

Acoustic assessment and distribution of the main pelagic fish species in ICES Subdivision 9a South during the *ECOCADIZ-RECLUTAS 2021-10* Spanish survey (October 2021).

By

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ABSTRACT

The present working document summarises the main results obtained from the *ECOCADIZ-RECLUTAS 2021-10* Spanish (pelagic ecosystem-) acoustic-trawl survey conducted by IEO between 21st October and 07th November 2021 in the Portuguese and Spanish shelf waters (20-200 m isobaths) off the Gulf of Cadiz (GoC) onboard the R/V *Ramón Margalef*. The survey suffered a ten-day delay in relation to the usual starting dates. The survey's main objective is the acoustic assessment of anchovy and sardine juveniles (age 0 fish) in the GoC recruitment areas. The 21 foreseen acoustic transects were sampled. A total of 18 valid fishing hauls were carried out for echo-trace ground-truthing purposes. Chub mackerel, anchovy and sardine were the most frequent captured species in the fishing hauls, followed by horse mackerel, bogue, Atlantic mackerel, Mediterranean horse mackerel and blue jack mackerel. Boarfish, longspine snipefish and pearlside showed an incidental occurrence in the hauls performed in the surveyed area. Sardine and chub mackerel showed the highest yields in these hauls, followed by anchovy and Mediterranean horse mackerel. Total and Spanish estimates of total NASC allocated to the "pelagic fish species assemblage" in this survey showed lower values than those recorded last year, whereas the Portuguese estimates showed an increasing trend. GoC anchovy was widely distributed in the surveyed area, although avoided the easternmost waters. Higher densities were recorded between Alfanzina and west of Cape Santa Maria, in the Algarve, and between Isla Cristina and Bay of Cadiz. Anchovy acoustic estimates in autumn 2021, 17 512 t and 1973 million fish, experienced 38% and 51% decreases in abundance and biomass, respectively, in relation to the last year's autumn estimates and they were lower than their time-series averages. The population was composed by fishes not older than 2 years. As usual, the bulk of the population, including juveniles, was located in Spanish waters. Age-0 anchovies accounted for 83% (1629 million) and 69% (12 063 t) of the total estimated abundance and biomass, respectively. Age-0 estimates experienced a similar decreasing trend than the one showed by the whole population in relation to the historical peak recorded in 2019, but with values close to the time-series average. GoC sardine was widely distributed all over the surveyed area (also avoiding the easternmost waters) and recorded a relatively high acoustic echo-integration in autumn 2021 as a consequence of the occurrence of dense mid-water schools in the Algarve coastal and inner shelf waters (20-78 m). Abundance (2986 million fish) and biomass (151 320 t) estimates were the second historical records within its respective series, although they represented 83% and 38% decreases in relation to the last year's estimates. GoC sardine population was mainly concentrated in Portuguese waters. Age-5 group was the oldest age group in the population, although the occurrence of fishes older than 4 years was incidental. The population was mainly composed by fishes belonging to the age-0 to age-2 groups. Juvenile sardines (age-0 group) were not the dominant group, accounting for 21% (638 million) and 9% (12 854 t) of the total abundance and biomass, respectively. The bulk of this juvenile fraction was recorded in Spanish coastal waters. Chub mackerel was also widely distributed in the surveyed area, but showing higher densities in three between Cape San Vicente and Mazagón. Chub mackerel estimates were of 13 115 t and 106 million fish, accounting for 64% and 43% strong decreases in relation to the estimates in the previous year and with the above values being lower than their time-series average. The population was mainly concentrated in Portuguese waters and it was composed by fishes not older than 5 years, with the age-1 group being the dominant one. Age-0 fish was the second most important age group in the estimated population ((24%, 26 million

fish, and 13%, 1689 t, of the total abundance and biomass estimates). The bulk of the age-0 and age-1 groups were recorded in the Portuguese waters, whereas older age-groups were more frequent in Spanish waters.

INTRODUCTION

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

The general objective of these surveys is the acoustic assessment by vertical echo-integration and mapping of the abundance and biomass of recruits of small pelagic species (especially anchovy and sardine), as well as the mapping of both the oceanographic and biological conditions featuring the recruitment areas of these species in the Division 9a. The long term objective of the surveys would be to be able to assess the strength of the incoming recruitment to the fishery of these species the next year.

The present Working Document reports the main results from the *ECOCADIZ-RECLUTAS 2021-10* survey (the seventh survey within its series), 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-RECLUTAS 2021-10* survey was conducted between 21st October and 07th November onboard the Spanish R/V *Ramón Margalef* covering a survey area which comprised the waters of the Gulf of Cadiz, both Spanish and Portuguese, between the 20 m and 200 m isobaths. The survey design consisted in a systematic parallel grid with tracks equally spaced by 8 nm, normal to the shoreline (**Figure 1**).

The survey suffered a ten-day delay in relation to the usual starting dates, resulting in ending dates very close to the starting ones of the WGACEEG meeting. Causes for such a delay were of logistic (a delay in R/V's dry-dock repair works) and unforeseen (monitoring of the *Cumbre Vieja* volcano eruption) nature. Furthermore, the ship-time available was shortened in two days, and one day more was lost because of stormy weather and rough sea.

Echo-integration was carried out with a recently installed *Simrad™ EK80* echo-sounder working in the multi-frequency fashion (18, 38, 70, 120, 200, 333 kHz) and in CW mode. Average survey speed was about 10 knots and the acoustic signals were integrated over 1-nm intervals (ESDU). Raw acoustic data were stored for further post-processing using *Myriax Software Echoview™* software package. Acoustic equipment was calibrated between 23rd and 24th October in the Bay of Algeciras following the ICES standard procedures (Demer *et al.*, 2015; see also Foote *et al.*, 1987).

Survey execution and abundance estimation followed the methodologies firstly adopted by the ICES Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX (ICES, 1998) and the recommendations given later by the *Working Group on Acoustic and Egg Surveys for Small Pelagic Fish in NE Atlantic* (WGACEGG; ICES, 2006a,b; see also ICES TIMES 64 report, Doray *et al.*, 2021).

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

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

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

Individual biological sampling (length, weight, sex, maturity stage, stomach fullness, and mesenteric fat content) was performed in each haul for anchovy, sardine, mackerel (2 spp.) and horse-mackerel species (3 spp.), and bogue. Otoliths were extracted from anchovy, sardine and chub mackerel sampled specimens.

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

Species	b_{20}
Sardine (<i>Sardina pilchardus</i>)	-72.6
Round sardinella (<i>Sardinella aurita</i>)	-72.6
Anchovy (<i>Engraulis encrasicolus</i>)	-72.6
Chub mackerel (<i>Scomber japonicus</i>)	-68.7
Mackerel (<i>S. scombrus</i>)	-84.9
Horse mackerel (<i>Trachurus trachurus</i>)	-68.7
Mediterranean horse-mackerel (<i>T. mediterraneus</i>)	-68.7
Blue jack mackerel (<i>T. picturatus</i>)	-68.7
Bogue (<i>Boops boops</i>)	-67.0
Transparent goby (<i>Aphia minuta</i>)	-67.5
Atlantic pomfret (<i>Brama brama</i>)	-67.5
Blue whiting (<i>Micromesistius poutassou</i>)	-67.5
Silvery lightfish/pearlside (<i>Mauroliscus muelleri</i>)	-72.2
Longspine snipefish (<i>Macroramphosus scolopax</i>)	-80.0
Boarfish (<i>Capros aper</i>)	-66.2* (-72.6)

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

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

A *Sea-bird Electronics™ SBE 21 SEACAT* thermosalinograph and a *Turner™ 10 AU 005 CE Field* fluorometer were used during the acoustic tracking to continuously collect some hydrographical variables (sub-surface

sea temperature, salinity, and in vivo fluorescence). Vertical profiles of hydrographical variables were also recorded by night from 168 CTD_{O₂} casts over 22 transects (from the 23-transect planned grid) using a *Sea-bird Electronics™ SBE 911+ SEACAT* (with coupled *Datasonics* altimeter, *SBE 43* oximeter, *WetLabs ECO-FL-NTU* fluorimeter and *WetLabs C-Star 25 cm* transmissometer sensors) profiler (**Figure 2**). *VMADCP RDI 150 kHz* records were also continuously recorded by night between CTD stations. Census of top predators was not recorded during the survey.

A detailed description of protocols and methods followed in this survey series is reported in Doray *et al.* (2021).

RESULTS

Acoustic sampling

The acoustic sampling was restricted to the period comprised between 25th October and 06th November. The complete grid (21 transects) was acoustically sampled (**Table 1; Figure 1**). The sampling scheme followed to accomplish this grid was conditioned by the conduction of Spanish Navy and Army exercises (*FLOTEX 21*) during the survey, which occupied all the Spanish shelf waters. The sampling experienced one “jump” looking for space-time opportunity windows for the acoustic surveying trying to avoid such military exercises. Thus, the order and/or direction of the realization of the acoustic transects RA01 to RA04 had to be modified on 25th and 26th October. The acoustic sampling was partially interrupted on 28th-29th October in order to satisfy the R/V's refueling and provisioning needs. All works at sea were totally interrupted on 30th October because a stormy weather and rough sea. In order to perform the acoustic sampling with daylight, the acoustic sampling started at 06:40-06:45 UTC until 31st October, and at 07:15-07:20 UTC later on, although this time might vary depending on the duration of the works related with the hydrographic sampling the previous night.

Groundtruthing hauls

A total of eighteen (18) fishing operations for echo-trace ground-truthing (all of them were valid according to a correct gear performance and resulting catches), were carried out during the survey (**Table 2, Figure 3**). Because of many echo-traces usually occurred close to the bottom, all the pelagic hauls were carried out like a bottom-trawl haul, with the ground rope working over or very close to the bottom. Only one haul was performed over a determined isobath instead of being conducted over the acoustic transect. According to the above, the sampled depth range in the valid hauls oscillated between 25 and 202 m.

During the survey were captured 3 Chondrichthyan, 44 Osteichthyes, 8 Cephalopod, 3 Echinoderm, and several Cnidarian and Ascidian species. The percentage of occurrence of the fish species (sharks excluded) in the hauls is shown in the enclosed Text Table below (see also **Figure 4**). The pelagic ichthyofauna was both the most frequently captured species set and the one composing the bulk of the overall yields of the catches. Within this pelagic fish species set chub mackerel and anchovy (both with 78% presence index) and sardine (61%) were the most frequent species in the valid hauls, followed by horse mackerel and bogue (both 56%), mackerel (44%), Mediterranean horse mackerel (39%) and Blue jack mackerel (28%). Round sardinella (17%) and blue whiting (11%) showed very low occurrences. Boarfish, longspine snipefish and pearlside showed an incidental occurrence (6% each) in the hauls performed in the surveyed area.

For the purposes of the acoustic assessment, anchovy, sardine, mackerel species, horse & jack mackerel species, bogue, boarfish, snipefish and pearlside were initially considered as the survey target species. All the invertebrates, skates, rays and benthic fish species 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 fish species were included in an operational category termed as “Others”.

According to the above premises, during the survey were captured a total of 10 889 kg and 182 thousand fish (**Table 3**). Forty nine per cent (49%) of this “total” fished biomass corresponded to sardine, 38% to chub mackerel, 5% to anchovy, 4% to Mediterranean horse mackerel, 1% to horse mackerel and contributions lower than 1% for the remaining species. The most abundant species in ground-truthing trawl hauls was sardine (50%), followed by anchovy (24%), chub mackerel (21%), and horse mackerel (3%), with each of the remaining species accounting for equal to or less than 1%.

