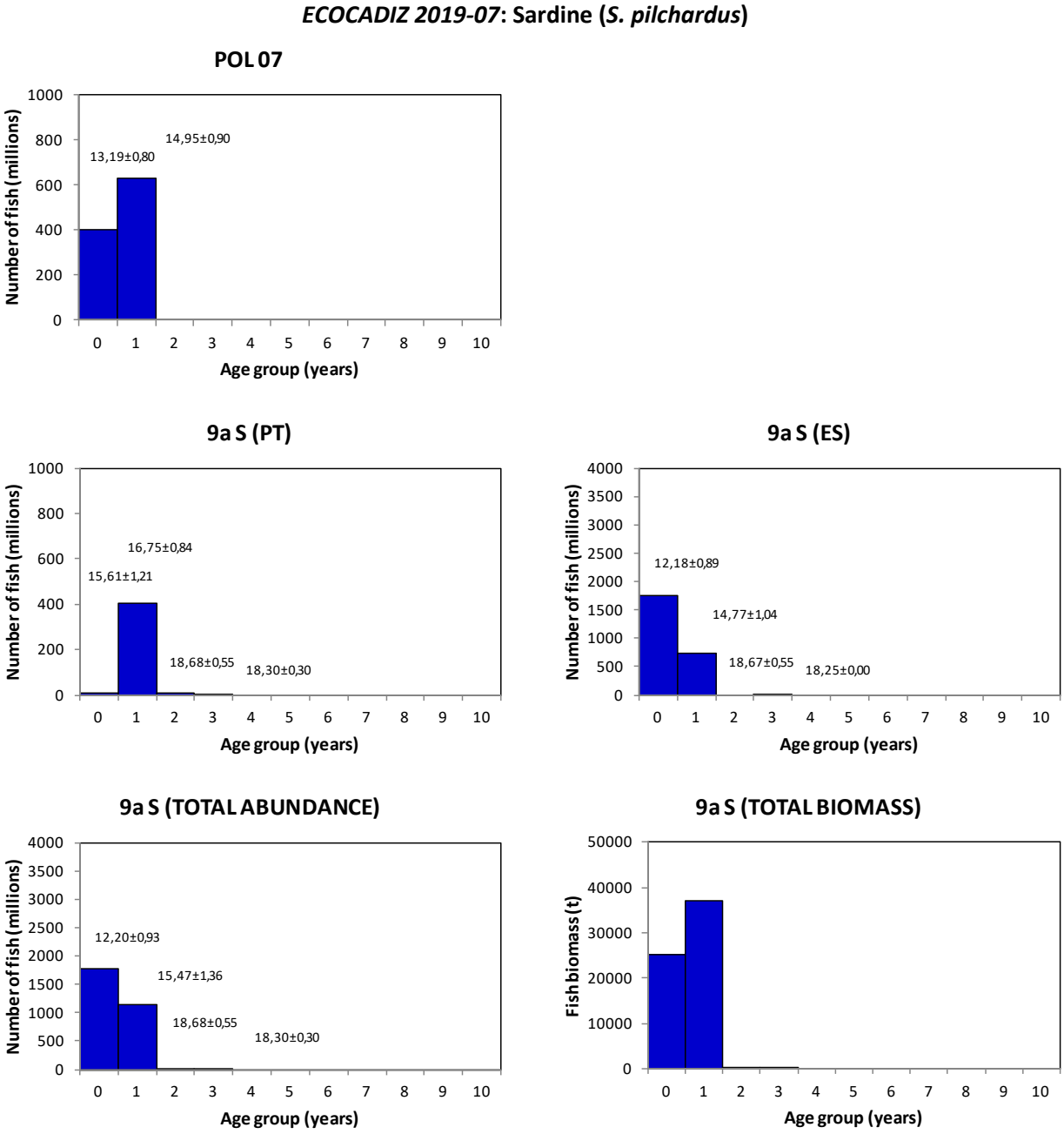


Figure 26. *ECOCADIZ 2019-07* survey. Sardine (*S. pilchardus*). Cont'd.

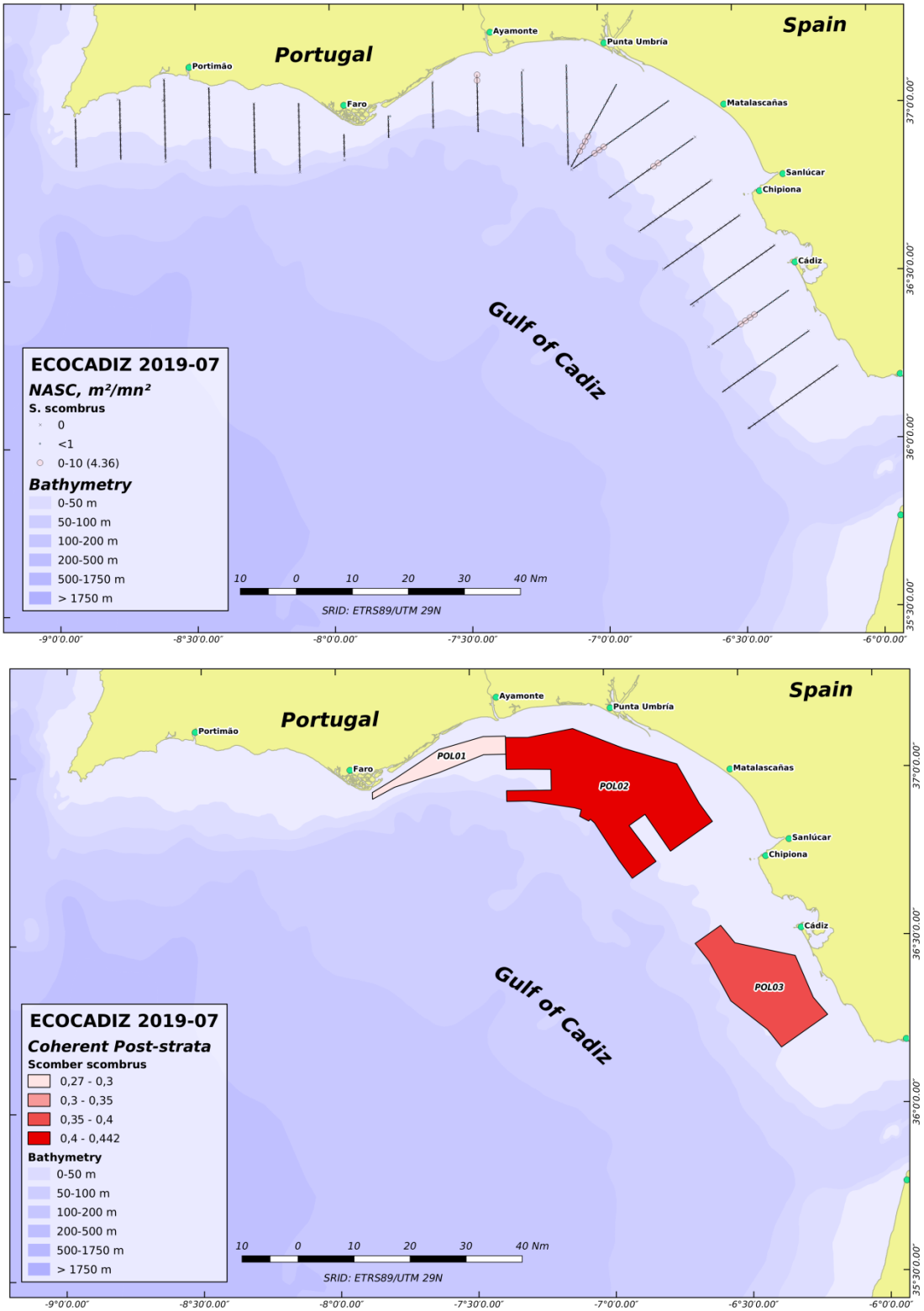


Figure 27. *ECOCADIZ 2019-07* survey. Mackerel (*Scomber scombrus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

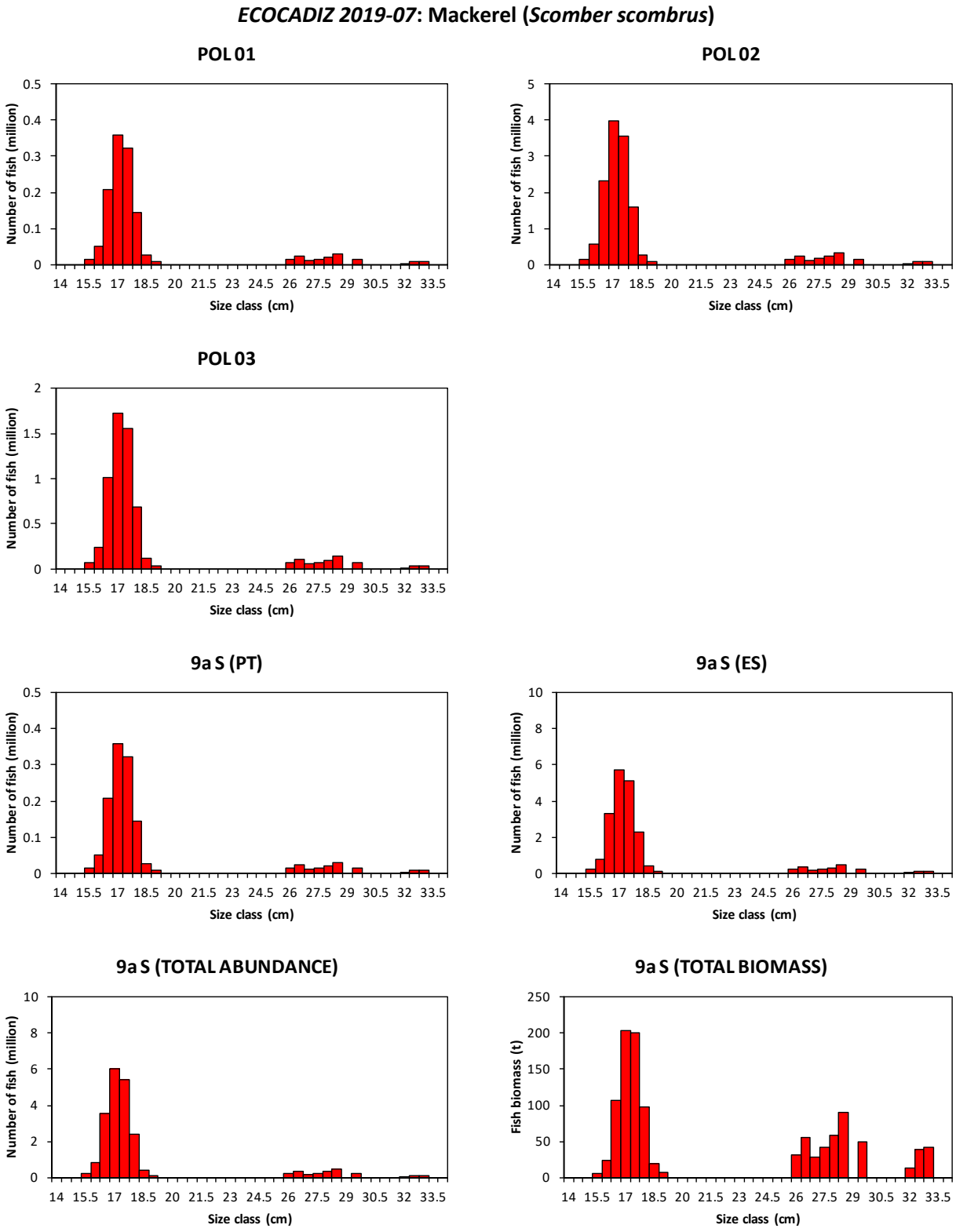


Figure 28. *ECOCADIZ 2019-07* survey. Mackerel (*Scomber scombrus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 27**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