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

Species	OCCURRENCE (Number of valid hauls)	OCCURRENCE (% over Total valid hauls)	Total weight (Kg)	Total number
<i>Scomber colias</i>	14	78 %	4167,685	37825
<i>Engraulis encrasicolus</i>	14	78 %	559,681	44176
<i>Sardina pilchardus</i>	11	61 %	5357,42	90324
<i>Trachurus trachurus</i>	10	56 %	141,529	1361
<i>Boops boops</i>	10	56 %	15,798	108
<i>Merluccius merluccius</i>	10	56 %	4,072	34
<i>Scomber scombrus</i>	8	44 %	18,903	133
<i>Trachurus mediterraneus</i>	7	39 %	388,923	2007
<i>Spondyliosoma cantharus</i>	7	39 %	13,401	105
<i>Pagellus erythrinus</i>	7	39 %	7,605	44
<i>Trachurus picturatus</i>	5	28 %	66,589	1462
<i>Lepidopus caudatus</i>	5	28 %	0,107	12
<i>Diplodus vulgaris</i>	4	22 %	7,720	41
<i>Spicara flexuosa</i>	4	22 %	3,402	99
<i>Pagellus bellottii bellottii</i>	4	22 %	2,540	29
<i>Pagellus acarne</i>	4	22 %	2,038	15
<i>Sardinella aurita</i>	3	17 %	3,712	15
<i>Pomatomus saltatrix</i>	3	17 %	3,450	10
<i>Diplodus annularis</i>	3	17 %	0,221	5
<i>Brama brama</i>	2	11 %	6,605	15
<i>Diplodus bellottii</i>	2	11 %	4,785	107
<i>Pomadasys incisus</i>	2	11 %	3,875	44
<i>Caranx rhonchus</i>	2	11 %	2,580	8
<i>Stromateus fiatola</i>	2	11 %	1,955	3
<i>Liza ramada</i>	2	11 %	1,620	6
<i>Zeus faber</i>	2	11 %	0,905	2
<i>Sparus aurata</i>	2	11 %	0,862	2
<i>Micromesistius poutassou</i>	2	11 %	0,209	7
<i>Mola mola</i>	1	6 %	49,850	2
<i>Macroramphosus scolopax</i>	1	6 %	18,705	1849
<i>Dentex gibbosus</i>	1	6 %	10,770	2
<i>Sarda sarda</i>	1	6 %	5,455	3
<i>Zenopsis conchifer</i>	1	6 %	1,79	1
<i>Maurolicus muelleri</i>	1	6 %	1,62	1684
<i>Spicara maena</i>	1	6 %	1,55	40
<i>Capros aper</i>	1	6 %	0,962	129
<i>Alosa fallax</i>	1	6 %	0,625	4
<i>Parapristipoma octolineatum</i>	1	6 %	0,262	1
<i>Trachinotus ovatus</i>	1	6 %	0,19	1
<i>Umbrina canariensis</i>	1	6 %	0,131	1
<i>Mullus barbatus</i>	1	6 %	0,128	1
<i>Trachinus draco</i>	1	6 %	0,054	1
<i>Chelidonichthys obscurus</i>	1	6 %	0,038	1

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

A total of 305 nmi (ESDU) from 21 transects has been acoustically sampled by echo-integration for assessment purposes. The enclosed text table below provides the nautical area-scattering coefficients attributed to each of the selected target species and for the whole “pelagic fish assemblage”.

S_A ($m^2 nmi^{-2}$)	TOTAL	PIL	ANE	MAC	VMA	HOM	HMM	JAA	BOG	BOC	SNS	MAV
TOTAL AREA	149445	82051	24291	22	13402	6722	8536	3590	603	197	5337	4693
%	100	54,9	16,3	0,01	9,0	4,5	5,7	2,4	0,4	0,1	3,6	3,1
Portugal	108617	73657	6033	18	9497	6603	148	3590	421	197	5337	3116
%	72,7	89,8	24,8	82,2	70,9	98,2	1,7	100	69,7	100	100	66,4
Spain	40828	8394	18258	4	3905	119	8388	0	182	0	0	1577
%	27,3	10,2	75,2	17,8	29,1	1,8	98,3	0	30,3	0	0	33,6

For this “pelagic fish assemblage” has been estimated a total of 149 445 $m^2 nmi^{-2}$, a lower value than the maximum value recorded throughout the time-series the last year (229 241 $m^2 nmi^{-2}$), but still above the historical mean (120 817 $m^2 nmi^{-2}$). The highest NASC value (15 415 $m^2 nmi^{-2}$) was recorded in the inner-shelf waters (50 m) in front of Vila Real de Sto. Antonio (transect R12, **Figure 5**), with relatively high values being also recorded in the inner- and mid-shelf waters (20-123 m depth) of transects R06, R07, R13, R19 and R20. By species, sardine accounted for 55% of this total back-scattered energy, followed by anchovy (16%) and chub mackerel (9%), and the remaining species with relative contributions of acoustic energies lower than 6%.

According to the resulting values of integrated acoustic energy and the availability and representativeness of the length frequency distributions, the species acoustically assessed in the present survey finally were anchovy, sardine, mackerel, chub mackerel, blue jack mackerel, horse mackerel, Mediterranean horse mackerel, bogue, boarfish, 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**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 6**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $m^2 nmi^{-2}$) attributed to the species and the coherent strata considered for the acoustic estimation are shown in **Figure 7**. The estimated abundance and biomass by size class are given in **Table 5** and **Figure 8**. **Figure 9** shows the acoustic estimates by age group. **Table 6** shows the time-series of estimates for the whole population and Age-0 fish.

Gulf of Cadiz anchovy (16% of the total *NASC* attributed to fish) was widely distributed in the surveyed area, although avoided the easternmost waters. Higher densities were mainly recorded in two areas: between Alfanina and west of Cape Santa Maria, in the Algarve, and between Isla Cristina and Bay of Cadiz (**Figure 7**). The whole size class range for the pooled catches varied between the 2.0 and 18.5 cm size classes, with 3 modal classes, the main mode at 10.0 cm, a secondary mode at 14.5 cm and a third mode at 3.0 cm.

Ten (10) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the representative fishing hauls (**Figure 7**). Overall anchovy acoustic estimates in autumn

2021 were of 1973 million fish and 17 512 tones (**Table 5; Figure 8**), entailing 38% and 51% decreases in abundance and biomass, respectively, in relation to the last year's estimates (3197 million, 36 070 t). The current overall estimates are lower than the time-series average (i.e. 3258 million; 25 627 t), (see **Table 6** and **Figure 42**). By geographical strata, the Spanish waters yielded 89% (1763 million) and 76% (13 370 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 211 million and 4143 t (**Table 5; Figure 8**).

The size class range of the assessed anchovy population in autumn 2021 varied between the 2.0 and 18.5 cm size classes. The size distribution showed a mixed composition, with several modal classes, the main mode at 10.0 cm, a secondary mode at 14.0 cm, and less important modes at 8.0 and 3.0 cm size class. It is noticeable the occurrence of this last modal size, as a consequence of the record of very tiny juveniles (size class range: 2.0 – 4.5 cm) in the coastal waters located between Mazagón and Punta Umbría. The size composition of anchovy throughout the surveyed area confirms the usual pattern exhibited by the species during the survey 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 (**Figures 6 and 8**).

The population was composed by fishes not older than 2 years. Age 0 fish accounted for 83% (1629 million) and 69% (12 063 t) of the total estimated abundance and biomass, respectively (**Table 6; Figure 9**). Spanish waters concentrated the bulk (97%) of this juvenile fraction. The estimates of age-0 fish experienced a similar decreasing trend than the one showed by the whole population in relation to the historical peak recorded in 2019 and the values recorded in 2020, but with values close to the time-series average (**Table 6**). Age 1 fish represented 16% and 28% of the total abundance and biomass (**Figure 9**).

The 2021 autumn estimates of mean size and weight of the whole population (11.2 cm, 8.9 g) were somewhat lower than their respective time-series averages (11.3 cm, 9.5 g). Regional mean size and weights in the estimated population were estimated at 14.6 cm and 19.6 g in Portuguese waters and 10.7 cm and 7.6 g in Spanish ones.

Sardine

Parameters of the survey's size-weight relationship for sardine are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 10**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 11**. Estimated abundance and biomass by size class are given in **Table 7** and **Figure 12**. **Figure 13** shows the acoustic estimates by age group. **Table 8** shows the time-series of estimates for the whole population and Age-0 fish.

GoC sardine recorded a relatively high acoustic echo-integration in autumn 2021 (55% of the total *NASC* attributed to pelagic fish species assemblage), as a consequence of the occurrence of dense mid-water schools in the Algarve coastal and inner shelf waters (20-78 m), with a main hotspot between Cape Santa María and the Guadiana river mouth and another one between Burgau and Portimão (**Figure 11**). Sardine was widely distributed all over the surveyed area (avoiding the easternmost waters) and, as a consequence of the abovementioned occurrence of dense schools in coastal waters, with very high densities in the inner-middle shelf waters.

The whole size class range for the pooled catches varied between the 10.0 and 21.5 cm size classes, with 2 modal classes, the main mode at 19.0 cm and a secondary mode at 12.5 cm. The size composition of sardine catches throughout the surveyed area confirms the usual pattern exhibited by the species during

the survey season, with the largest (and oldest) fish being distributed in the Portuguese waters and the smallest (and youngest) ones concentrated in the coastal waters between Chipiona and El Rompido (**Figure 10**).

Five (5) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing hauls (**Figure 11**). GoC sardine abundance and biomass in autumn 2021 were estimated at 2986 million fish and 151 320 t, the second historical record within its respective series, values which, however, entailed 83% and 38% decreases in relation to the last year's estimates (5451 million and 208 400 t, the historical record in the series; **Table 7, Figure 12**). Portuguese waters concentrated 82% and 94% of the total estimated abundance and biomass, respectively (2448 million and 142 532 t). The estimates for the Spanish waters were 538 million and 8 788 t.

Sizes of the assessed sardine population in autumn 2021 ranged between 10.0 and 21.5 cm size classes. The length frequency distribution of the population was clearly bimodal, with one main mode at 18.0 cm size class and a secondary one at 12.5 cm (**Table 7; Figure 12**).

Age-5 group was the oldest age group occurring in the population, although the occurrence of fishes older than 4 years was relatively low. The population was mainly composed by fishes belonging to the age-0 to age-2 groups. Juvenile sardines (age-0 group) were not the dominant group, accounting for 21% (638 million) and 9% (12 854 t) of the total abundance and biomass, respectively. The bulk of the juvenile fraction (82% of the juvenile total abundance) was recorded in Spanish waters, especially in the relatively shallow waters along the coastal fringe comprised between the Guadiana river mouth and the Bay of Cadiz (**Table 8; Figures 10 and 13**).

The 2021 autumn estimates of mean length and weight of the whole population (17.7 cm, 50.6 g), are both higher than both the last year's estimates and the time-series averages (i.e. 15.6 cm, 37.4 g).

Mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 14**. The mapping of the backscattering energy (nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 15**. Estimated abundance and biomass by size class are given in **Table 9** and **Figure 16**.

Atlantic mackerel (0.01% of the total $NASC$) showed a main density nucleus in the westernmost Algarve and a relatively lower density in the outer shelf waters off the central zone of the surveyed area (**Figure 15**).

Two (2) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing stations (**Figure 15**). Mackerel abundance and biomass in autumn 2021 in the GoC shelf waters were estimated at only 6 million fish and 803 t (**Table 9; Figure 16**). Almost the whole estimated population (84.0% of the total abundance) was located in Portuguese waters (5 million, 675 t). The estimates for the Spanish waters were c.a. 1 million and 128 t.

The size range of the estimated population in autumn 2021 varied between 24.0 and 35.5 cm size classes, with a dominant mode at 24.5 cm size class and a secondary mode at 27.0 cm (**Table 9; Figure 16**). No clear spatial pattern in mean size was observed; perhaps the smallest fish were more common in Portuguese waters.

Chub mackerel

Parameters of the survey's length-weight relationship are shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 17**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 18**. Estimated abundance and biomass by size class are given in **Table 10** and **Figure 19**. **Figure 20** shows the acoustic estimates by age group. **Table 11** shows the time-series of estimates for the whole population and Age-0 fish.

Chub mackerel (9% of the total *NASC*) was widely distributed in the surveyed area, but showing higher densities in three between Cape San Vicente and Mazagón (**Figure 18**). The species' positive hauls did not show a clear spatial pattern in (mean) size. The largest fish were commonly captured in Spanish waters, with smaller fish occurring in Portuguese waters and the smallest ones in the middle-outer shelf waters between Albufeira and Alfanzina (**Table 10**; **Figures 17** and **19**).

Five (5) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing stations (**Figure 18**). Chub mackerel abundance and biomass in the surveyed area were estimated in 106 million fish and 13 115 t, accounting for 64% and 43% strong decreases in relation to the estimates in the previous year (295 million, 22 918 t; **Table 10**, **Figure 19**). Portuguese waters accounted for 81% (86 million) and 62% (8075 t) of the total abundance and biomass, respectively. Spanish waters yielded a population of 21 million and 5040 t.

The size range recorded for the estimated population was comprised between 17.0 and 37.5 cm size classes, showing a very mixed composition, with a dominant modal class at 24.0 cm, a secondary mode at 20.0 cm and less represented modes at 28.0 cm and 32.0 cm size classes. A rather similar size composition is also recorded for the estimated biomass, although the mode at 24.0 cm clearly dominates over the smaller modes (**Table 10**, **Figure 19**). Regional size compositions showed different shapes, with larger modes dominating in the size distribution off Spanish waters whereas smaller modes are the most important in the Portuguese shelf.

The population was composed by fishes not older than 5 years, with the age-1 group being the dominant one (54%, 57 million, and 47%, 6134 t, of the total abundance and biomass estimated in the surveyed area, respectively; **Figure 20**). Age-0 fish was the second most important age group in the estimated population (24%, 26 million fish, and 13%, 1689 t, of the total abundance and biomass estimates). The bulk of the age-0 (99.8%) and age-1 groups (94%) was recorded in the Portuguese waters, whereas older age-groups were more frequent in Spanish waters.

Horse mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 21**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 22**. Estimated abundance and biomass by size class are given in **Table 12** and **Figure 23**.

Horse mackerel (4.5% of the total *NASC*) showed a very scattered distribution, with the main density nucleus being located in the western Algarve shelf waters (**Figure 22**).

The size range recorded in positive hauls was comprised between 7.5 and 28.5 cm size classes, with a dominant mode at 18.5 cm size class and a secondary mode at 23.0 cm. Small fish were recorded in the Spanish waters (**Figure 21**).

Six (6) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing hauls (**Figure 22**). Horse mackerel abundance and biomass in the surveyed area were estimated in 59 million fish and 6141 t (**Table 12, Figure 23**). Portuguese waters accounted for 97% (57 million) and 99% (6066 t) of the total abundance and biomass, respectively. Spanish waters yielded a population of 2 million and 75 t.

The size range recorded for the estimated population was comprised between 15.5 and 30.5 cm size classes, with two distinct modes, the dominant one at 23.0 cm (exclusively recorded in Portuguese waters) and a secondary mode at 18.0 cm size class (mainly distributed in Spanish waters; **Table 12, Figure 23**).

Mediterranean horse-mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 24**. The mapping of the backscattering energy (nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 25**. Estimated abundance and biomass by size class are given in **Table 13** and **Figure 26**.

Mediterranean horse mackerel (5.7% of the total $NASC$) was a typically Spanish species in autumn 2021. The species distributed over the Spanish eastern and central waters, not further west than Fuzeta, mainly over the inner-mid shelf waters (**Figure 25**). The size class range for the pooled catches varied between the 20.0 and 39.0 cm size classes, with one modal class at 27.0 cm. No clear spatial pattern in mean size was observed, although the largest fish occurred in the easternmost Spanish waters (**Figure 24**).

Four (4) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing hauls (**Figure 25**). Mediterranean horse mackerel abundance and biomass in the surveyed area were estimated in 47 million fish and 9711 t, with the bulk of the population (99% of abundance and biomass; 47 million, 9595 t) being located in Spanish waters, as usual (**Table 13, Figure 26**).

The size range recorded for the estimated population was comprised between 20.0 and 39.0 cm size classes, with at least one clearly distinct mode at 27.0 cm size class, and other secondary modes at 29.5 and 44.5 cm size class. Largest fish occurred in the easternmost waters of the Spanish shelf, as previously evidenced by the positive hauls raw data (**Table 13, Figure 26**).

Blue jack mackerel

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 27**. The mapping of the backscattering energy (nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 28**. Estimated abundance and biomass by size class are given in **Table 14** and **Figure 29**.

Blue jack mackerel (2.4% of the total $NASC$) was restricted exclusively to the Portuguese waters, showing the highest acoustic densities in the western Algarve shelf waters (**Figure 28**). The size class range for the pooled catches varied between the 15.5 and 23.0 cm size classes. No clear spatial pattern in mean size was observed (**Figure 27**).

Two (2) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the fishing hauls (**Figure 28**). Blue Jack mackerel abundance and biomass in the surveyed area were estimated in 53 million fish and 2236 t, with all the estimated population being located in Portuguese waters (**Table 14, Figure 29**).

The size range recorded for the estimated population was comprised between 15.5 and 20.5 cm size classes, with a single modal size class at 17.0 cm (**Table 12, Figure 23**).

Bogue

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 30**. The mapping of the backscattering energy (nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 31**. Estimated abundance and biomass by size class are given in **Table 15** and **Figure 32**.

Bogue (0.4% of the total $NASC$) showed a scattered distribution, showing relatively low acoustic densities, although the highest densities were recorded in the westernmost Algarve shelf waters (**Figure 31**). The size class range for the pooled catches varied between the 10.5 and 34.5 cm size classes, with one modal class at 23.0 cm. No clear spatial pattern in mean size was observed, although the largest fish occurred in the easternmost Spanish waters (**Figure 30**).

Five (5) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the representative fishing hauls (**Figure 31**). Bogue abundance and biomass in the surveyed area were estimated in about 4 million fish and 412 t (**Table 15, Figure 32**). Portuguese waters accounted for 71% of both total abundance (3 million) and biomass (291 t), respectively. Spanish waters yielded a population of 1 million and 121 t.

The size range recorded for the estimated population was comprised between 18.5 and 25.0 cm size classes, with one mode at 23.0 cm size class (**Table 15, Figure 32**).

Boarfish

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 33**. The mapping of the backscattering energy (nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 34**. Estimated abundance and biomass by size class are given in **Table 16** and **Figure 35**.

The occurrence of boarfish (0.1%) was incidental and restricted to the westernmost Algarve outer shelf waters, co-occurring with longspine snipefish (**Figure 34**). The size range recorded in the only positive haul was comprised between 5.0 and 9.0 cm size classes, with one single modal class at 6.5 cm (**Figure 33**).

One (1) coherent post-stratum has been differentiated according to the S_A value distribution and the size composition in the representative fishing hauls (**Figure 31**). Boarfish abundance and biomass in the surveyed area were estimated in 11 million fish and 21 t, with the whole population being restricted to the westernmost Algarve outer shelf waters (**Table 16, Figure 35**).

The size range recorded for the estimated population was comprised between 5.0 and 9.0 cm size classes, with a single mode at 7.5 cm size class (**Table 16, Figure 35**).

Longspine snipefish

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 36**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 37**. Estimated abundance and biomass by size class are given in **Table 17** and **Figure 38**.

Comparatively, longspine snipefish (3.6%) showed relatively high acoustic densities, although they were restricted to the westernmost Algarve outer shelf waters (**Figure 37**). The species showed a concurrent distribution with boarfish. The size range recorded in the only positive haul was comprised between 9.0 and 14.5 cm size classes, with 2 modal classes, the main mode at 12.0 cm and a secondary mode at 9.0 cm. No spatial pattern in mean size was observed (**Figure 36**).

One (1) coherent post-stratum, located in the westernmost Algarve outer shelf waters, has been differentiated according to the S_A value distribution and the size composition in the representative fishing hauls (**Figure 37**). Longspine snipefish abundance and biomass in the surveyed area were estimated in 2454 million fish and 78 026 t, as a consequence of the occurrence of a very dense aggregation located over the shelf break in the R20 transect (**Table 17, Figure 38**).

The size range recorded for the estimated population was comprised between 9.0 and 14.5 cm size classes, with 2 modal classes, the main mode at 12.0 cm and a secondary mode at 9.0-9.5 cm size classes (**Table 17, Figure 38**).

Pearlside

The survey's length-weight relationship for this species is shown in **Table 4**. Size composition and mean size in the fishing hauls are represented in the spatial context in **Figure 39**. The mapping of the backscattering energy (nautical area scattering coefficient, *NASC*, in $\text{m}^2 \text{nmi}^{-2}$) attributed to the species and the coherent post-strata considered for the acoustic estimation are shown in **Figure 40**. Estimated abundance and biomass by size class are given in **Table 18** and **Figure 41**.

Pearlside (3.1%) was relatively common over the shelf break, especially in the western Algarve waters (**Figure 40**). The size range in the only positive haul (Cape Santa Maria area in Portuguese waters) varied between 3.5 and 5.5 cm size class (mode at 4.5 cm size class; **Figure 39**).

Two (2) coherent post-strata have been differentiated according to the S_A value distribution and the size composition in the representative fishing hauls (**Figure 40**). Pearlside abundance and biomass in the surveyed area were estimated in 1907 million fish and 2013 t. Portuguese waters accounted for 54% (1023 million, 1080 t) of both the total abundance and biomass, respectively. Spanish waters yielded a population of 884 million and 933 t. (**Table 16, Figure 35**).

The size range recorded for the estimated population was comprised between 3.5 and 5.5 cm size classes, with a dominant mode at 4.5 cm size class (**Table 18, Figure 41**).

(SHORT) DISCUSSION

The time series of anchovy, sardine and chub mackerel estimates from this survey series are described in **Tables 6, 8 and 11** and **Figure 42**.

GoC anchovy population in autumn 2021 (1973 million fish, 17 512 t) experienced 38% and 51% decreases in abundance and biomass, respectively, in relation to the last year's autumn estimates (3197 million, 36 070 t; **Table 6; Figure 42**). Spanish waters concentrated the bulk of the total estimated abundance and biomass in the Gulf, confirming the importance of these waters in the species' distribution. The current overall estimates are lower than the time-series average (i.e. 3258 million; 25 627 t). Age 0 fish accounted for 83% (1629 million) and 69% (12 063 t) of the total estimated abundance and biomass, respectively (**Table 6; Figure 9**). Spanish waters concentrated the bulk (97%) of this juvenile fraction. The estimates of age-0 fish experienced a similar decreasing trend than the one showed by the whole population in relation to the historical peak recorded in 2019 and the values recorded in 2020, but with values close to the time-series average (**Table 6**).

GoC sardine abundance (2986 million fish) and biomass (151 320 t) in autumn 2021 peaked at their second historical maximum within its series, representing however 83% and 38% decreases in relation to the last year's estimates (5451 million and 208 400 t, the historical record in the series; **Table 7, Figure 12**). Portuguese waters concentrated the bulk of the total estimated abundance and biomass. The GoC sardine population was mainly composed by fishes belonging to the age-0 to age-2 groups and in a lesser extent by age-3 fish (incidental occurrence of 4 to 5 year old fishes). Juvenile sardines (age-0 group) were not the dominant group, accounting for 21% (638 million) and 9% (12 854 t) of the total abundance and biomass, respectively. The bulk of the juvenile fraction (82% of the juvenile total abundance) was recorded in Spanish waters, especially in the relatively shallow waters along the coastal fringe comprised between the Guadiana river mouth and the Bay of Cadiz (**Table 8; Figures 10 and 13**).

Chub mackerel abundance (106 million fish) and biomass (13 115 t) in autumn 2021 experienced 64% and 43% strong decreases in relation to the estimates in the previous year (295 million, 22 918 t; **Table 10, Figure 19**), and they are below their respective time-series averages (i.e. 214 million, 15 487 t) (**Table 11, Figure 42**). Portuguese waters concentrated the great part of the total population abundance and biomass. The population was composed by fishes not older than 5 years, with the age-1 group being the dominant one (54%, 57 million, and 47%, 6134 t, of the total abundance and biomass estimated in the surveyed area, respectively; **Figure 20**). Age-0 fish was the second most important age group in the estimated population (24%, 26 million fish, and 13%, 1689 t, of the total abundance and biomass estimates). The bulk of the age-0 (99.8%) and age-1 groups (94%) was recorded in the Portuguese waters, whereas older age-groups were more frequent in Spanish waters.

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Table 1. *ECOCADIZ-RECLUTAS 2021-10* survey. Descriptive characteristics of the acoustic tracks.