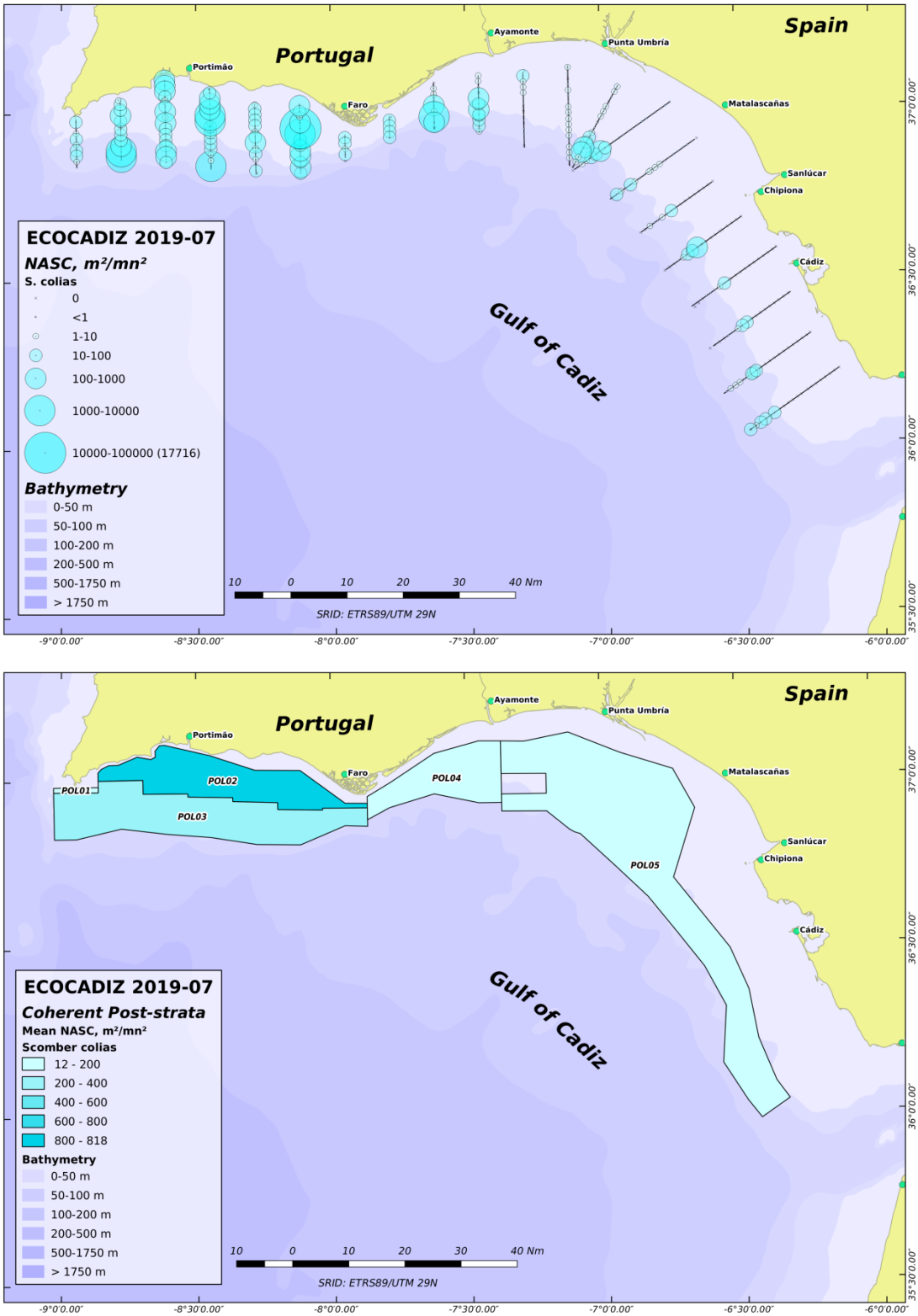


Figure 29. *ECOCADIZ 2019-07* survey. Chub mackerel (*Scomber colias*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

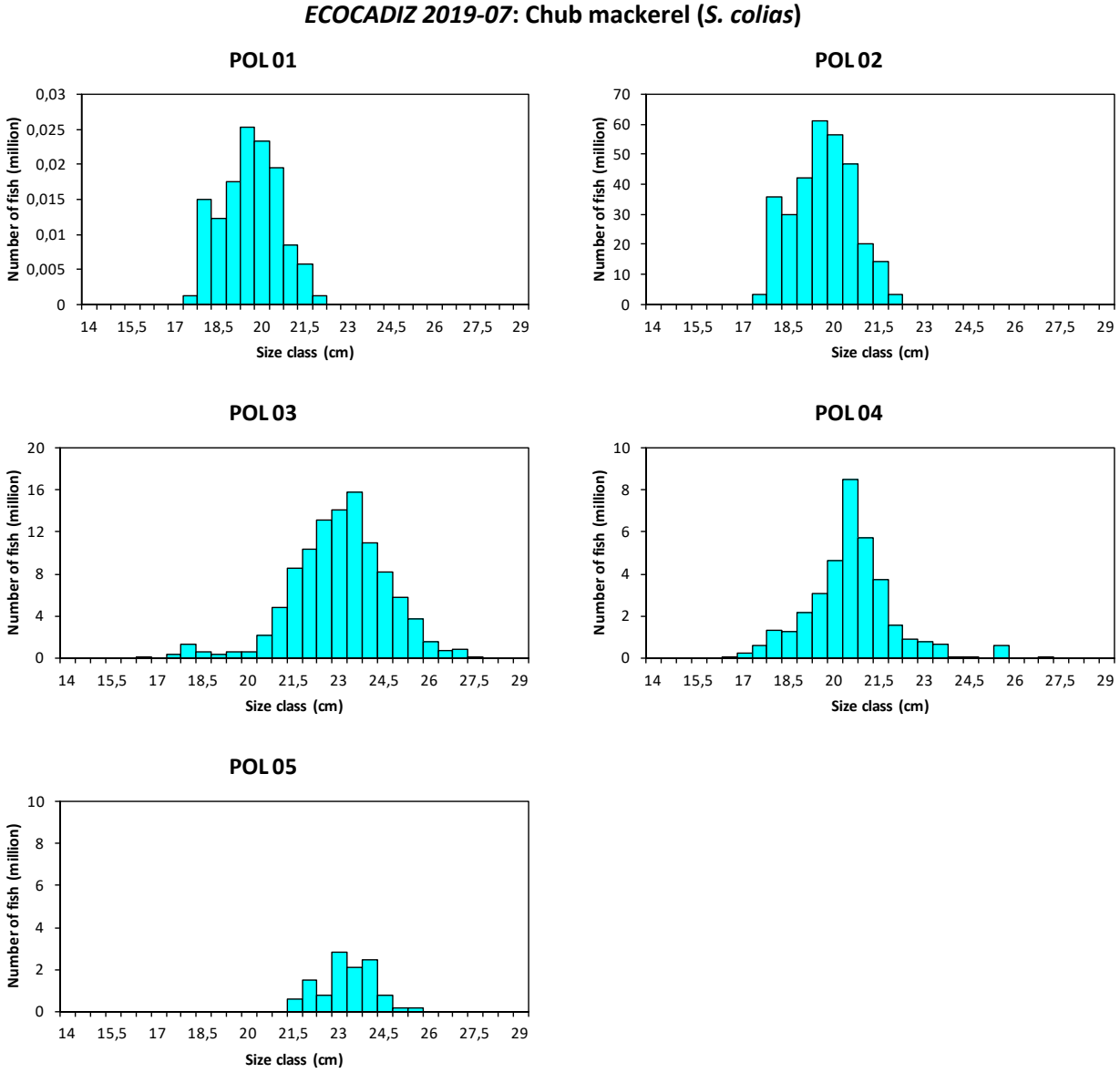


Figure 30. *ECOCADIZ 2019-07* survey. Chub mackerel (*Scomber colias*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 29**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

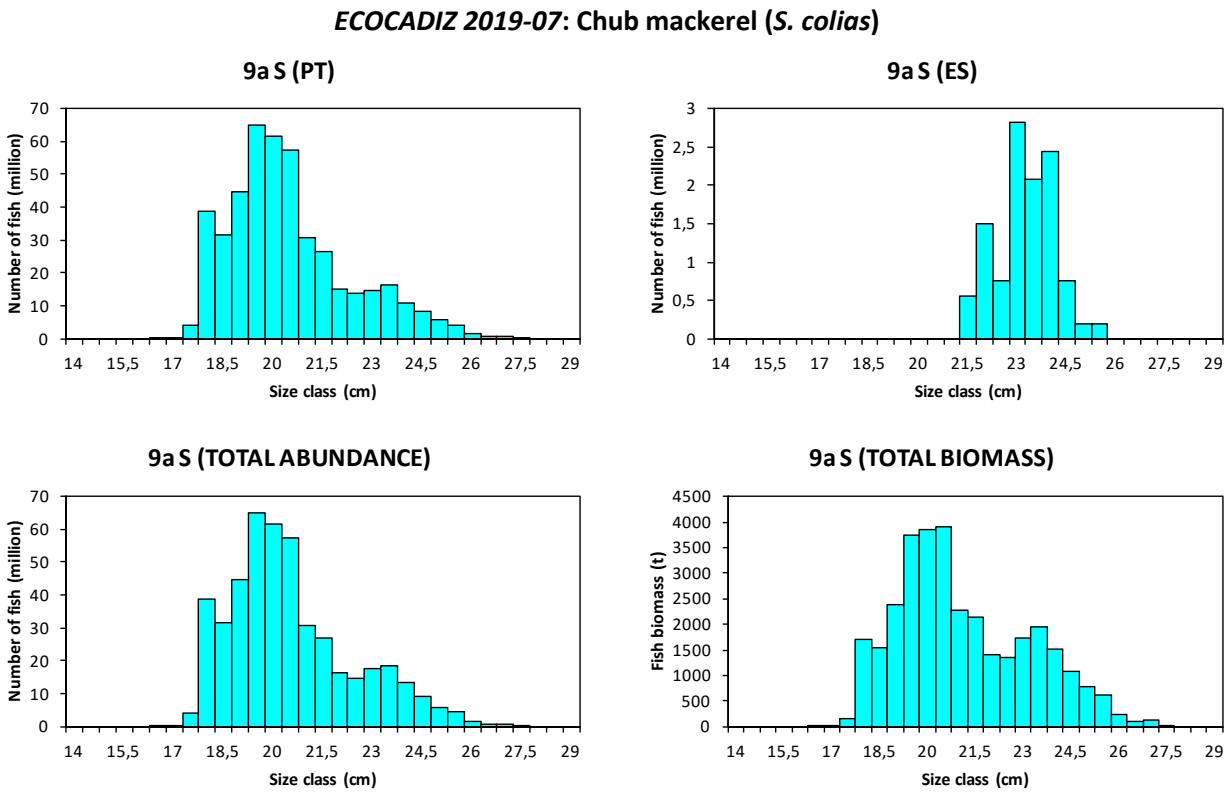


Figure 30. *ECOCADIZ 2019-07* survey. Chub mackerel (*Scomber colias*). Cont'd.