Acoustic Track	Location	Date	Start				End			
			Latitude	Longitude	UTC time	Mean depth (m)	Latitude	Longitude	UTC time	Mean depth (m)
R01	Trafalgar	26/10/21	36° 02.01' N	06° 29.12' W	13:30	240	36° 13.03' N	06° 08.84' W	15:35	23
R02	Sancti-Petri	26/10/21	36° 19.31' N	06° 14.93' W	6:50	26	36° 08.79' N	06° 34.30' W	10:35	204
R03	Cádiz	25/10/21	36° 17.40° N	06° 36.24' W	11:23	181	36° 29.79' N	06° 18.93' W	15:09	23
R04	Rota	25/10/21					36° 24.53' N	06° 40.80' W	10:34	199
R05	Chipiona	27/10/21	36° 40.36' N	06° 29.41' W	6:46	21	36° 31.25' N	06° 46.24' W	10:15	193
R06	Doñana	27/10/21	36° 38.00' N	06° 51.65' W	11:10	200	36° 46.60' N	06° 35.70' W	14:46	19
R07	Matalascañas	29/10/21	36° 54.45' N	06° 38.95' W	12:20	16	36° 43.90' N	06° 58.32' W	16:15	220
R08	Mazagón	31/10/21	36° 49.39' N	07° 06.06' W	7:25	198	36° 01.08' N	06° 44.78' W	11:37	20
R09	Punta Umbría	31/10/21	37° 04.30' N	06° 56.08' W	13:53	23	36° 49.68' N	07° 06.55' W	15:34	198
R10	El Rompido	01/11/21	36° 50.03' N	07° 07.21' N	7:22	191	37° 07.93' N	07° 07.21' W	11:18	18
R11	Isla Cristina	01/11/21	37° 06.84' N	07° 17.06' W	13:57	22	36° 53.47' W	07° 17.14' W	15:16	200
R12	V.R. do Sto. Antonio	02/11/21	37° 06.35' N	7° 17.26' W	7:16	18	36° 56.26' N	07° 27.11' W	10:18	202
R13	Tavira	02/11/21	36° 57.10' N	07° 37.12' W	11:05	189	37° 05.19' N	07° 37.17' W	11:55	16
R14	Fuzeta	02/11/21	36° 59.27' N	07° 46.96' W	14:33	42	36° 55.48' N	07° 47.02' W	14:55	193
R15	Cabo Sta. María	03/11/21	36° 56.13' N	07° 56.99' W	7:21	51	36° 52.15' N	07° 56.91' W	7:46	187
R16	Cuarreira	03/11/21	37° 01.77' N	08° 07.05' W	10:19	19	36° 49.82' N	08° 06.85' W	11:41	162
R17	Albufeira	04/11/21	36° 49.39' N	08° 16.83' W	7:22	196	36° 01.8' N	08° 17.01' W	8:36	21
R18	Alfanzina	04/11/21	37° 04.30' N	08° 26.99' W	11:34	24	36° 50.23' W	08° 26.69' W	14:57	209
R19	Portimão	05/11/21	37° 06.02' N	08° 37.07' W	7:36	21	36° 51.88' W	08° 36.62' W	9:01	148
R20	Burgau	05/11/21	36° 51.17' N	08° 46.68' W	9:52	217	37° 02.47' N	08° 46.96' W	13:31	45
R21	Punta de Sagres	06/11/21	36° 59.13' N	08° 56° .79' W	7:07	24	36° 50.56' N	8° 56.58' W	8:01	206

Table 2. ECOCADIZ-RECLUTAS 2021-10 survey. Descriptive characteristics of the fishing hauls.

Fishing haul	Date	Start		End		UTC Time		Depth (m)		Duration (min)		Trawled Distance (nm)	Acoustic Transect	Zone (landmark)
		Latitude	Longitude	Latitude	Longitude	Start	End	Start	End	Effective Trawling	Total Manoeuvre			
1	25-10-2021	36° 27.8394 N	6° 34.7840 W	83,46	36° 28.9480 N	6° 32.7166 W	68,48	08:47	09:14	00:27	01:13	2,002	R04	Rota
2	25-10-2021	36° 23.6390 N	6° 24.7175 W	51,45	36° 21.5517 N	6° 28.5754 W	69,28	12:53	13:44	00:50	01:24	3,748	R03	Cádiz
3	26-10-2021	36° 15.6718 N	6° 21.7453 W	47,41	36° 16.7514 N	6° 19.0876 W	40,79	08:09	08:41	00:32	01:11	2,404	R02	Sancti-Petri
4	26-10-2021	36° 09.3423 N	6° 33.4767 W	156,46	36° 10.5130 N	6° 31.3233 W	116,12	11:17	11:46	00:28	01:27	2,099	R02	Sancti-Petri
5	27-10-2021	36° 36.3974 N	6° 36.7585 W	57,78	36° 38.0278 N	6° 33.7723 W	38,16	07:54	08:34	00:39	01:17	2,903	R05	Chipiona
6	27-10-2021	36° 40.5672 N	6° 46.9273 W	94,71	36° 38.8771 N	6° 49.7937 W	120,81	12:05	12:46	00:40	01:28	2,858	R06	Doñana
7	29-10-2021	36° 50.6064 N	6° 46.4508 W	41,17	36° 52.1859 N	6° 43.6623 W	24,89	13:35	14:12	00:37	01:13	2,738	R07	Matalascañas
8	31-10-2021	36° 53.9092 N	6° 56.8250 W	79,98	36° 52.3850 N	7° 00.6593 W	101,41	08:42	09:20	00:38	01:26	3,432	R08	Mazagón
9	30-10-2021	36° 59.6417 N	6° 47.3898 W	26,91	36° 57.9788 N	6° 50.3552 W	36,97	12:06	12:46	00:40	01:10	2,899	R08	Mazagón
10	01-11-2021	36° 52.3377 N	7° 07.1216 W	123,59	36° 49.9269 N	7° 07.0607 W	201,96	08:10	08:42	00:32	01:26	2,408	R10	El Rompido
11	01-11-2021	37° 05.5373 N	7° 07.0416 W	26,3	37° 03.0531 N	7° 06.5738 W	42,23	12:02	12:36	00:33	01:04	2,509	R10	El Rompido
12	02-11-2021	37° 03.4301 N	7° 27.0741 W	59,9	37° 05.4515 N	7° 27.0567 W	29,39	08:03	08:29	00:26	01:24	2,019	R12	Vila Real do Santo Antonio
13	02-11-2021	37° 00.4410 N	7° 36.9744 W	94,78	36° 58.6553 N	7° 36.9066 W	108,48	12:33	12:57	00:24	01:18	1,784	R13	Tavira
14	03-11-2021	36° 52.6355 N	7° 56.9689 W	102,88	36° 55.2322 N	7° 57.3097 W	66,44	08:13	08:51	00:37	01:22	2,608	R15	Cabo de Santa María
15	03-11-2021	36° 53.9360 N	8° 06.0203 W	87,49	36° 53.9802 N	8° 07.0103 W	84,58	12:48	12:58	00:10	00:55	0,795	R16	Cuarteira
16	04-11-2021	36° 59.1968 N	8° 16.8204 W	45,5	36° 56.3192 N	8° 16.8261 W	72,19	09:09	09:49	00:40	01:22	2,874	R17	Albufeira
17	04-11-2021	36° 54.3264 N	8° 26.7825 W	115,8	36° 57.0316 N	8° 26.7953 W	89,08	13:01	13:39	00:37	01:23	2,702	R18	Alfanzina
18	05-11-2021	36° 54.5772 N	8° 46.6952 W	110,12	36° 57.6744 N	8° 46.7128 W	92,32	11:59	12:41	00:42	01:23	3,093	R20	Burgau

Table 3. ECOCADIZ-RECLUTAS 2021-10 survey. Catches by species in number (upper panel) and weight (in kg, lower panel) from valid fishing stations.

Fishing haul	CATCH IN NUMBER														TOTAL
	<i>Anchovy</i>	<i>Sardine</i>	<i>Round sardin.</i>	<i>Chub mack.</i>	<i>Mackerel</i>	<i>Blue Jack mack.</i>	<i>Horse-mack.</i>	<i>Medit. Horse-mack.</i>	<i>Atlantic pomfret</i>	<i>Bogue</i>	<i>Boarfish</i>	<i>Snipefish</i>	<i>Pearlside</i>	<i>Other spp.</i>	
01	1629	1	0	0	0	0	0	0	0	0	0	0	0	1	1631
02	0	0	12	244	0	0	0	229	0	19	0	0	0	1	505
03	0	0	0	1	0	0	8	81	0	0	0	0	0	155	245
04	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
05	820	2024	0	3	0	0	0	168	0	4	0	0	0	22	3041
06	17535	238	0	0	4	0	0	0	0	0	0	0	0	7	17784
07	0	780	2	44	0	0	14	997	0	1	0	0	0	141	1979
08	3181	20	0	2	4	0	0	0	0	0	0	0	0	3	3210
09	2776	362	1	879	0	0	3	464	0	5	0	0	0	115	4605
10	8505	0	0	0	2	0	0	0	14	0	0	0	0	2	8523
11	250	712	0	15	0	0	4	36	0	1	0	0	0	14	1032
12	170	74413	0	130	0	0	10	32	0	22	0	0	0	85	74862
13	94	4860	0	35853	0	509	55	0	0	12	0	0	0	9	41392
14	988	0	0	27	6	25	30	0	0	2	0	0	1684	18	2780
15	902	0	0	1	17	0	0	0	1	0	0	0	0	4	925
16	66	5979	0	554	9	925	1010	0	0	39	0	0	0	30	8612
17	7247	0	0	56	81	1	224	0	0	3	0	0	0	21	7633
18	13	935	0	16	10	2	3	0	0	0	129	1849	0	8	2965
TOTAL	44176	90324	15	37825	133	1462	1361	2007	15	108	129	1849	1684	638	181726

Table 3. ECOCADIZ-RECLUTAS 2021-10 survey. Cont'd.

Fishing haul	CATCH IN WEIGHT (kg)														TOTAL
	Anchovy	Sardine	Round sardin.	Chub mack.	Mackerel	Blue Jack mack.	Horse-mack.	Medit. Horse-mack.	Atlantic pomfret	Bogue	Boarfish	Snipefish	Pearlside	Other spp.	
01	15,780	0,022	0	0	0	0	0	0	0	0	0	0	0	0,089	15,891
02	0	0	3,220	89,325	0	0	0	49,020	0	5,700	0	0	0	0,090	147,355
03	0	0	0	0,422	0	0	0,432	17,636	0	0	0	0	0	27,855	46,345
04	0	0	0	0	0	0	0	0	0	0	0	0	0	49,850	49,850
05	2,790	37,940	0	0,277	0	0	0	38,880	0	0,800	0	0	0	6,935	87,622
06	118,21	5,740	0	0	0,615	0	0	0	0	0	0	0	0	5,435	130,000
07	0	14,600	0,380	9,386	0	0	0,902	182,860	0	0,109	0	0	0	14,186	222,423
08	21,860	0,352	0	0,235	0,730	0	0	0	0	0	0	0	0	0,338	23,515
09	10,340	6,080	0,112	194,720	0	0	0,070	87,990	0	0,735	0	0	0	14,484	314,531
10	156,310	0	0	0	0,270	0	0	0	6,205	0	0	0	0	0,018	162,803
11	2,0150	11,690	0	4,230	0	0	0,230	6,765	0	0,070	0	0	0	2,532	27,532
12	2,048	4527,074	0	13,880	0	0	0,261	5,772	0	2,113	0	0	0	3,719	4554,867
13	1,678	324,842	0	3806,339	0	24,425	2,349	0	0	1,431	0	0	0	1,101	4162,165
14	17,130	0	0	2,830	1,115	1,330	4,950	0	0	0,405	0	0	1,620	2,743	32,123
15	17,600	0	0	0,083	2,530	0	0	0	0,400	0	0	0	0	0,066	20,679
16	1,230	359,620	0	37,650	1,470	40,600	105,910	0	0	4,045	0	0	0	6,283	556,808
17	192,260	0	0	6,675	10,945	0,059	26,020	0	0	0,390	0	0	0	1,391	237,740
18	0,430	69,460	0	1,633	1,228	0,175	0,405	0	0	0	0,962	18,705	0	3,305	96,303
TOTAL	559,681	5357,420	3,712	4167,685	18,903	66,589	141,529	388,923	6,605	15,798	0,962	18,705	1,620	140,42	10888,552

Table 4. ECOCADIZ-RECLUTAS 2021-10 survey. Parameters of the size-weight relationships for the survey's target species susceptible of being assessed. FAO codes for the species: ANE: *Engraulis encrasicolus*; PIL: *Sardina pilchardus*; VAM: *Scomber colias*; MAC: *S. scombrus*; JAA: *Trachurus picturatus*; HOM: *T. trachurus*; HMM: *T. mediterraneus*; BOG: *Boops boops*; POA: *Brama brama*; BOC: *Capros aper*; SNS: *Macroramphosus scolopax*; MAV: *Maurolicus muelleri*.