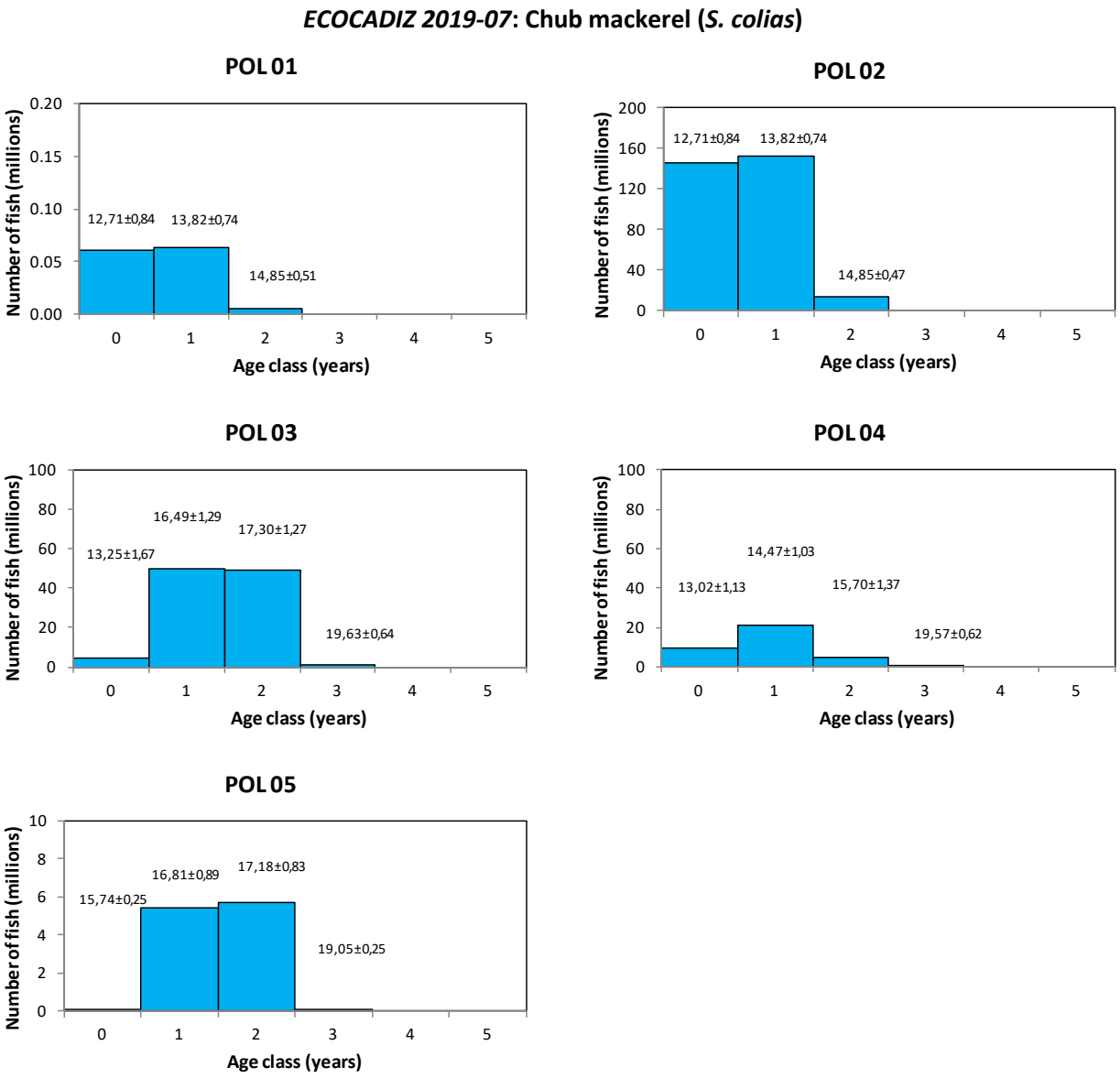


Figure 31. *ECOCADIZ 2019-07* survey. Chub mackerel (*Scomber colias*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous stratum (POL01-POLn, numeration as in **Figure 29**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

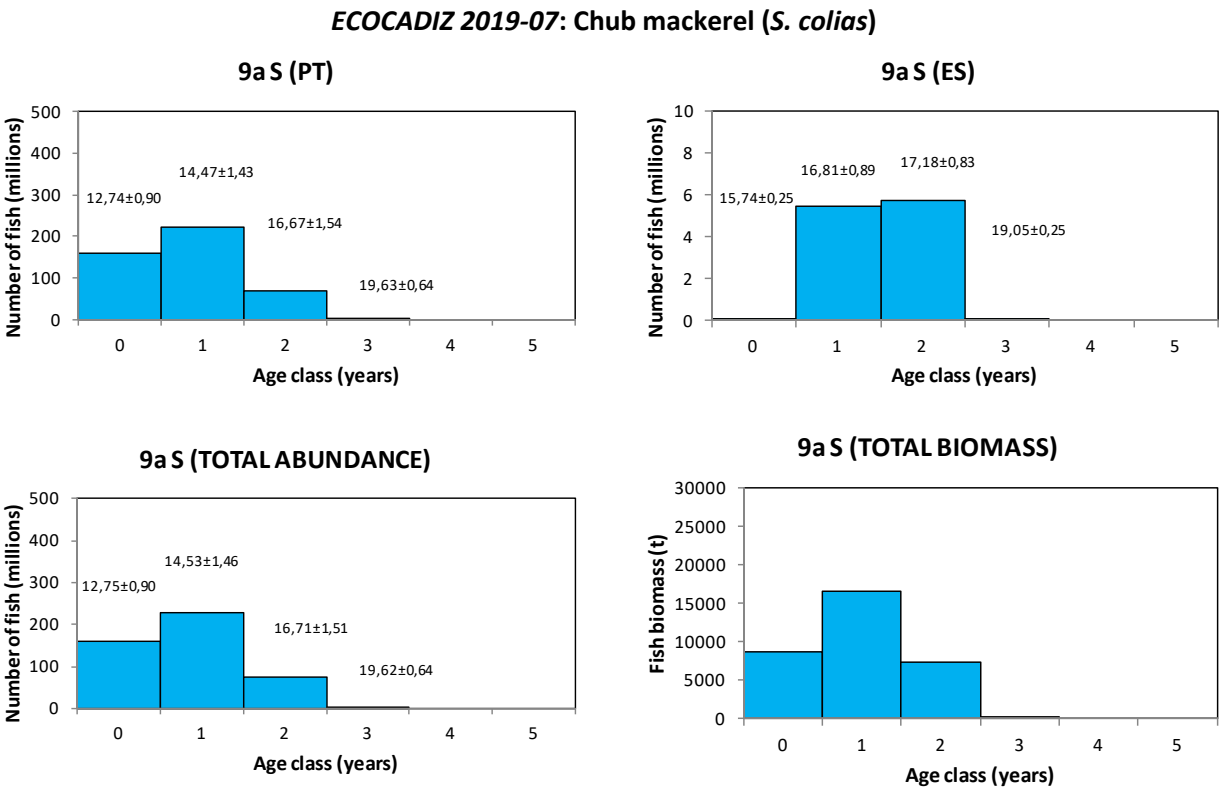


Figure 31. *ECOCADIZ 2019-07* survey. Chub mackerel (*Scomber colias*). Cont'd.

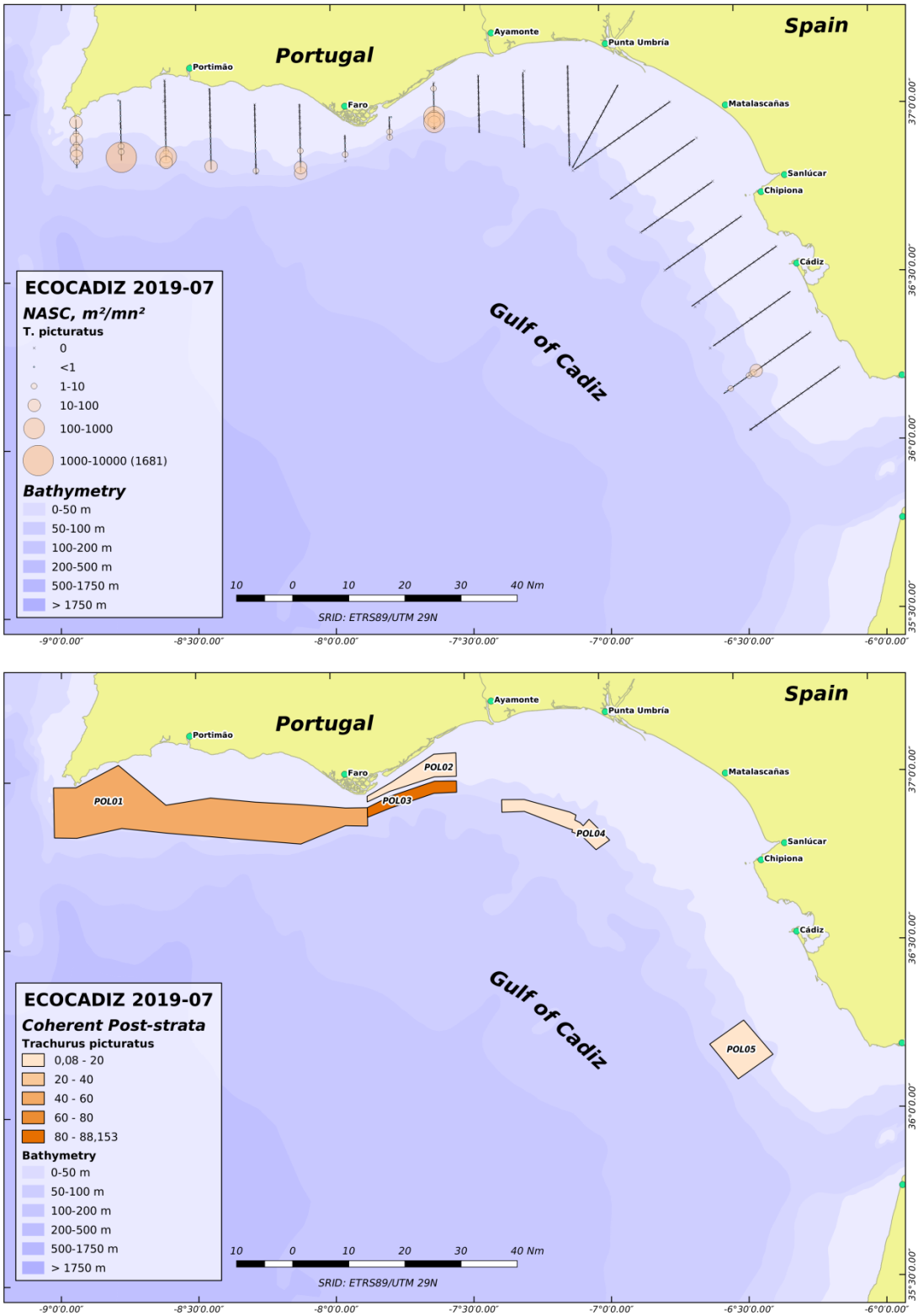


Figure 32. *ECOCADIZ 2019-07* survey. Blue jack mackerel (*Trachurus picturatus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

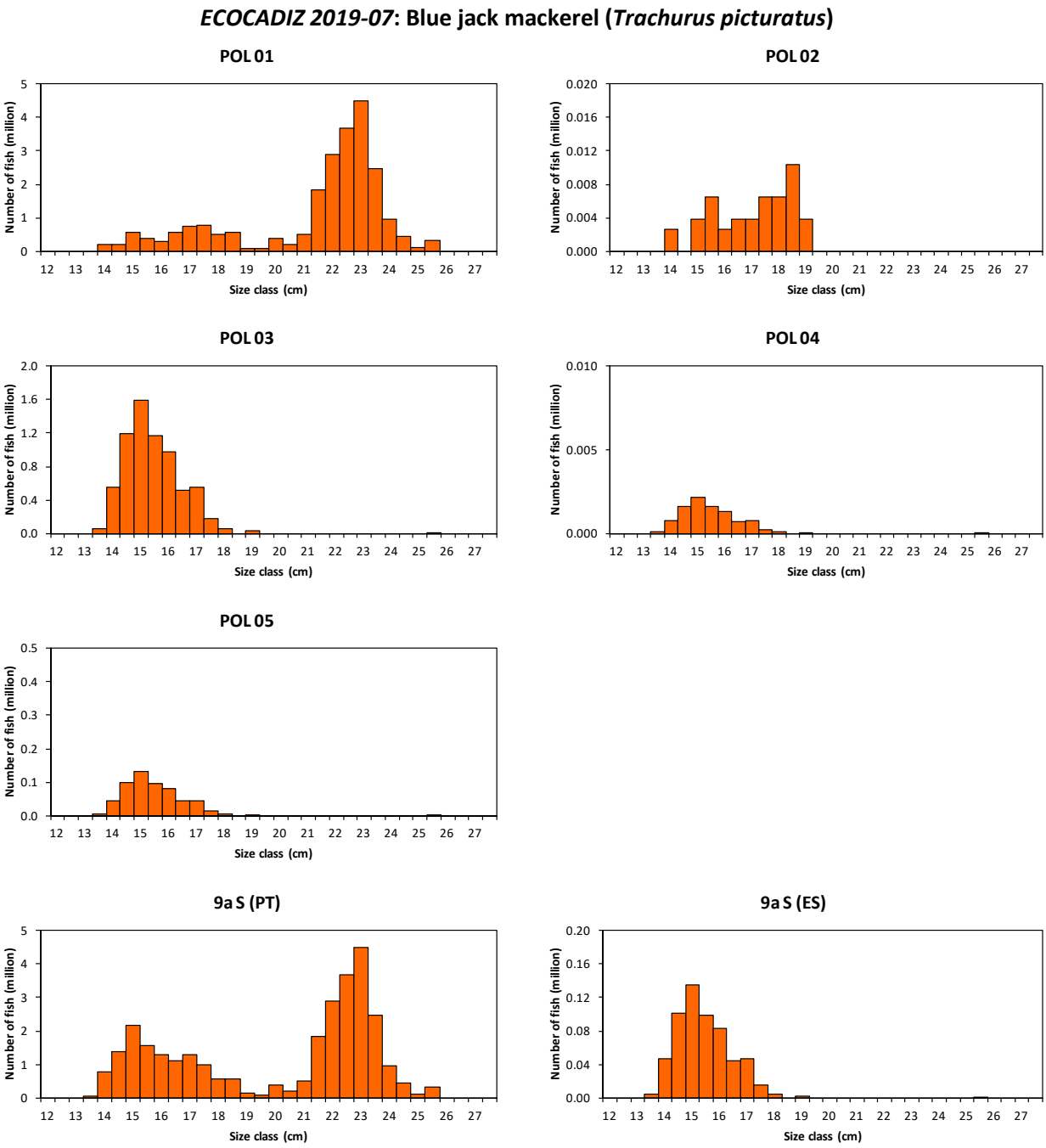


Figure 33. *ECOCADIZ 2019-07* survey. Blue jack mackerel (*Trachurus picturatus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 32**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