Parameter	ANE	PIL	SAA	VAM	MAC	JAA	HOM	HMM	POA	BOG	BOC	SNS	MAV
Size range (mm)	27 - 193	104 - 216	260 - 344	182 - 374	240 - 357	162 - 232	69 - 308	200 - 415	342 - 400	181 - 345	91 - 141	54 - 90	35 - 55
n	685	464	13	406	101	128	180	301	14	85	150	129	151
a	0.003213570	0.002008436	0.002717708	0.001264585	0.002786321	0.005100145	0.008084745	0.066215667	0.017383890	0.006246972	0.005225102	0.027534889	0.037865257
b	3.250660	3.503799	3.311204	3.577470	3.296999	3.133309	3.011662	2.386548	2.803991	3.144430	3.014743	2.856752	2.086193
r ²	0.9947721	0.9607988	0.8205893	0.9885517	0.9343625	0.9502970	0.9817678	0.9156734	0.8094138	0.9726588	0.8784573	0.9309560	0.7588735

Table 5. EOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*E. encrasicolus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 7.**

EOCADIZ-RECLUTAS 2021-10 . <i>Engraulis encrasicolus</i> . ABUNDANCE (in numbers and million fish)																
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	n			Millions		
											PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
2	0	0	0	0	0	0	0	3712239	0	0	0	3712239	3712239	0	4	4
2,5	0	0	0	0	0	0	0	4242559	0	0	0	4242559	4242559	0	4	4
3	0	0	0	0	0	0	0	8485117	0	0	0	8485117	8485117	0	8	8
3,5	0	0	0	0	0	0	0	1590959	0	0	0	1590959	1590959	0	2	2
4	0	0	0	0	0	0	0	2651599	0	0	0	2651599	2651599	0	3	3
4,5	0	0	0	0	0	0	0	1590959	0	0	0	1590959	1590959	0	2	2
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	563418	0	0	563418	563418	0	1	1
7,5	0	0	0	0	0	0	1750645	0	18592806	0	0	20343451	20343451	0	20	20
8	0	0	0	0	0	0	2848854	0	56905254	0	0	59754108	59754108	0	60	60
8,5	0	0	0	0	0	0	13466076	0	32114847	0	0	45580923	45580923	0	46	46
9	0	0	0	0	0	0	76785171	655922	5070765	0	0	82511858	82511858	0	83	83
9,5	0	0	0	0	60520	0	279735115	990861	1126837	0	60520	281852813	281913333	0,1	282	282
10	0	0	0	0	30260	0	296143954	1646783	0	3060960	30260	300851697	300881957	0,03	301	301
10,5	0	0	0	0	121041	0	230410511	1646783	1126837	23416342	121041	256600473	256721514	0,1	257	257
11	0	0	0	0	60520	0	153764282	4605409	0	82645912	60520	241015603	241076123	0,1	241	241
11,5	0	0	0	0	166431	0	115494696	2302705	0	65504538	166431	183301939	183468370	0,2	183	183
12	0	95104	0	76	469034	25685	79573472	3628504	0	42853436	564214	126081097	126645311	1	126	127
12,5	0	895993	0	713	499294	241983	33933387	990861	0	18671854	1396000	53838085	55234085	1	54	55
13	100950	13469141	17531	10712	817026	3637636	21629070	0	0	9335927	14415360	34602633	49017993	14	35	49
13,5	988946	30978548	171742	24638	257212	8366434	1750645	0	0	2295720	32421086	12412799	44833885	32	12	45
14	3486321	54263641	605439	43157	90781	14655082	2848854	0	0	0	58489339	17503936	75993275	58	18	76
14,5	6467734	42698538	1123196	33959	0	11531673	1750645	0	0	1530480	50323427	14812798	65136225	50	15	65
15	7711698	18013336	1339224	14326	0	4864895	1098209	0	0	0	27078584	5963104	33041688	27	6	33
15,5	5960717	5557637	1035146	4420	0	1500961	0	0	0	0	12557920	1500961	14058881	13	2	14
16	3474428	3700093	603374	2943	0	999291	0	0	0	0	7780838	999291	8780129	8	1	9
16,5	1905543	330377	330919	263	0	89225	0	0	0	0	2567102	89225	2656327	3	0,1	3
17	1317458	188787	228792	150	0	50986	0	0	0	0	1735187	50986	1786173	2	0,1	2
17,5	522423	94393	90725	75	0	25493	0	0	0	0	707616	25493	733109	1	0,03	1
18	68523	0	11900	0	0	0	0	0	0	0	80423	0	80423	0,1	0	0,1
18,5	33156	0	5758	0	0	0	0	0	0	0	38914	0	38914	0,04	0	0,04
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	32037897	170285588	5563746	135432	2572119	45989344	1312983586	38741260	115500764	249315169	210594782	1762530123	1973124905	211	1763	1973
Millions	32	170	6	0,1	3	46	1313	39	116	249	211	1763	1973	211	1763	1973

Table 5. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*E. encrasicolus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10. <i>Engraulis encrasicolus</i> . BIOMASS (t)													
Size class	POL01	POL02	POL03	POL04	POL05	POL06	POL07	POL08	POL09	POL10	PORTUGAL	SPAIN	TOTAL
2	0	0	0	0	0	0	0	0,167	0	0	0	0,167	0,167
2,5	0	0	0	0	0	0	0	0,365	0	0	0	0,365	0,365
3	0	0	0	0	0	0	0	1,258	0	0	0	1,258	1,258
3,5	0	0	0	0	0	0	0	0,376	0	0	0	0,376	0,376
4	0	0	0	0	0	0	0	0,940	0	0	0	0,940	0,940
4,5	0	0	0	0	0	0	0	0,810	0	0	0	0,810	0,810
5	0	0	0	0	0	0	0	0	0	0	0	0	0
5,5	0	0	0	0	0	0	0	0	0	0	0	0	0
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	1,134	0	0	1,134	1,134
7,5	0	0	0	0	0	0	4,375	46,468	0	0	0	50,843	50,843
8	0	0	0	0	0	0	8,724	0	174,269	0	0	182,993	182,993
8,5	0	0	0	0	0	0	49,932	0	119,081	0	0	169,013	169,013
9	0	0	0	0	0	0	341,086	2,914	22,525	0	0	366,525	366,525
9,5	0	0	0	0	0,319	0	1474,526	5,223	5,940	0	0,319	1485,689	1486,008
10	0	0	0	0	0,188	0	1836,582	10,213	0	18,983	0,188	1865,778	1865,966
10,5	0	0	0	0	0,876	0	1668,200	11,923	8,158	169,537	0,876	1857,818	1858,694
11	0	0	0	0	0,508	0	1290,573	38,654	0	693,663	0,508	2022,890	2023,398
11,5	0	0	0	0	1,609	0	1116,552	22,262	0	633,269	1,609	1772,083	1773,692
12	0	1,053	0	0,001	5,192	0,284	880,879	40,168	0	474,388	6,246	1395,719	1401,965
12,5	0	11,296	0	0,009	6,295	3,051	427,812	12,492	0	235,403	17,60	678,758	696,358
13	1,442	192,429	0,250	0,153	11,673	51,970	309,007	0	0	133,379	205,947	494,356	700,303
13,5	15,937	499,211	2,768	0,397	4,145	134,823	28,211	0	0	36,995	522,458	200,029	722,487
14	63,098	982,102	10,958	0,781	1,643	265,238	51,561	0	0	0	1058,582	316,799	1375,381
14,5	130,944	864,463	22,740	0,688	0	233,467	35,443	0	0	30,986	1018,835	299,896	1318,731
15	173,999	406,434	30,217	0,323	0	109,766	24,779	0	0	0	610,973	134,545	745,518
15,5	149,361	139,261	25,938	0,111	0	37,611	0	0	0	0	314,671	37,611	352,282
16	96,370	102,63	16,736	0,082	0	27,717	0	0	0	0	215,818	27,717	243,535
16,5	58,326	10,112	10,129	0,008	0	2,731	0	0	0	0	78,575	2,731	81,306
17	44,372	6,358	7,706	0,005	0	1,717	0	0	0	0	58,441	1,717	60,158
17,5	19,308	3,489	3,353	0,003	0	0,942	0	0	0	0	26,153	0,942	27,095
18	2,772	0	0,481	0	0	0	0	0	0	0	3,253	0	3,253
18,5	1,464	0	0,254	0	0	0	0	0	0	0	1,718	0	1,718
19	0	0	0	0	0	0	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	757,393	3218,838	131,530	2,561	32,448	869,317	9548,242	147,765	377,575	2426,603	4142,770	13369,502	17512,272

Table 6. ECOCADIZ-RECLUTAS surveys series. Anchovy (*E. encrasicolus*). Acoustic estimates of biomass (t) and abundance (million fish) for the whole Gulf of Cadiz anchovy population and for the juvenile fraction (*i.e.* age 0 fish, between parentheses). Note that the 2012 survey only surveyed the Spanish waters. The 2017 estimates correspond to an incomplete coverage (only the seven easternmost transects) of the standard surveyed area due to a research vessels' breakdown.

Estimate/Year	Total Population (Recruits at age 0)								
	2012	2014	2015	2016	2017	2018	2019	2020	2021
Biomass (t)	13680 (13354)	8113 (5131)	30827 (29219)	19861 (15969)	7642 (7290)	10493 (3834)	48357 (36405)	36070 (21060)	17512 (12063)
Abundance (millions)	2469 (2619)	986 (814)	5227 (5117)	3667 (3445)	1492 (1433)	953 (543)	5505 (4845)	3197 (2385)	1973 (1629)

Table 7. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 11**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Sardina pilchardus</i> . ABUNDANCE (in numbers and million fish)											
Size class	POL01	POL02	POL03	POL04	POL05	n			Millions		
						PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
8	0	0	0	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0	0,0	0	0
10	0	0	0	371003	0	0	371003	371003	0,00	0	0
10,5	0	0	0	1669512	0	0	1669512	1669512	0,0	2	2
11	0	0	0	9779828	0	0	9779828	9779828	0,0	10	10
11,5	0	63241	95937	46569152	121920	159178	46691072	46850250	0,2	47	47
12	0	84321	127916	122853804	284481	212237	123138285	123350522	0	123	123
12,5	0	252964	383749	151718034	1137925	636713	152855959	153492672	1	153	153
13	0	1016070	1541390	108500302	1584966	2557460	110085268	112642728	3	110	113
13,5	0	1058231	1605348	29847214	934724	2663579	30781938	33445517	3	31	33
14	0	1226873	1861180	13805319	1300485	3088053	15105804	18193857	3	15	18
14,5	0	695650	1055308	9588810	1219205	1750958	10808015	12558973	2	11	13
15	0	274044	415728	8847975	650243	689772	9498218	10187990	1	9	10
15,5	0	2174073	3298093	12217421	812803	5472166	13030224	18502390	5	13	19
16	0	4813326	7301869	4733619	447042	12115195	5180661	17295856	12	5	17
16,5	0	38113987	57819343	3378984	487682	95933330	3866666	99799996	96	3,9	100
17	0	96855106	146930276	2389888	528322	243785382	2918210	246703592	244	2,9	247
17,5	924790	138311454	209820019	756386	162561	349056263	918947	349975210	349	0,92	350
18	2774369	148113529	224689876	1095045	0	375577774	1095045	376672819	375,6	1	376,7
18,5	12106338	137508501	208601931	0	0	358216770	0	358216770	358,22	0	358,22
19	17823220	136821379	207559559	0	0	362204158	0	362204158	362	0	362,204158
19,5	21522378	126992904	192649652	185501	0	341164934	185501	341350435	341	0	341,350435
20	15553281	61232531	92890433	0	0	169676245	0	169676245	170	0	169,676245
20,5	5464666	41658883	63196990	0	0	110320539	0	110320539	110	0	110,320539
21	2017723	3921788	5949396	0	0	11888907	0	11888907	12	0	11,888907
21,5	420359	0	0	0	0	420359	0	420359	0	0	0,420359
22	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	78607124	941188855	1427793993	528307797	9672359	2447589972	537980156	2985570128	2448	538	2986
Millions	79	941	1428	528	10	2448	538	2986			