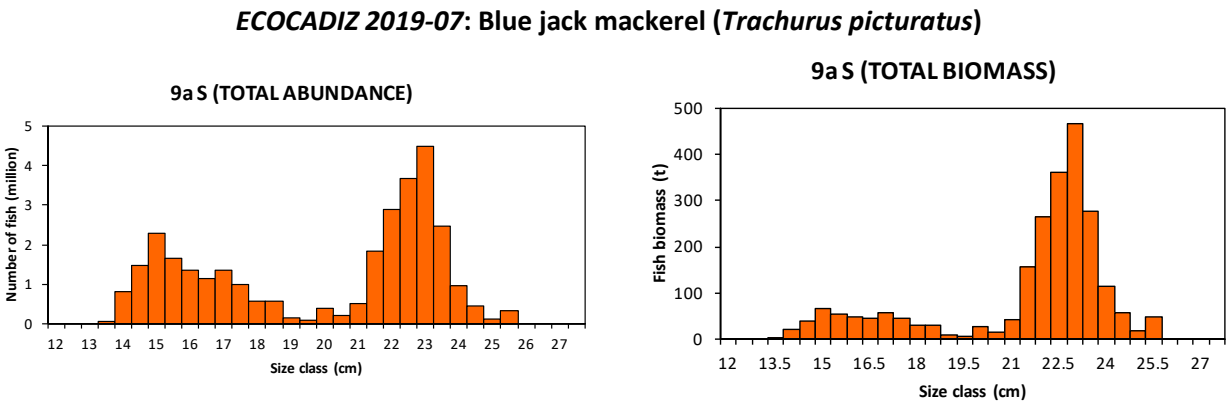


Figure 33. *ECOCADIZ 2019-07* survey. Blue jack mackerel (*Trachurus picturatus*). Cont'd.

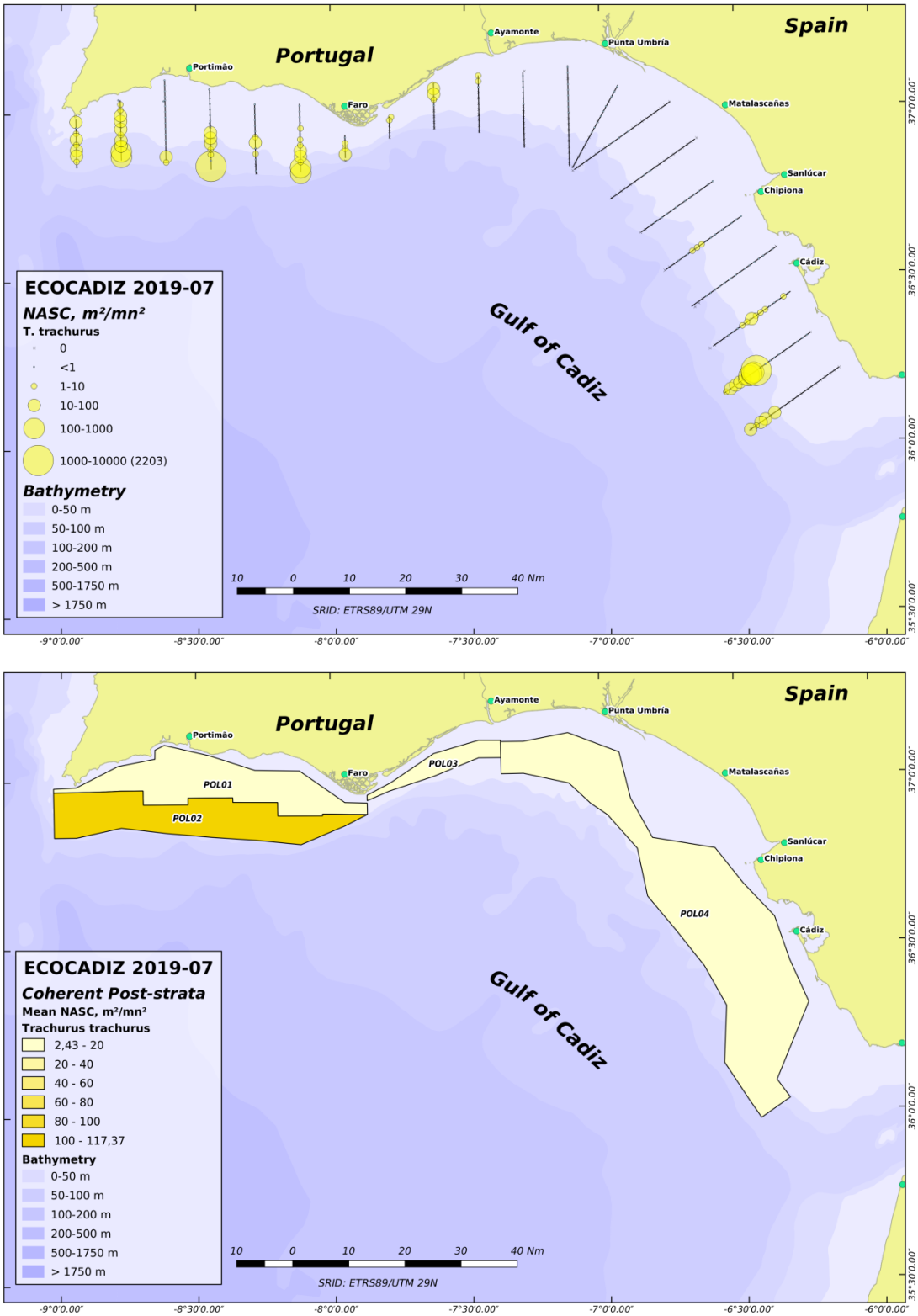


Figure 34. *ECOCADIZ 2019-07* survey. Horse mackerel (*Trachurus trachurus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

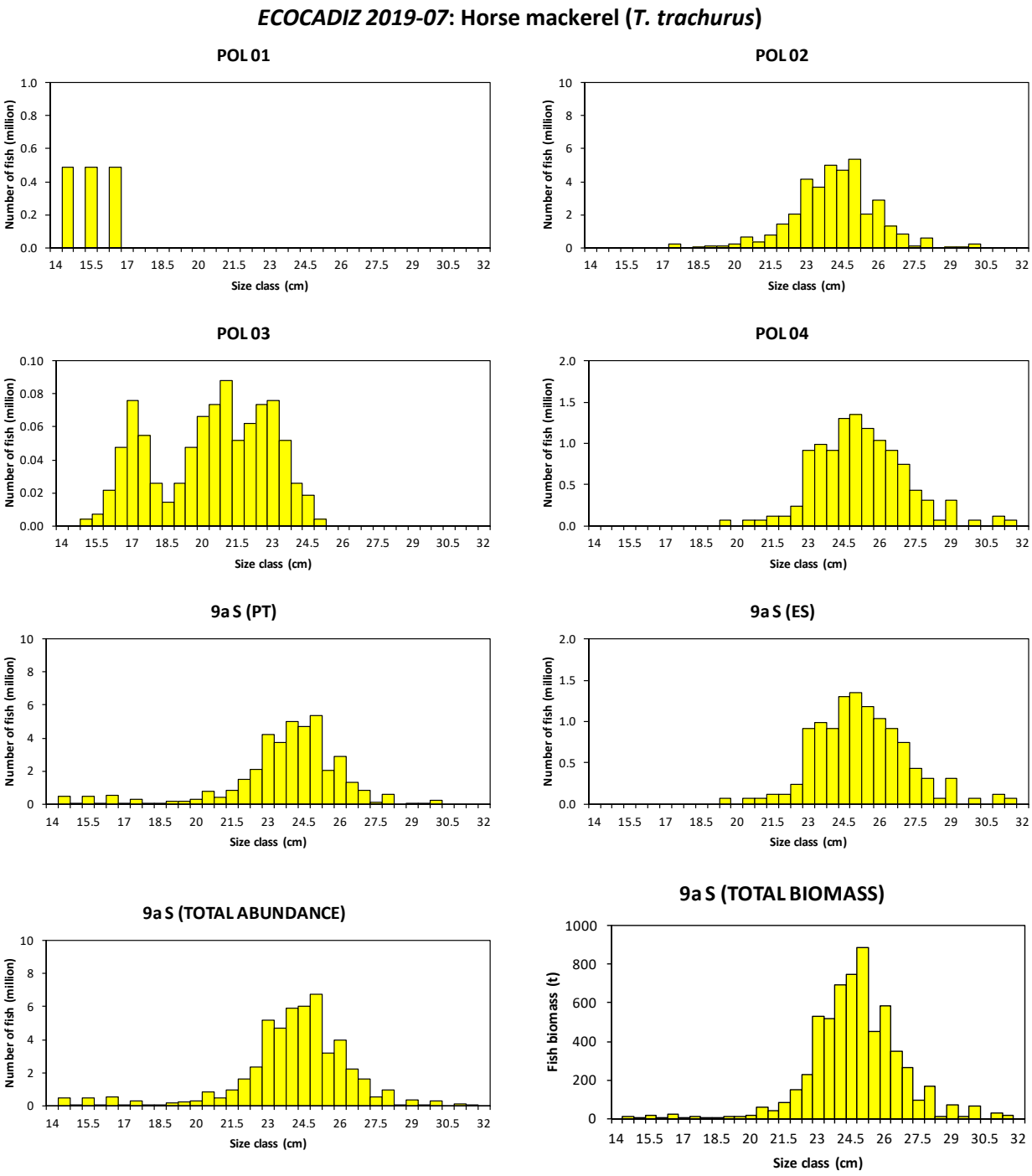


Figure 35. *ECOCADIZ 2019-07* survey. Horse mackerel (*Trachurus trachurus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 34**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