Table 7. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>Sardina pilchardus</i> . BIOMASS (t)								
Size class	POL01	POL02	POL03	POL04	POL05	PORTUGAL	SPAIN	TOTAL
8	0	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0
10	0	0	0	2,539	0	0	2,539	2,539
10,5	0	0	0	13,523	0	0	13,523	13,523
11	0	0	0	93,050	0	0	93,050	93,050
11,5	0	0,702	1,065	516,834	1,353	1,767	518,187	519,954
12	0	1,085	1,645	1580,237	3,659	2,730	1583,896	1586,626
12,5	0	3,749	5,687	2248,472	16,864	9,436	2265,336	2274,772
13	0	17,255	26,177	1842,601	26,917	43,432	1869,518	1912,950
13,5	0	20,490	31,083	577,914	18,099	51,573	596,013	647,586
14	0	26,958	40,895	303,340	28,575	67,853	331,915	399,768
14,5	0	17,270	26,199	238,055	30,268	43,469	268,323	311,792
15	0	7,656	11,614	247,183	18,166	19,270	265,349	284,619
15,5	0	68,086	103,287	382,615	25,455	171,373	408,070	579,443
16	0	168,378	255,432	165,590	15,638	423,810	181,228	605,038
16,5	0	1484,314	2251,721	131,591	18,992	3736,035	150,583	3886,618
17	0	4185,950	6350,133	103,288	22,833	10536,083	126,121	10662,204
17,5	44,223	6614,047	10033,584	36,170	7,774	16691,854	43,944	16735,798
18	146,383	7814,854	11855,221	57,777	0	19816,458	57,777	19874,235
18,5	702,913	7983,954	12111,748	0	0	20798,615	0	20798,615
19	1135,908	8719,888	13228,168	0	0	23083,964	0	23083,964
19,5	1502,028	8862,722	13444,847	12,946	0	23809,597	12,946	23822,543
20	1185,918	4668,901	7082,775	0	0	12937,594	0	12937,594
20,5	454,259	3462,957	5253,345	0	0	9170,561	0	9170,561
21	182,480	354,681	538,055	0	0	1075,216	0	1075,216
21,5	41,280	0	0	0	0	41,280	0	41,280
22	0	0	0	0	0	0	0	0
TOTAL	5395,392	54483,897	82652,681	8553,725	234,593	142531,970	8788,318	151320,288

Table 8. ECOCADIZ-RECLUTAS surveys series. Sardine (*Sardina pilchardus*). Acoustic estimates of biomass (t) and abundance (million fish) for the whole Gulf of Cadiz anchovy population and for the juvenile fraction (*i.e.* age 0 fish, between parentheses). Note that the 2012 survey only surveyed the Spanish waters. The 2017 estimates correspond to an incomplete coverage (only the seven easternmost transects) of the standard surveyed area due to a research vessels' breakdown.

Estimate/Year	Total Population (Recruits at age 0)								
	2012	2014	2015	2016	2017	2018	2019	2020	2021
Biomass (t)	22119 (9182)	36571 (705)	30992 (8645)	35173 (21899)	12119 (8778)	20679 (15224)	36465 (7858)	208400 (49259)	151320 (12854)
Abundance (millions)	603 (359)	507 (26)	861 (509)	2379 (1940)	591 (483)	1134 (1036)	937 (384)	5451 (2454)	2986 (638)

Table 9. ECOCADIZ-RECLUTAS 2021-10 survey. Atlantic mackerel (*Scomber scombrus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (i.e., coherent or homogeneous post-strata) numbered as in **Figure 15**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Scomber scombrus</i> . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	n			Millions		
			PORTUGAL	SPAIN	TOTAL	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	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
20,5	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
21,5	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
22,5	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0
24	506504	96128	506504	96128	602632	0,506504	0,1	1
24,5	949694	180240	949694	180240	1129934	0,949694	0,2	1
25	886381	168224	886381	168224	1054605	0,886381	0,2	1
25,5	823068	156208	823068	156208	979276	0,823068	0,2	1
26	633130	120160	633130	120160	753290	0,63313	0,1	1
26,5	316565	60080	316565	60080	376645	0,316565	0,1	0,4
27	506504	96128	506504	96128	602632	0,506504	0,1	1
27,5	189939	36048	189939	36048	225987	0,2	0,04	0,2
28	0	0	0	0	0	0	0	0
28,5	126626	24032	126626	24032	150658	0,1	0,02	0,2
29	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0
31	63313	12016	63313	12016	75329	0,063313	0,01	0,1
31,5	63313	12016	63313	12016	75329	0,063313	0,01	0,1
32	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
34,5	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
35,5	63313	12016	63313	12016	75329	0,1	0,01	0,1
36	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
TOTAL n	5128350	973296	5128350	973296	6101646	5	1	6
Millions	5	1						

Table 9. ECOCADIZ-RECLUTAS 2021-10 survey. Atlantic mackerel (*Scomber scombrus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>Scomber scombrus</i> . BIOMASS (t)					
Size class	POL01	POL02	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0
14,5	0	0	0	0	0
15	0	0	0	0	0
15,5	0	0	0	0	0
16	0	0	0	0	0
16,5	0	0	0	0	0
17	0	0	0	0	0
17,5	0	0	0	0	0
18	0	0	0	0	0
18,5	0	0	0	0	0
19	0	0	0	0	0
19,5	0	0	0	0	0
20	0	0	0	0	0
20,5	0	0	0	0	0
21	0	0	0	0	0
21,5	0	0	0	0	0
22	0	0	0	0	0
22,5	0	0	0	0	0
23	0	0	0	0	0
23,5	0	0	0	0	0
24	51,881	9,846	51,881	9,846	61,727
24,5	104,047	19,747	104,047	19,747	123,794
25	103,731	19,687	103,731	19,687	123,418
25,5	102,754	19,501	102,754	19,501	122,255
26	84,216	15,983	84,216	15,983	100,199
26,5	44,810	8,504	44,810	8,504	53,314
27	76,211	14,464	76,211	14,464	90,675
27,5	30,345	5,759	30,345	5,759	36,104
28	0	0	0	0	0
28,5	22,734	4,315	22,734	4,315	27,049
29	0	0	0	0	0
29,5	0	0	0	0	0
30	0	0	0	0	0
30,5	0	0	0	0	0
31	14,964	2,840	14,964	2,840	17,804
31,5	15,768	2,993	15,768	2,993	18,761
32	0	0	0	0	0
32,5	0	0	0	0	0
33	0	0	0	0	0
33,5	0	0	0	0	0
34	0	0	0	0	0
34,5	0	0	0	0	0
35	0	0	0	0	0
35,5	23,317	4,425	23,317	4,425	27,742
36	0	0	0	0	0
36,5	0	0	0	0	0
37	0	0	0	0	0
37,5	0	0	0	0	0
38	0	0	0	0	0
TOTAL	674,778	128,064	674,778	128,064	802,842

Table 10. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 18**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Scomber colias</i> . ABUNDANCE (in numbers and million fish)											
Size class	POL01	POL02	POL03	POL04	POL05	n			Millions		
						PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0	0	0
17	0	52029	0	0	0	52029	0	52029	0,1	0	0,1
17,5	0	52029	0	0	0	52029	0	52029	0,1	0	0,1
18	339195	208116	2864	0	0	547311	2864	550175	1	0,003	1
18,5	0	52029	0	0	0	52029	0	52029	0,1	0	0,1
19	46622	1664924	394	0	0	1711546	394	1711940	2	0,0004	2
19,5	46622	5463033	394	0	0	5509655	394	5510049	6	0,0004	6
20	479249	7023899	4047	0	0	7503148	4047	7507195	8	0,004	8
20,5	1239291	5723177	10465	0	0	6962468	10465	6972933	7	0,01	7
21	1310195	4058253	11063	0	0	5368448	11063	5379511	5	0,01	5
21,5	2654696	2341300	22417	0	0	4995996	22417	5018413	5	0,02	5
22	3982044	728404	33625	0	0	4710448	33625	4744073	5	0,03	5
22,5	5279736	780433	44583	0	0	6060169	44583	6104752	6	0,04	6
23	4759739	312173	40192	0	0	5071912	40192	5112104	5	0,04	5
23,5	6635979	156087	56035	0	0	6792066	56035	6848101	7	0,1	7
24	10518954	52029	88823	16389	0	10570983	105212	10676195	11	0,1	11
24,5	9863779	156087	83291	90138	0	10019866	173429	10193295	10	0,2	10
25	3602220	0	30418	40972	0	3602220	71390	3673610	4	0,1	4
25,5	3723927	0	31445	335782	0	3723927	367227	4091154	4	0,4	4
26	1251070	0	10564	466892	0	1251070	477456	1728526	1	0,5	2
26,5	479592	0	4050	467078	0	479592	471128	950720	0,5	0,5	1
27	432969	0	3656	688139	0	432969	691795	1124764	0,4	1	1
27,5	46622	0	394	1793445	0	46622	1793839	1840461	0,05	2	2
28	0	0	0	2333714	23062	0	2356776	2356776	0	2	2
28,5	0	0	0	2153624	0	0	2153624	2153624	0	2	2
29	292229	0	2468	1981543	0	292229	1984011	2276240	0,3	2	2
29,5	0	0	0	2031081	0	0	2031081	2031081	0	2	2
30	0	0	0	630779	92249	0	723028	723028	0	1	1
30,5	0	0	0	557030	207560	0	764590	764590	0	1	1
31	0	0	0	483280	253685	0	736965	736965	0	1	1
31,5	0	0	0	73749	576556	0	650305	650305	0	1	1
32	0	0	0	204673	922490	0	1127163	1127163	0	1	1
32,5	0	0	0	40972	945552	0	986524	986524	0	1	1
33	0	0	0	0	876365	0	876365	876365	0	1	1
33,5	0	0	0	0	530432	0	530432	530432	0	1	0,5
34	0	0	0	16389	415120	0	431509	431509	0	0,4	0,4
34,5	0	0	0	0	276747	0	276747	276747	0	0,3	0,3
35	0	0	0	0	138373	0	138373	138373	0	0,1	0,1
35,5	0	0	0	0	207560	0	207560	207560	0	0,2	0,2
36	0	0	0	0	69187	0	69187	69187	0	0,1	0,1
36,5	0	0	0	0	23062	0	23062	23062	0	0,02	0,02
37	0	0	0	0	46124	0	46124	46124	0	0,05	0,05
37,5	0	0	0	0	23062	0	23062	23062	0	0,02	0,02
38	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	56984730	28824002	481188	14405669	5627186	85808732	20514043	106322775	86	21	106
Millions	57	29	0,5	14	6						

Table 10. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>Scomber colias</i> . BIOMASS (t)								
Size class	POL01	POL02	POL03	POL04	POL05	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0
17	0	1,749	0	0	0	1,749	0	1,749
17,5	0	1,937	0	0	0	1,937	0	1,937
18	13,949	8,558	0,118	0	0	22,507	0,118	22,625
18,5	0	2,357	0	0	0	2,357	0	2,357
19	2,320	82,862	0,020	0	0	85,182	0,020	85,202
19,5	2,543	298,013	0,021	0	0	300,556	0,021	300,577
20	28,589	419,009	0,241	0	0	447,598	0,241	447,839
20,5	80,670	372,545	0,681	0	0	453,215	0,681	453,896
21	92,869	287,657	0,784	0	0	380,526	0,784	381,310
21,5	204,495	180,354	1,727	0	0	384,849	1,727	386,576
22	332,726	60,863	2,810	0	0	393,589	2,810	396,399
22,5	477,662	70,606	4,033	0	0	548,268	4,033	552,301
23	465,445	30,527	3,930	0	0	495,972	3,930	499,902
23,5	700,243	16,471	5,913	0	0	716,714	5,913	722,627
24	1195,875	5,915	10,098	1,863	0	1201,79	11,961	1213,751
24,5	1206,328	19,089	10,186	11,024	0	1225,417	21,210	1246,627
25	473,224	0	3,996	5,382	0	473,224	9,378	482,602
25,5	524,763	0	4,431	47,317	0	524,763	51,748	576,511
26	188,852	0	1,595	70,479	0	188,852	72,074	260,926
26,5	77,451	0	0,654	75,430	0	77,451	76,084	153,535
27	74,711	0	0,631	118,742	0	74,711	119,373	194,084
27,5	8,586	0	0,073	330,268	0	8,586	330,341	338,927
28	0	0	0	458,111	4,527	0	462,638	462,638
28,5	0	0	0	450,144	0	0	450,144	450,144
29	64,967	0	0,549	440,528	0	64,967	441,077	506,044
29,5	0	0	0	479,768	0	0	479,768	479,768
30	0	0	0	158,153	23,129	0	181,282	181,282
30,5	0	0	0	148,098	55,184	0	203,282	203,282
31	0	0	0	136,122	71,454	0	207,576	207,576
31,5	0	0	0	21,986	171,883	0	193,869	193,869
32	0	0	0	64,525	290,824	0	355,349	355,349
32,5	0	0	0	13,648	314,961	0	328,609	328,609
33	0	0	0	0	308,175	0	308,175	308,175
33,5	0	0	0	0	196,758	0	196,758	196,758
34	0	0	0	6,408	162,302	0	168,71	168,710
34,5	0	0	0	0	113,960	0	113,96	113,960
35	0	0	0	0	59,967	0	59,967	59,967
35,5	0	0	0	0	94,600	0	94,60	94,600
36	0	0	0	0	33,140	0	33,14	33,140
36,5	0	0	0	0	11,601	0	11,601	11,601
37	0	0	0	0	24,352	0	24,352	24,352
37,5	0	0	0	0	12,771	0	12,771	12,771
38	0	0	0	0	0	0	0	0
TOTAL	6216,268	1858,512	52,491	3037,996	1949,588	8074,780	5040,075	13114,855

Table 11. *ECOCADIZ-RECLUTAS* surveys series. Chub mackerel (*Scomber colias*). Acoustic estimates of biomass (t) and abundance (million fish) for the whole Gulf of Cadiz anchovy population and for the juvenile fraction (*i.e.* age 0 fish, between parentheses). Note that the 2012 survey only surveyed the Spanish waters. The 2017 estimates correspond to an incomplete coverage (only the seven easternmost transects) of the standard surveyed area due to a research vessels' breakdown.

Estimate/Year	Total Population (Recruits at age 0)								
	2012	2014	2015	2016	2017	2018	2019	2020	2021
Biomass (t)	11155 (n.a.)	17471 (n.a.)	5683 (n.a.)	13689 (n.a.)	11726 (n.a.)	6950 (n.a.)	26212 (5265)	22918 (2759)	13115 (1689)
Abundance (millions)	157 (n.a.)	148 (n.a.)	65 (n.a.)	297 (n.a.)	86 (n.a.)	108 (n.a.)	367 (88)	295 (51)	106 (26)

Table 12. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (i.e., coherent or homogeneous post-strata) numbered as in **Figure 22**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Trachurus trachurus</i> . ABUNDANCE (in numbers and million fish)												
Size class	POL01	POL02	POL03	POL04	POL05	POL06	n			Millions		
							PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
12	0	0	0	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
13,5	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	22704	61674	118316	22704	179990	202694	0,02	0,2	0,2
16	0	0	0	22704	61674	118316	22704	179990	202694	0,02	0,2	0,2
16,5	0	0	0	22704	61674	118316	22704	179990	202694	0,02	0,2	0,2
17	0	0	0	22704	61674	118316	22704	179990	202694	0,02	0,2	0,2
17,5	83765	0	0	22704	61674	118316	106469	179990	286459	0,1	0,2	0,3
18	0	0	0	60544	164463	315509	60544	479972	540516	0,1	0,5	1
18,5	0	0	0	22704	61674	118316	22704	179990	202694	0,0	0,2	0,2
19	83765	0	0	11352	30837	59158	95117	89995	185112	0,1	0,1	0,2
19,5	614276	0	0	0	0	0	614276	0	614276	1	0	1
20	530511	0	0	0	0	0	530511	0	530511	1	0	1
20,5	1689507	0	0	0	0	0	1689507	0	1689507	2	0	2
21	1564109	0	0	0	0	0	1564109	0	1564109	2	0	2
21,5	2779946	8810	6212	0	0	0	2794968	0	2794968	3	0	3
22	4679115	8810	6212	0	0	0	4694137	0	4694137	5	0	5
22,5	9767830	0	0	0	0	0	9767830	0	9767830	10	0	10
23	12983803	0	0	0	0	0	12983803	0	12983803	13	0	13
23,5	9547948	0	0	0	0	0	9547948	0	9547948	10	0	10
24	5340010	8810	6212	0	0	0	5355032	0	5355032	5	0	5
24,5	2739310	17619	12425	0	0	0	2769354	0	2769354	3	0	3
25	1537684	35239	24849	0	0	0	1597772	0	1597772	2	0	2
25,5	1327523	26429	18637	0	0	0	1372589	0	1372589	1	0	1
26	671116	0	0	0	0	0	671116	0	671116	1	0	1
26,5	209661	17619	12425	0	0	0	239705	0	239705	0,2	0	0,2
27	125897	35239	24849	0	0	0	185985	0	185985	0,2	0	0,2
27,5	0	35239	24849	0	0	0	60088	0	60088	0,1	0	0,1
28	0	35239	24849	0	0	0	60088	0	60088	0,1	0	0,1
28,5	125897	17619	12425	0	0	0	155941	0	155941	0,2	0	0,2
29	0	0	0	0	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0	0	0	0	0
30	0	8810	6212	0	0	0	15022	0	15022	0,02	0	0,02
30,5	0	8810	6212	0	0	0	15022	0	15022	0,02	0	0,02
31	0	0	0	0	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	56401673	264292	186368	208120	565344	1084563	57060453	1649907	58710360	57	2	59
Millions	56	0,3	0,2	0,2	1	1						

Table 12. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10. <i>Trachurus trachurus</i> . BIOMASS (t)									
Size class	POL01	POL02	POL03	POL04	POL05	POL06	PORTUGAL	SPAIN	TOTAL
12	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0
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
15,5	0	0	0	0,741	2,012	3,859	0,741	5,871	6,612
16	0	0	0	0,814	2,210	4,240	0,814	6,450	7,264
16,5	0	0	0	0,891	2,422	4,645	0,891	7,067	7,958
17	0	0	0	0,974	2,646	5,076	0,974	7,722	8,696
17,5	3,916	0	0	1,062	2,884	5,532	4,978	8,416	13,394
18	0	0	0	3,078	8,36	16,039	3,078	24,399	27,477
18,5	0	0	0	1,252	3,401	6,525	1,252	9,926	11,178
19	5	0	0	0,678	1,841	3,531	5,678	5,372	11,050
19,5	39,613	0	0	0	0	0	39,613	0	39,613
20	36,887	0	0	0	0	0	36,887	0	36,887
20,5	126,427	0	0	0	0	0	126,427	0	126,427
21	125,745	0	0	0	0	0	125,745	0	125,745
21,5	239,706	0,760	0,536	0	0	0	241,002	0	241,002
22	432,049	0,813	0,574	0	0	0	433,436	0	433,436
22,5	964,348	0	0	0	0	0	964,348	0	964,348
23	1368,587	0	0	0	0	0	1368,587	0	1368,587
23,5	1073,026	0	0	0	0	0	1073,026	0	1073,026
24	638,987	1,054	0,743	0	0	0	640,784	0	640,784
24,5	348,566	2,242	1,581	0	0	0	352,389	0	352,389
25	207,812	4,762	3,358	0	0	0	215,932	0	215,932
25,5	190,324	3,789	2,672	0	0	0	196,785	0	196,785
26	101,953	0	0	0	0	0	101,953	0	101,953
26,5	33,713	2,833	1,998	0	0	0	38,544	0	38,544
27	21,405	5,991	4,225	0	0	0	31,621	0	31,621
27,5	0	6,329	4,463	0	0	0	10,792	0	10,792
28	0	6,678	4,709	0	0	0	11,387	0	11,387
28,5	25,154	3,52	2,482	0	0	0	31,156	0	31,156
29	0	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0	0
30	0	2,052	1,447	0	0	0	3,499	0	3,499
30,5	0	2,155	1,520	0	0	0	3,675	0	3,675
31	0	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
TOTAL	5983,218	42,978	30,308	9,490	25,776	49,447	6065,994	75,223	6141,217

Table 13. *ECOCADIZ-RECLUTAS 2021-10* survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 25**.

ECOCADIZ-RECLUTAS 2021-10. <i>Trachurus mediterraneus</i> . ABUNDANCE (in numbers and million fish)										
Size class	POL01	POL02	POL03	POL04	n			Millions		
					PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
4	0	0	0	0	0	0	0	0	0	0
4,5	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
5,5	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
13,5	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0	0	0	0
20	4281	154727	0	0	4281	154727	159008	0,004	0,2	0,2
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	664	24009	17583	31218	664	72810	73474	0,001	0,1	0,1
22	4946	178736	0	0	4946	178736	183682	0,005	0,2	0,2
22,5	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0	0	0
24	1546	55869	0	0	1546	55869	57415	0,002	0,1	0,1
24,5	1546	55869	17583	31218	1546	104670	106216	0,002	0,1	0,1
25	1592	57531	38698	68707	1592	164936	166528	0,002	0,2	0,2
25,5	7226	261152	197095	349935	7226	808182	815408	0,01	1	1
26	40170	1451746	123231	218793	40170	1793770	1833940	0,04	2	2
26,5	84793	3064407	296982	527280	84793	3888669	3973462	0,1	4	4
27	136444	4931068	293450	521009	136444	5745527	5881971	0,1	6	6
27,5	119786	4329029	494077	877215	119786	5700321	5820107	0,1	6	6
28	60646	2191750	531848	944276	60646	3667874	3728520	0,1	4	4
28,5	30554	1104213	594266	1055096	30554	2753575	2784129	0,03	3	3
29	49507	1789187	769797	1366744	49507	3925728	3975235	0,05	4	4
29,5	31774	1148314	1353617	2403295	31774	4905226	4937000	0,03	5	5
30	6738	243515	969346	1721036	6738	2933897	2940635	0,01	3	3
30,5	8399	303538	1164886	2068209	8399	3536633	3545032	0,01	4	4
31	8399	303538	751059	1333476	8399	2388073	2396472	0,01	2	2
31,5	464	16761	411847	731219	464	1159827	1160291	0,0005	1	1
32	0	0	381365	677099	0	1058464	1058464	0	1	1
32,5	1993	72028	159549	283273	1993	514850	516843	0,002	1	1
33	4281	154727	119699	212522	4281	486948	491229	0,004	0,5	0,5
33,5	464	16761	70332	124871	464	211964	212428	0,0005	0,2	0,2
34	664	24009	52749	93654	664	170412	171076	0,001	0,2	0,2
34,5	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0	0	0	0
36	9633	348135	0	0	9633	348135	357768	0,01	0,3	0,4
36,5	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0	0	0
38	0	0	17583	31218	0	48801	48801	0	0,05	0,05
38,5	0	0	0	0	0	0	0	0	0	0
39	0	0	35166	62436	0	97602	97602	0	0,1	0,1
39,5	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
40,5	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0
41,5	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0
42,5	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0
43,5	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0
44,5	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0
45,5	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0
46,5	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0
47,5	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0
48,5	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0
49,5	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0
TOTAL n	616510	22280619	8861808	15733799	616510	46876226	47492736			
Millions	1	22	9	16				0,6	47	47