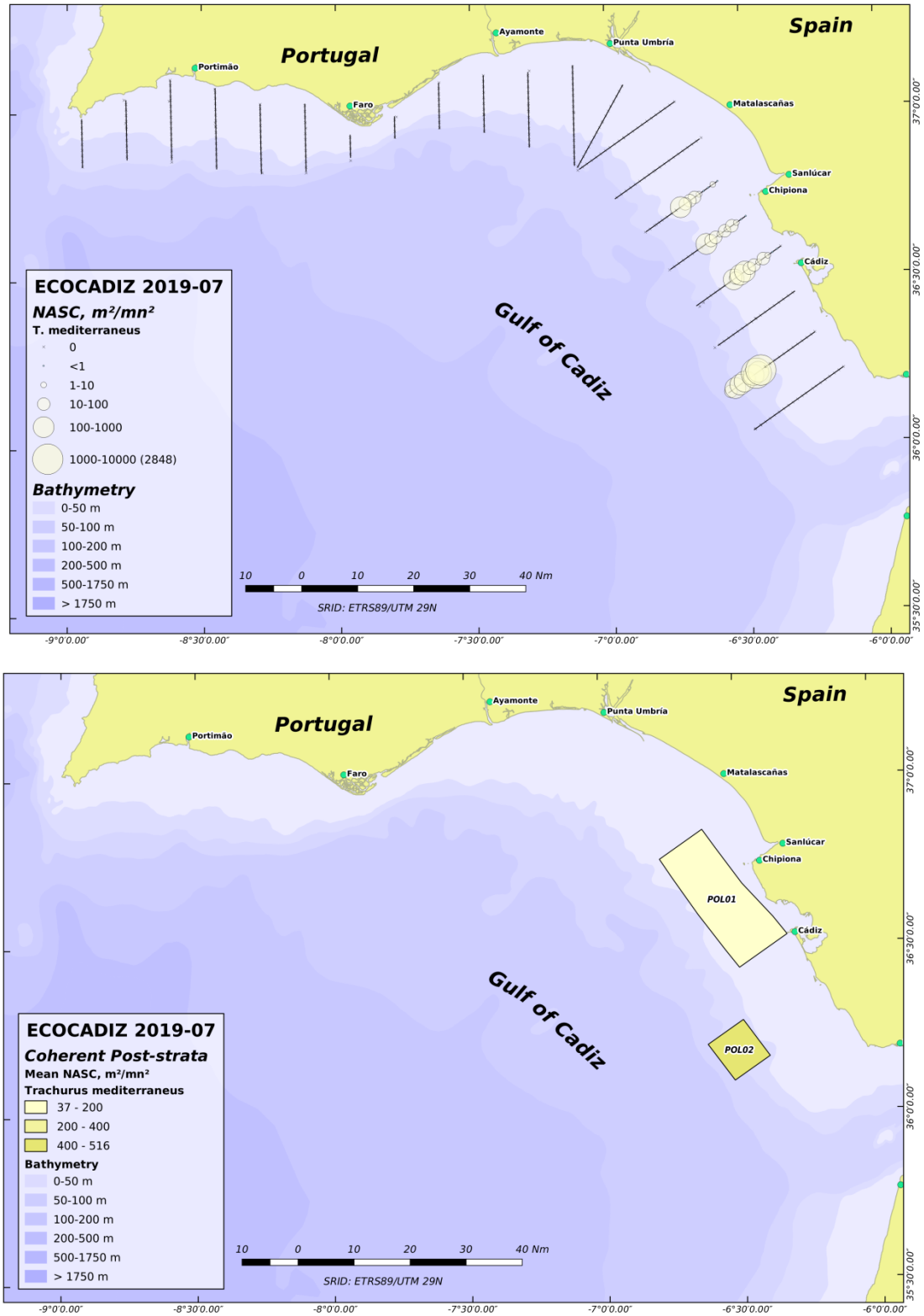


Figure 36. *ECOCADIZ 2019-07* survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC,* in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

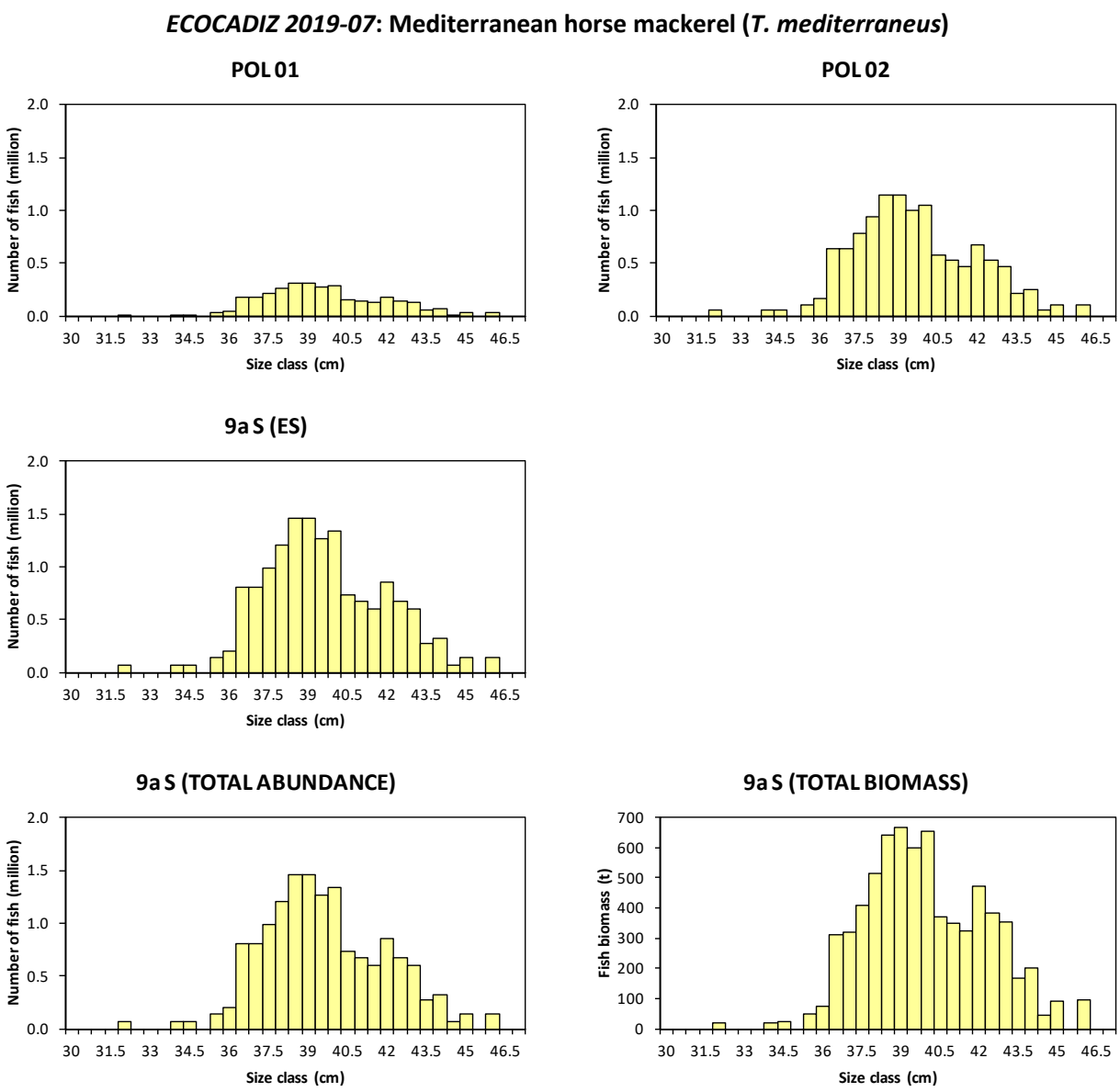


Figure 37. *ECOCADIZ 2019-07* survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 36**) and total sampled area. Post-strata ordered in the W-E direction. 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.

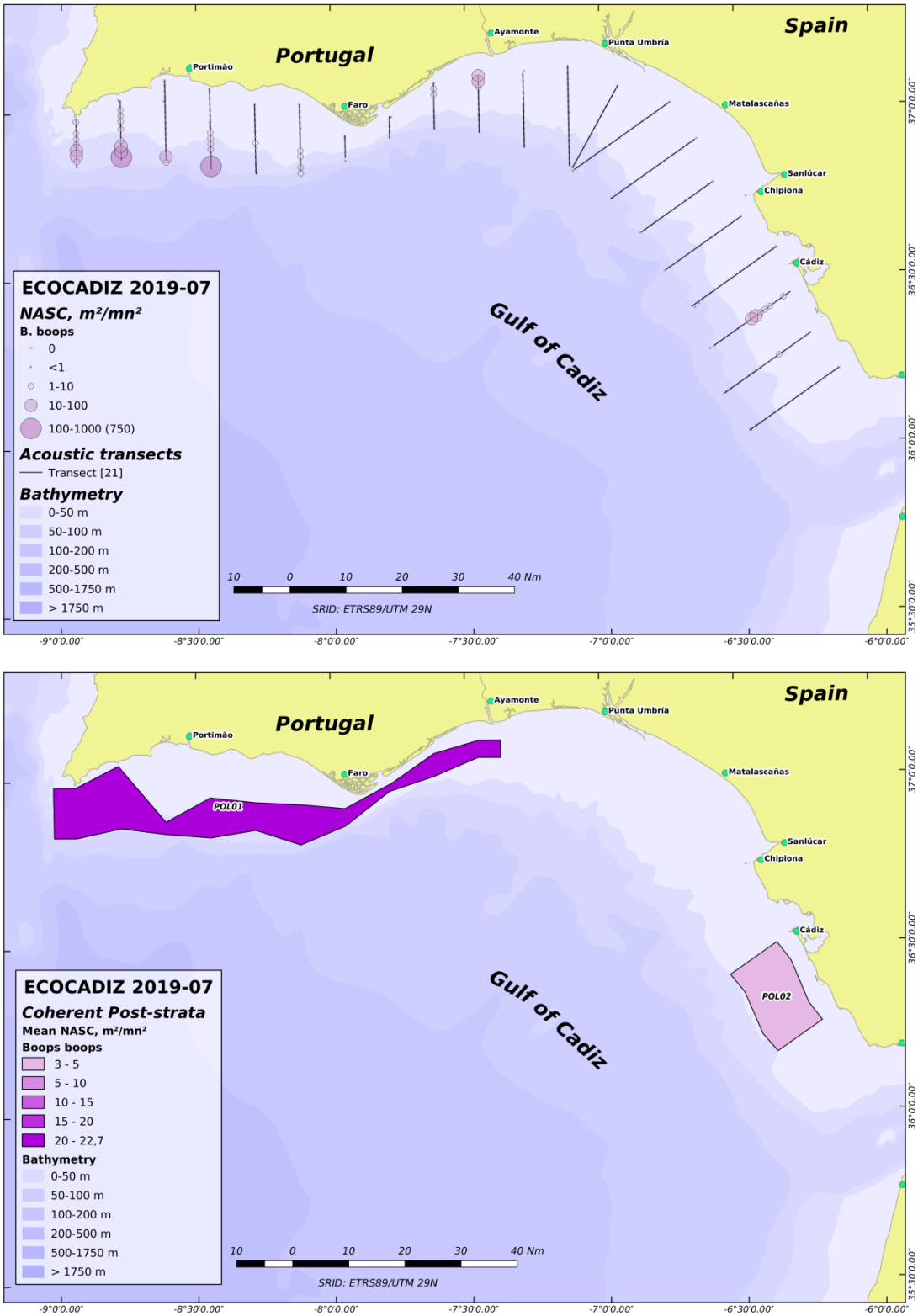


Figure 38. *ECOCADIZ 2019-07* survey. Bogue (*Boops boops*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

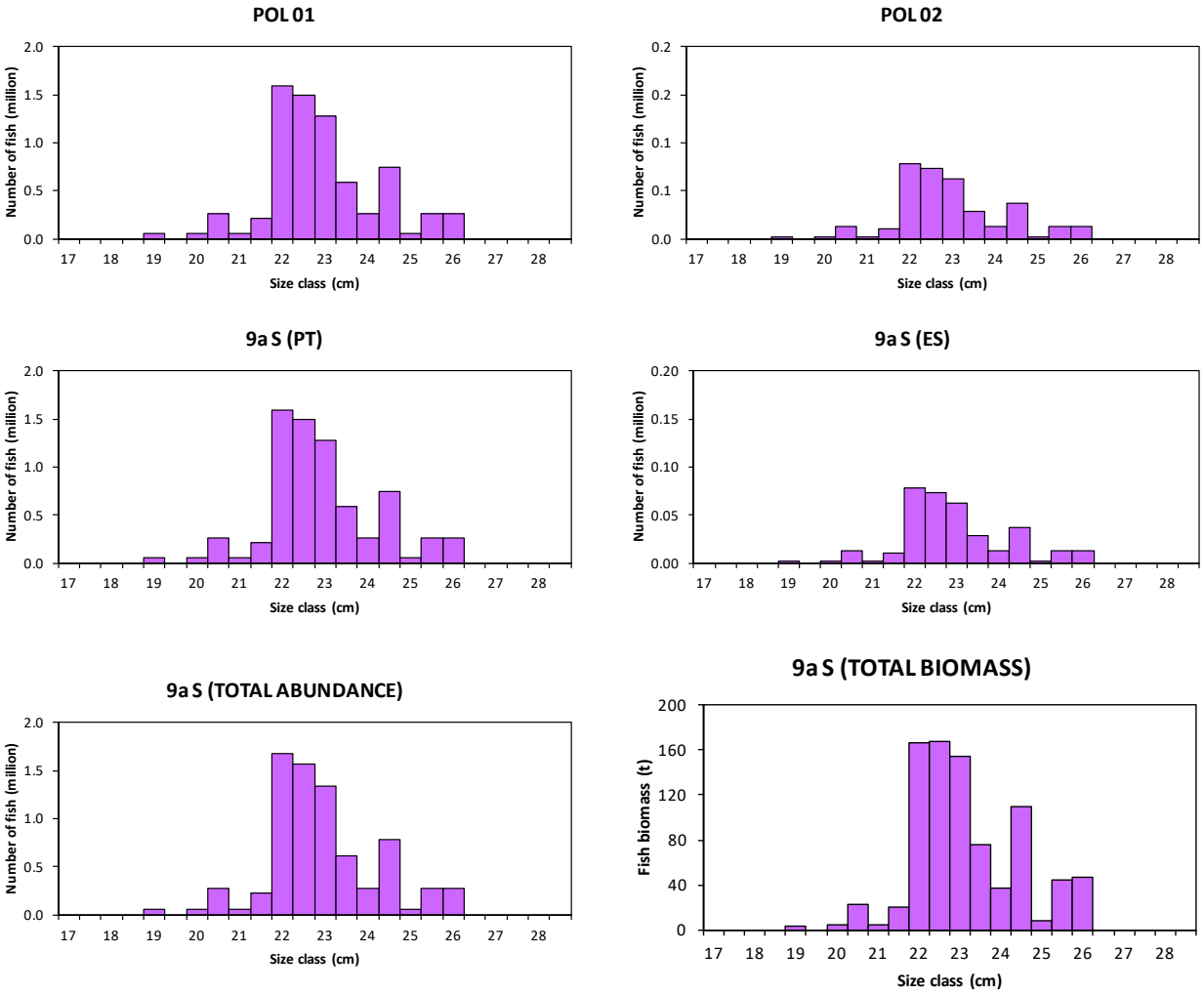


Figure 39. *ECOCADIZ 2019-07* survey. Bogue (*Boops boops*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 38**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

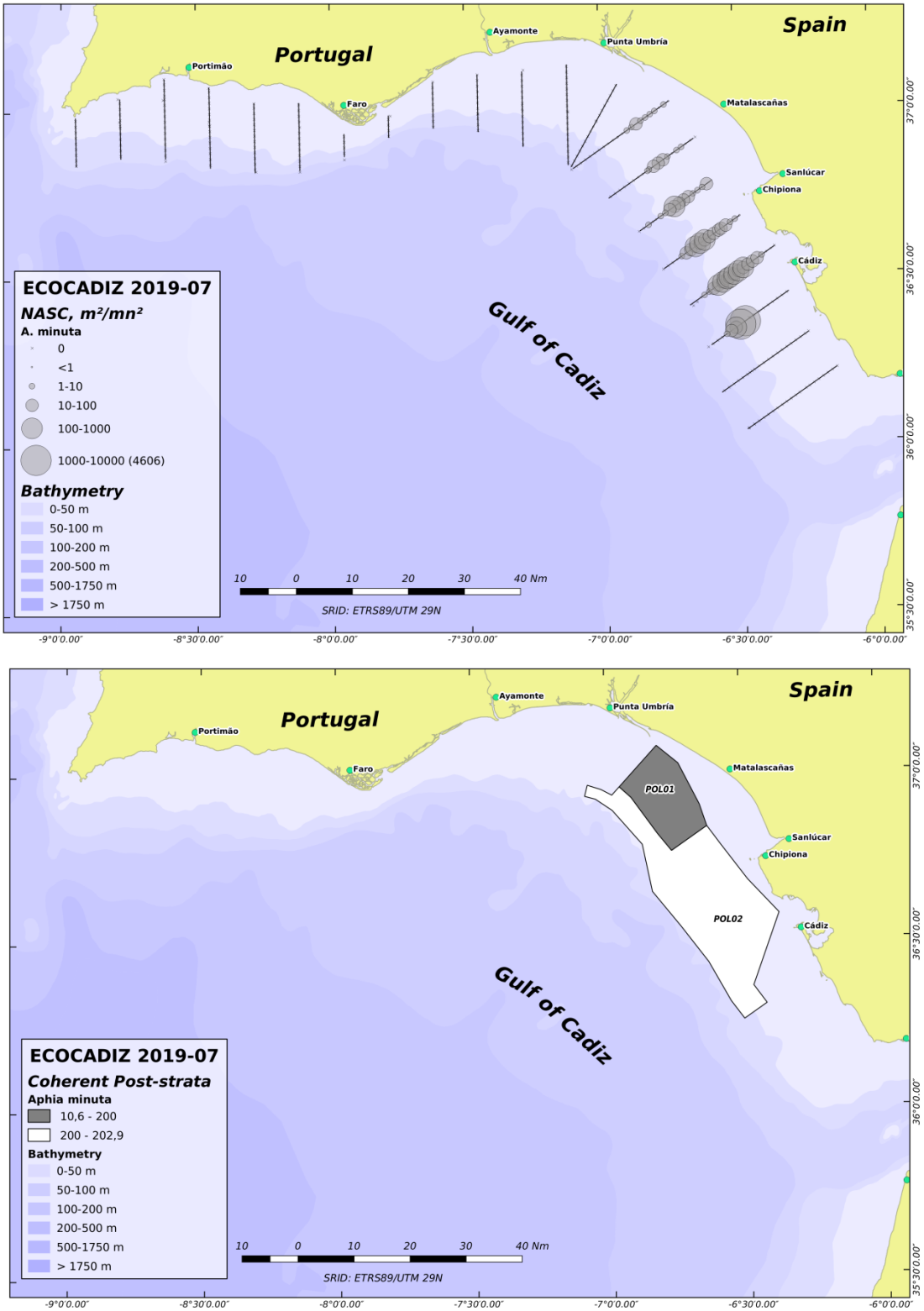


Figure 40. *ECOCADIZ 2019-07* survey. Transparent goby (*Aphia minuta*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

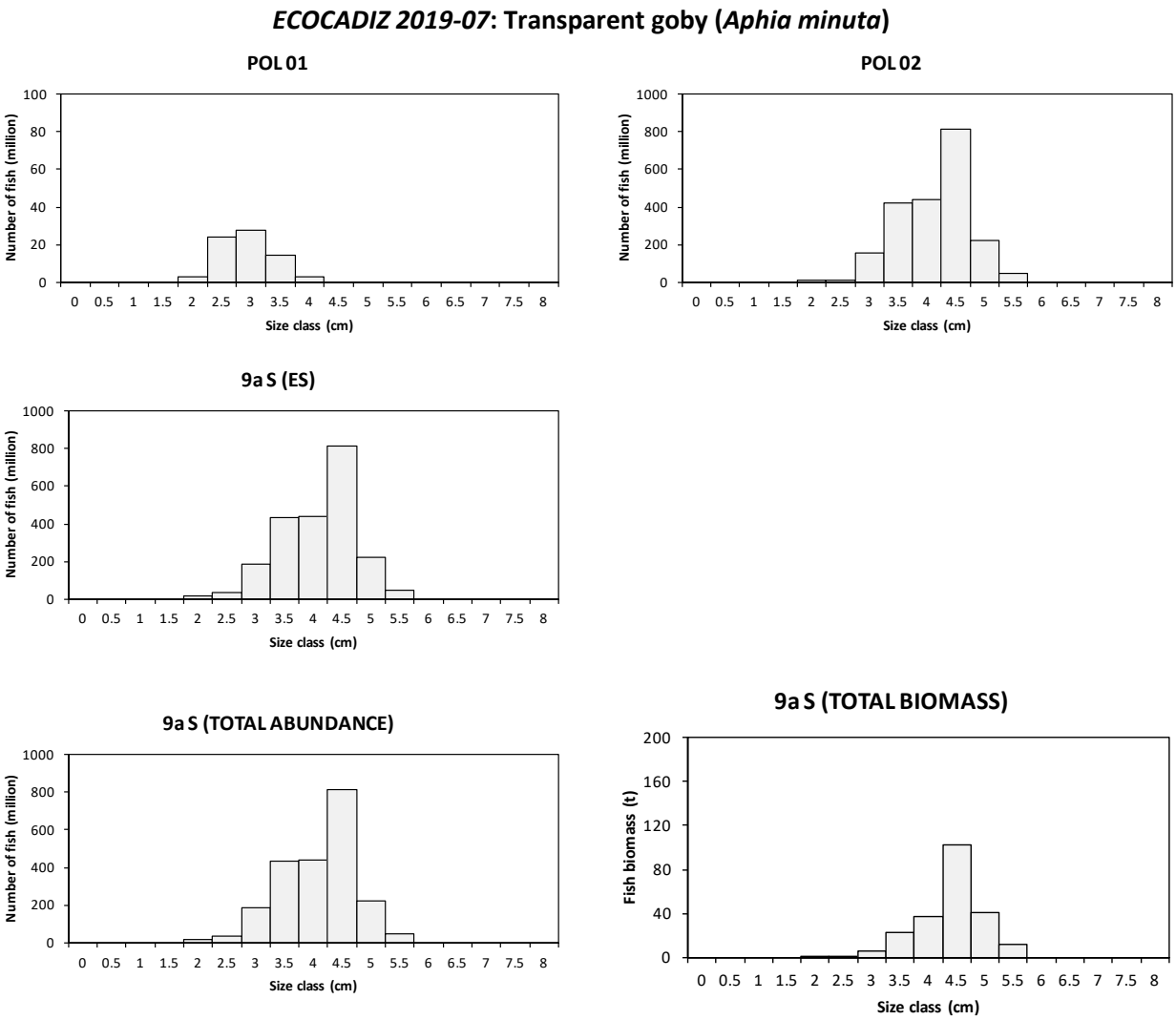


Figure 41. *ECOCADIZ 2019-07* survey. Transparent goby (*Aphia minuta*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 40**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

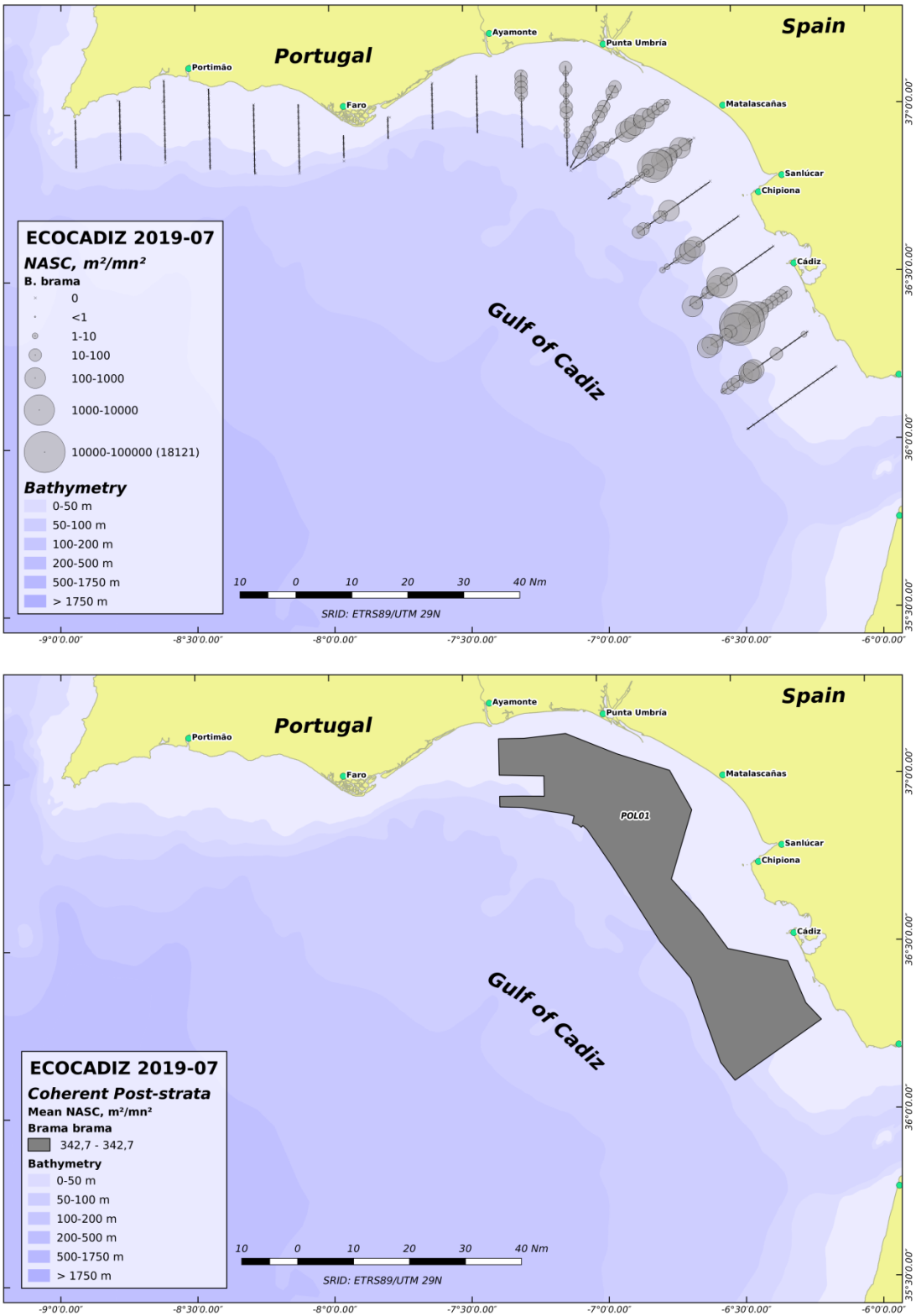


Figure 42. *ECOCADIZ 2019-07* survey. Atlantic pomfret (*Brama brama*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

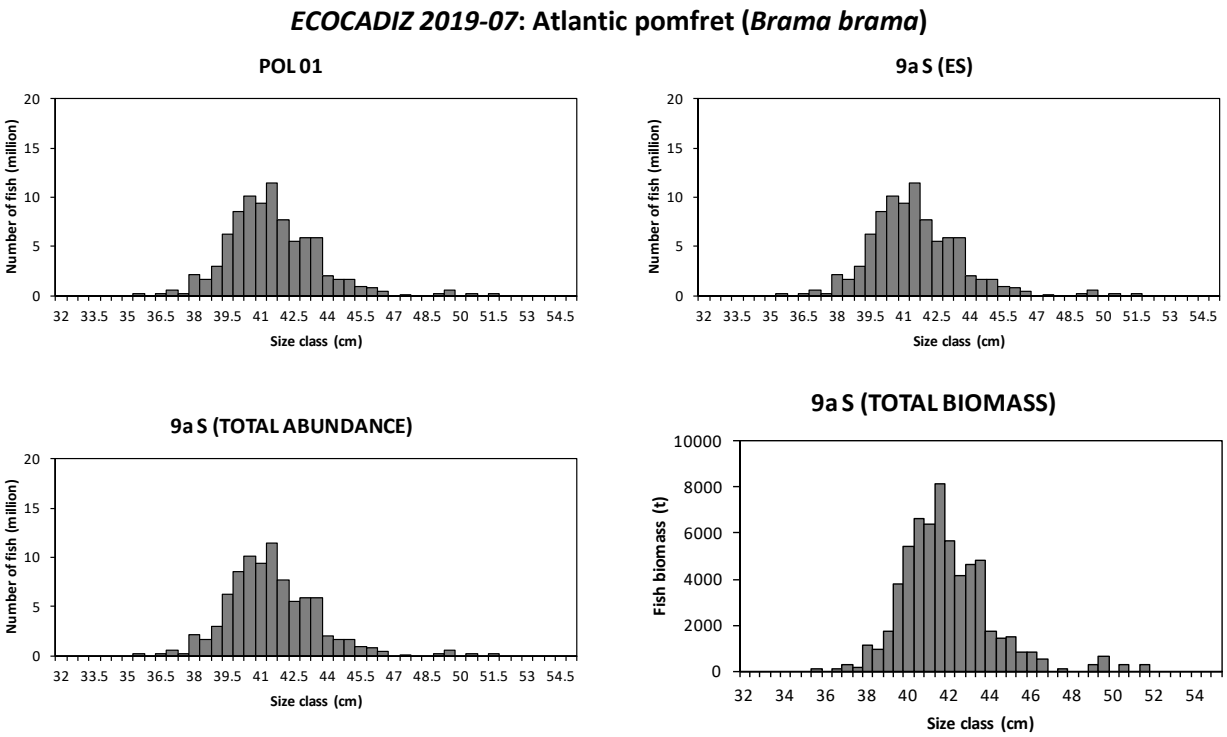


Figure 43. *ECOCADIZ 2019-07* survey. Atlantic pomfret (*Brama brama*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 42**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the *y* axis.

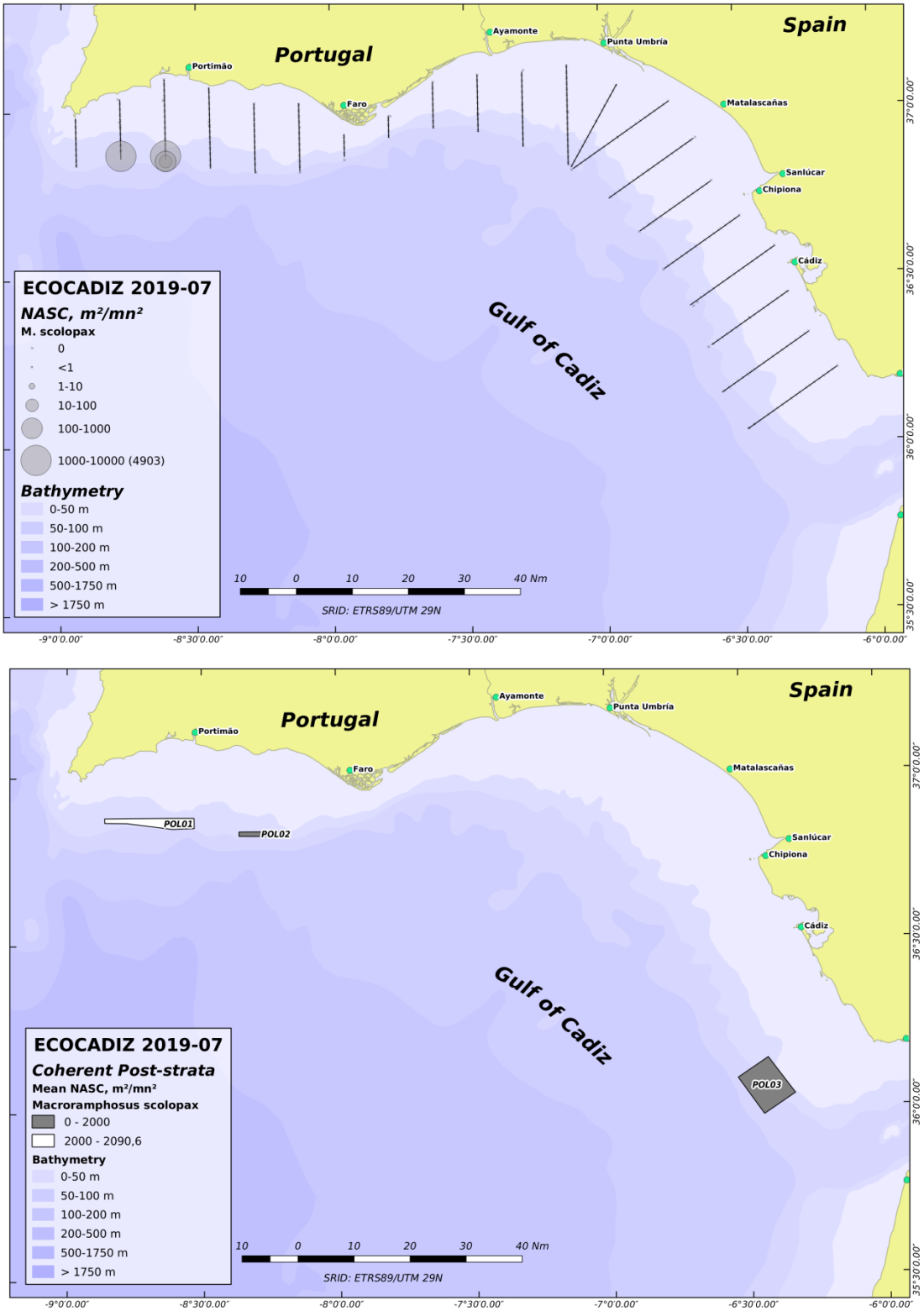


Figure 44. *ECOCADIZ 2019-07* survey. Longspine snipefish (*Macroramphosus scolopax*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

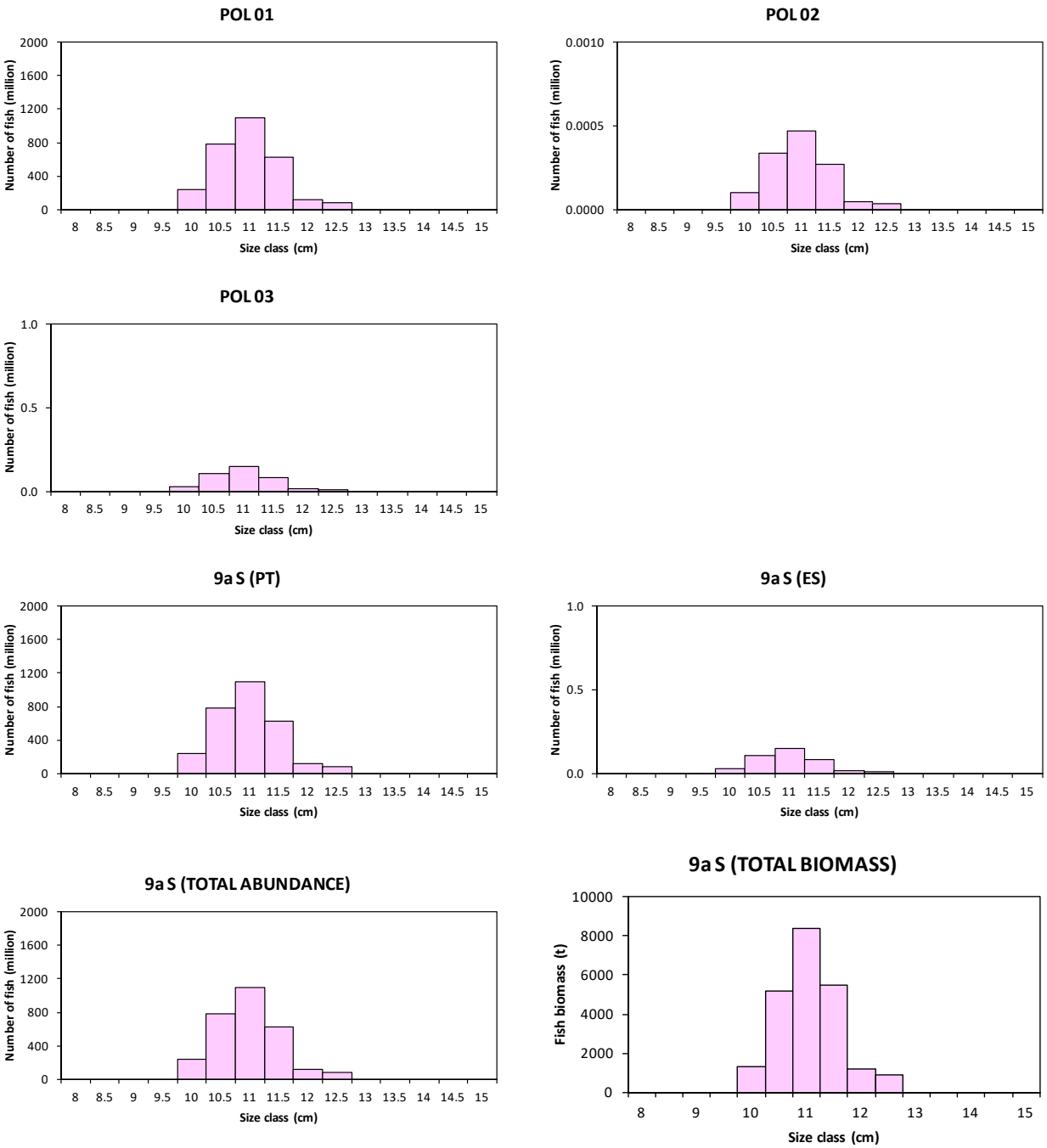


Figure 45. *ECOCADIZ 2019-07* survey. Longspine snipefish (*Macroramphosus scolopax*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 44**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

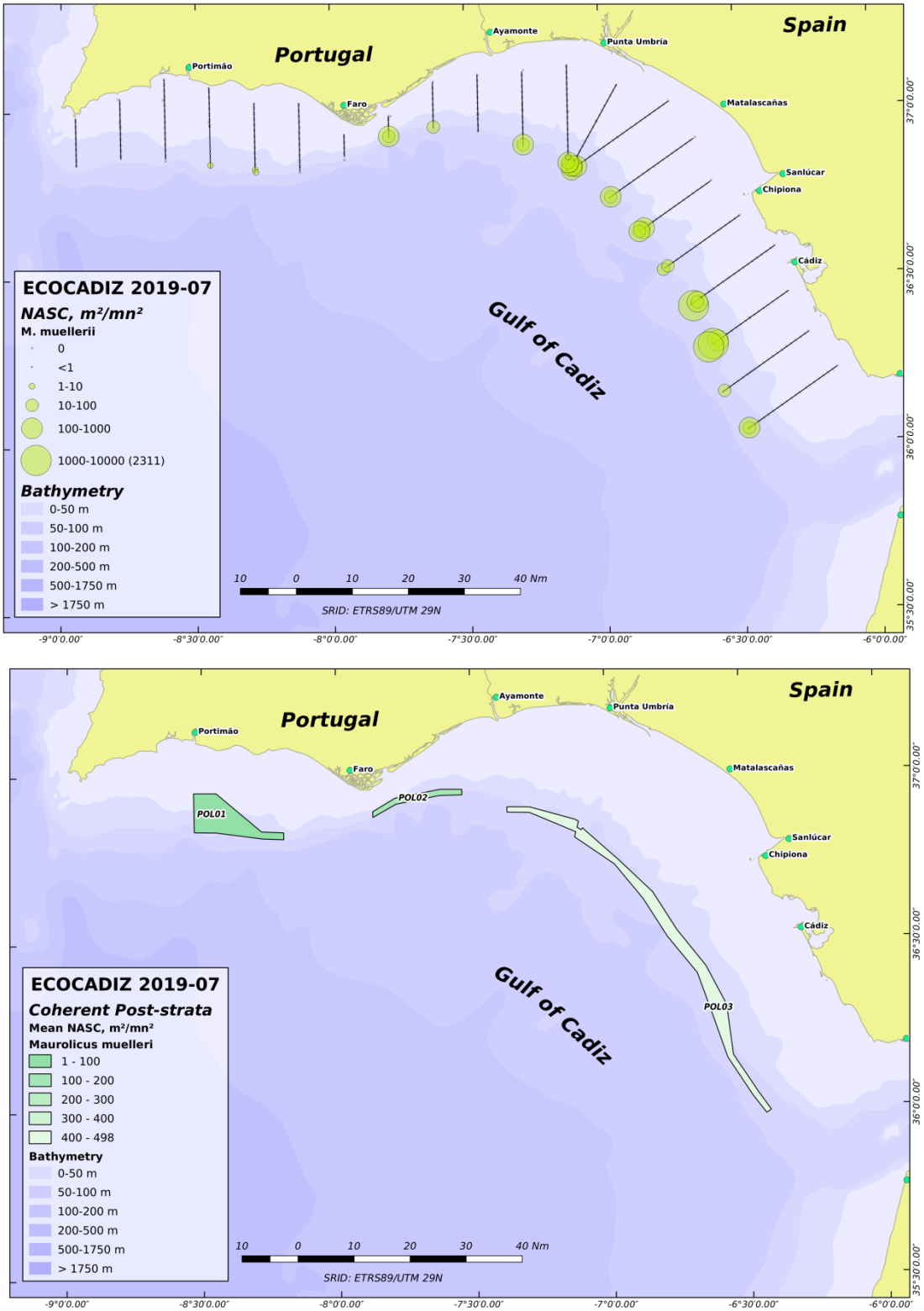


Figure 46. *ECOCADIZ 2019-07* survey. Pearlside (*Maurolicus muelleri*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in m^2 nmi^{-2}) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

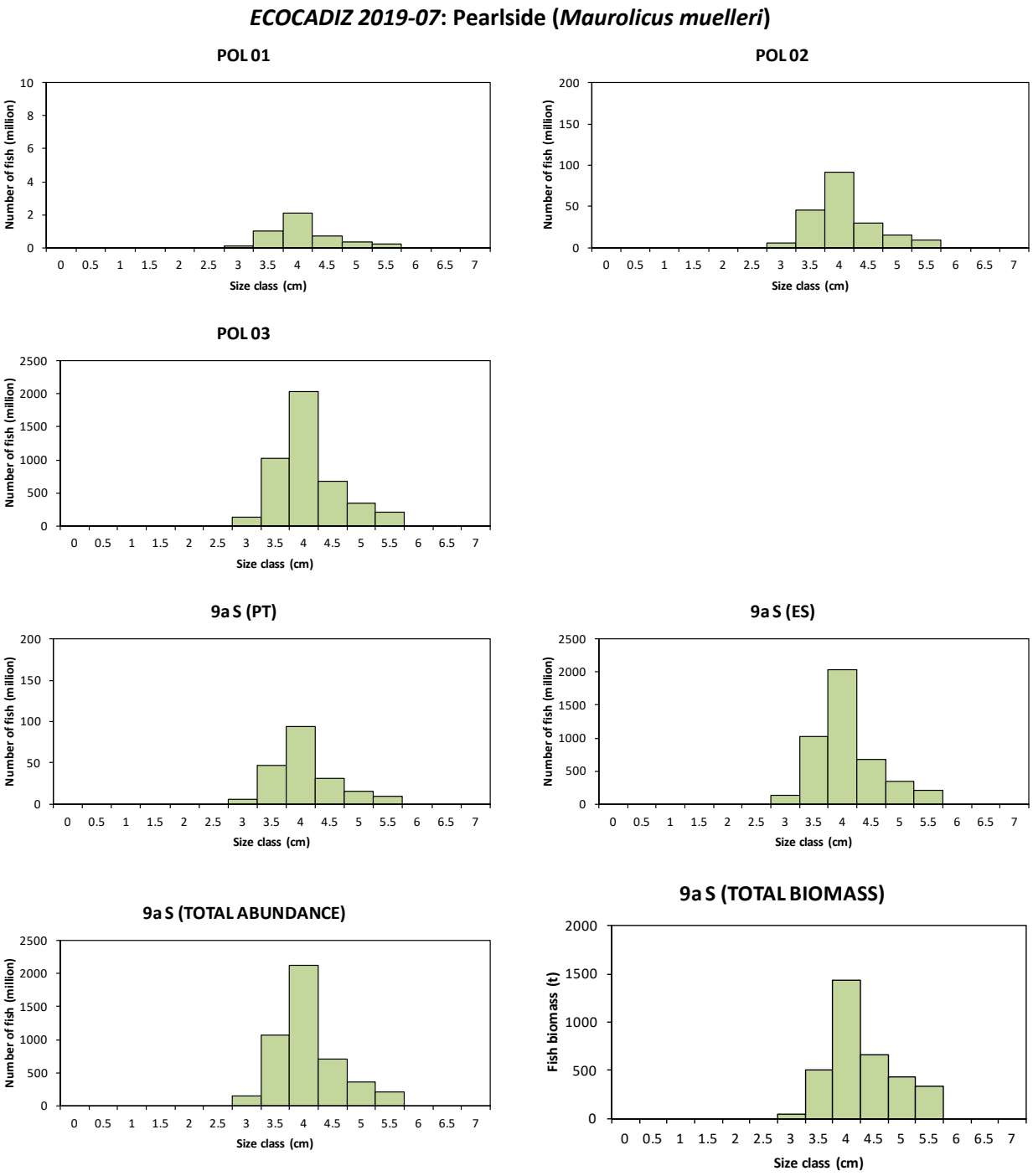


Figure 47. *ECOCADIZ 2019-07* survey. Pearlside (*Maurolicus muelleri*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous stratum (POL01-POLn, numeration as in **Figure 46**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

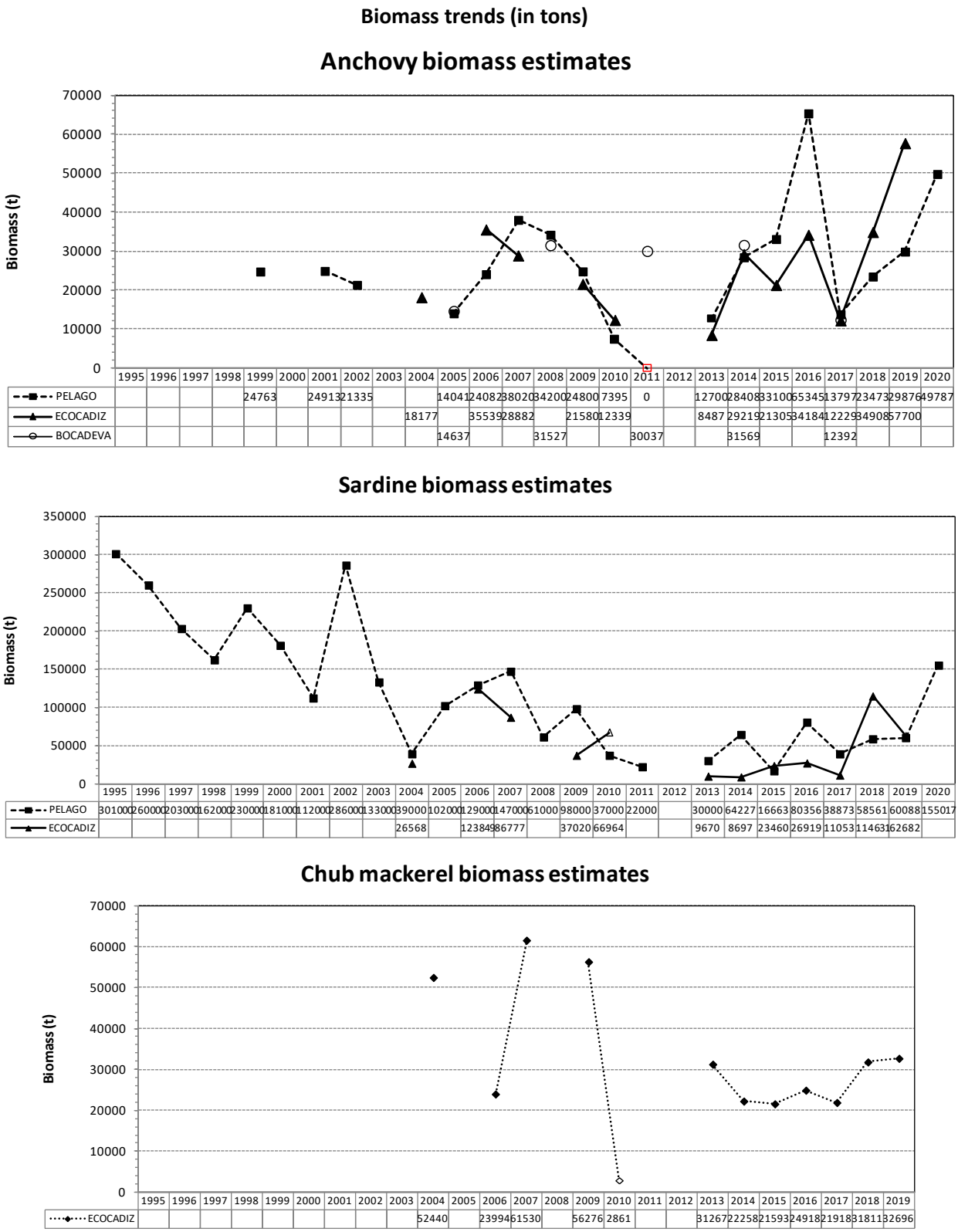


Figure 48. Trends in biomass estimates (in tons) for the main assessed species in Portuguese (*PELAGO*) and Spanish (*ECOCADIZ* and *BOCADEVA*) survey series. Note that the *ECOCADIZ* survey in 2010 partially covered the whole study area. The anchovy null estimate in 2011 from the *PELAGO* survey should be considered with caution.