Table 13. *ECOCADIZ-RECLUTAS 2021-10* survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10. <i>Trachurus mediterraneus</i> . BIOMASS (t)							
Size class	POL01	POL02	POL03	POL04	PORTUGAL	SPAIN	TOTAL
4	0	0	0	0	0	0	0
4,5	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
5,5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
10,5	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
11,5	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
12,5	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
13,5	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0
20	0,372	13,439	0	0	0	13,439	13,811
20,5	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
21,5	0,068	2,473	1,811	3,216	0,068	7,500	7,568
22	0,538	19,437	0	0	0,538	19,437	19,975
22,5	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0
24	0,206	7,461	0	0	0,206	7,461	7,667
24,5	0,217	7,834	2,465	4,377	0,217	14,676	14,893
25	0,234	8,461	5,691	10,105	0,234	24,257	24,491
25,5	1,114	40,248	30,375	53,931	1,114	124,554	125,668
26	6,482	234,245	19,884	35,303	6,482	289,432	295,914
26,5	14,312	517,230	50,126	88,998	14,312	656,354	670,666
27	24,071	869,906	51,768	91,913	24,071	1013,587	1037,658
27,5	22,069	797,567	91,027	161,615	22,069	1050,209	1072,278
28	11,660	421,382	102,252	181,545	11,660	705,179	716,839
28,5	6,125	221,372	119,138	211,525	6,125	552,035	558,160
29	10,342	373,762	160,811	285,514	10,342	820,087	830,429
29,5	6,912	249,786	294,444	522,775	6,912	1067,005	1073,917
30	1,525	55,120	219,412	389,558	1,525	664,090	665,615
30,5	1,977	71,448	274,194	486,820	1,977	832,462	834,439
31	2,055	74,251	183,724	326,195	2,055	584,170	586,225
31,5	0,118	4,258	104,636	185,777	0,118	294,671	294,789
32	0,000	0,000	100,573	178,563	0	279,136	279,136
32,5	0,545	19,705	43,649	77,498	0,545	140,852	141,397
33	1,214	43,889	33,953	60,283	1,214	138,125	139,339
33,5	0,136	4,927	20,673	36,705	0,136	62,305	62,441
34	0,202	7,309	16,059	28,512	0,202	51,880	52,082
34,5	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0
36	3,358	121,359	0	0	3,358	121,359	124,717
36,5	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0
38	0	0	6,968	12,371	0	19,339	19,339
38,5	0	0	0	0	0	0	0
39	0	0	14,820	26,313	0	41,133	41,133
39,5	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0
40,5	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0
41,5	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0
42,5	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0
43,5	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0
44,5	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0
45,5	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0
46,5	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0
47,5	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0
48,5	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0
49,5	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0
TOTAL	115,852	4186,869	1948,453	3459,412	115,852	9594,734	9710,586

Table 14. ECOCADIZ-RECLUTAS 2021-10 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 28**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Trachurus picturatus</i> . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	n			Millions		
			PORTUGAL	SPAIN	TOTAL	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	170332	0	170332	0	170332	0,2	0	0,2
16	3917647	7573	3925220	0	3925220	4	0	4
16,5	8403070	34077	8437147	0	8437147	8	0	8
17	13853709	126842	13980551	0	13980551	14	0	14
17,5	9425064	160919	9585983	0	9585983	10	0	10
18	7381075	213928	7595003	0	7595003	8	0	8
18,5	4428645	187424	4616069	0	4616069	5	0	5
19	1873657	153347	2027004	0	2027004	2	0	2
19,5	2043990	53009	2096999	0	2096999	2	0	2
20	681330	26504	707834	0	707834	1	0	1
20,5	340665	0	340665	0	340665	0,3	0	0,3
21	0	0	0	0	0	0	0	0
21,5	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
22,5	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
23,5	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
24,5	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
25,5	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
26,5	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
27,5	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
28,5	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
34,5	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
35,5	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0
36,5	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
37,5	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
TOTAL n	52519184	963623	53482807	0	53482807	53	0	53
Millions	53	1				53	0	53

Table 14. ECOCADIZ-RECLUTAS 2021-10 survey. Blue Jack mackerel (*Trachurus picturatus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>Trachurus picturatus</i> . BIOMASS (t)					
Size class	POL01	POL02	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0
14,5	0	0	0	0	0
15	0	0	0	0	0
15,5	4,901	0	4,901	0	4,901
16	124,333	0,240	124,573	0	124,573
16,5	293,249	1,189	294,438	0	294,438
17	530,140	4,854	534,994	0	534,994
17,5	394,449	6,735	401,184	0	401,184
18	336,999	9,767	346,766	0	346,766
18,5	220,069	9,314	229,383	0	229,383
19	101,109	8,275	109,384	0	109,384
19,5	119,529	3,100	122,629	0	122,629
20	43,090	1,676	44,766	0	44,766
20,5	23,256	0	23,256	0	23,256
21	0	0	0	0	0
21,5	0	0	0	0	0
22	0	0	0	0	0
22,5	0	0	0	0	0
23	0	0	0	0	0
23,5	0	0	0	0	0
24	0	0	0	0	0
24,5	0	0	0	0	0
25	0	0	0	0	0
25,5	0	0	0	0	0
26	0	0	0	0	0
26,5	0	0	0	0	0
27	0	0	0	0	0
27,5	0	0	0	0	0
28	0	0	0	0	0
28,5	0	0	0	0	0
29	0	0	0	0	0
29,5	0	0	0	0	0
30	0	0	0	0	0
30,5	0	0	0	0	0
31	0	0	0	0	0
31,5	0	0	0	0	0
32	0	0	0	0	0
32,5	0	0	0	0	0
33	0	0	0	0	0
33,5	0	0	0	0	0
34	0	0	0	0	0
34,5	0	0	0	0	0
35	0	0	0	0	0
35,5	0	0	0	0	0
36	0	0	0	0	0
36,5	0	0	0	0	0
37	0	0	0	0	0
37,5	0	0	0	0	0
38	0	0	0	0	0
TOTAL	2191,124	45,150	2236,274	0	2236,274

Table 15. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 31**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Boops boops</i> . ABUNDANCE (in numbers and million fish)											
Size class	POL01	POL02	POL03	POL04	POL05	n			Millions		
						PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
18,5	118198	18853	16907	36452	3423	137051	56782	193833	0,1	0,1	0,2
19	59099	9426	8453	18226	1712	68525	28391	96916	0,1	0,03	0,1
19,5	118198	18853	16907	36452	3423	137051	56782	193833	0,1	0,1	0,2
20	59099	9426	8453	18226	1712	68525	28391	96916	0,1	0,03	0,1
20,5	177297	28279	25360	54678	5135	205576	85173	290749	0,2	0,1	0,3
21	295495	47132	42267	91130	8558	342627	141955	484582	0,3	0,1	0,5
21,5	59099	9426	8453	18226	1712	68525	28391	96916	0,1	0,03	0,1
22	413692	65985	59173	127582	11981	479677	198736	678413	0,5	0,2	1
22,5	118198	18853	16907	36452	3423	137051	56782	193833	0,1	0,1	0,2
23	531890	84838	76080	164034	15404	616728	255518	872246	1	0,3	1
23,5	59099	9426	8453	18226	1712	68525	28391	96916	0,1	0,03	0,1
24	0	0	0	0	0	0	0	0	0	0	0
24,5	177297	28279	25360	54678	5135	205576	85173	290749	0,2	0,1	0,3
25	118198	18853	16907	36452	3423	137051	56782	193833	0,1	0,1	0,2
25,5	0	0	0	0	0	0	0	0	0	0	0
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
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
29,5	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0
34,5	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0
TOTAL n	2304859	367629	329680	710814	66753	2672488	1107247	3779735	3	1	4
Millions	2	0,4	0,3	1	0,1						

Table 15. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>Boops boops</i> . BIOMASS (t)								
Size class	POL01	POL02	POL03	POL04	POL05	PORTUGAL	SPAIN	TOTAL
14	0	0	0	0	0	0	0	0
14,5	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
18,5	7,433	1,186	1,063	2,292	0,215	8,619	3,570	12,189
19	4,037	0,644	0,577	1,245	0,117	4,681	1,939	6,620
19,5	8,752	1,396	1,252	2,699	0,253	10,148	4,204	14,352
20	4,734	0,755	0,677	1,460	0,137	5,489	2,274	7,763
20,5	15,334	2,446	2,193	4,729	0,444	17,780	7,366	25,146
21	27,543	4,393	3,940	8,494	0,798	31,936	13,232	45,168
21,5	5,926	0,945	0,848	1,828	0,172	6,871	2,848	9,719
22	44,559	7,107	6,374	13,742	1,290	51,666	21,406	73,072
22,5	13,653	2,178	1,953	4,210	0,395	15,831	6,558	22,389
23	65,783	10,493	9,409	20,287	1,905	76,276	31,601	107,877
23,5	7,815	1,246	1,118	2,410	0,226	9,061	3,754	12,815
24	0	0	0	0	0	0	0	0
24,5	26,691	4,257	3,818	8,232	0,773	30,948	12,823	43,771
25	18,949	3,022	2,711	5,844	0,549	21,971	9,104	31,075
25,5	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
26,5	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
27,5	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
28,5	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
29,5	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
30,5	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
31,5	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
32,5	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
33,5	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
34,5	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
TOTAL	251,209	40,068	35,933	77,472	7,274	291,277	120,679	411,956

Table 16. ECOCADIZ-RECLUTAS 2021-10 survey. Boarfish (*Capros aper*). 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-RECLUTAS 2021-10 . <i>Capros aper</i> . ABUNDANCE (in numbers and million fish)							
Size class	POL01	n			Millions		
		PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
4		0	0	0	0	0	0
4,5		0	0	0	0	0	0
5	81515	81515	0	81515	0,1	0	0,1
5,5	570602	570602	0	570602	1	0	1
6	1548776	1548776	0	1548776	2	0	2
6,5	2608464	2608464	0	2608464	3	0	3
7	2445435	2445435	0	2445435	2	0	2
7,5	2363921	2363921	0	2363921	2	0	2
8	652116	652116	0	652116	1	0	1
8,5	163029	163029	0	163029	0,2	0	0,2
9	81515	81515	0	81515	0,1	0	0,1
9,5	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
TOTAL n	10515373	10515373	0	10515373	11	0	11
Millions	11						

ECOCADIZ-RECLUTAS 2021-10 . <i>Capros aper</i> . BIOMASS (t)				
Size class	POL01	PORTUGAL	SPAIN	TOTAL
4		0	0	0
4,5		0	0	0
5	0,063	0,063	0	0,063
5,5	0,582	0,582	0	0,582
6	2,030	2,030	0	2,030
6,5	4,311	4,311	0	4,311
7	5,014	5,014	0	5,014
7,5	5,926	5,926	0	5,926
8	1,974	1,974	0	1,974
8,5	0,589	0,589	0	0,589
9	0,348	0,348	0	0,348
9,5	0	0	0	0
10	0	0	0	0
TOTAL	20,837	20,837	0	20,837

Table 17. ECOCADIZ-RECLUTAS 2021-10 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 37**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Macroramphosus scolopax</i> . ABUNDANCE (in numbers and million fish)							
Size class	POL01	n			Millions		
		PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
5	0	0	0	0	0	0	0
5,5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
6,5	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
7,5	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
8,5	0	0	0	0	0	0	0
9	217676774	217676774	0	217676774	218	0	218
9,5	217676774	217676774	0	217676774	218	0	218
10	163257581	163257581	0	163257581	163	0	163
10,5	108838387	108838387	0	108838387	109	0	109
11	217676774	217676774	0	217676774	218	0	218
11,5	327842459	327842459	0	327842459	328	0	328
12	491100039	491100039	0	491100039	491	0	491
12,5	327842459	327842459	0	327842459	328	0	328
13	327842459	327842459	0	327842459	328	0	328
13,5	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
14,5	54419194	54419194	0	54419194	54	0	54
15	0	0	0	0	0	0	0
15,5	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
16,5	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
17,5	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
18,5	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
19,5	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
TOTAL n	2454172900	2454172900	0	2454172900	2454	0	2454
Millions	2454				2454	0	2454

Table 17. ECOCADIZ-RECLUTAS 2021-10 survey. Longspine snipefish (*Macroramphosus scolopax*).
Cont'd.

ECOCADIZ-RECLUTAS 2021-10 . <i>M. scolopax</i> . BIOMASS (t)				
Size class	POL01	PORTUGAL	SPAIN	TOTAL
5	0	0	0	0
5,5	0	0	0	0
6	0	0	0	0
6,5	0	0	0	0
7	0	0	0	0
7,5	0	0	0	0
8	0	0	0	0
8,5	0	0	0	0
9	3449,235	3449,235	0	3449,235
9,5	4009,003	4009,003	0	4009,003
10	3468,520	3468,520	0	3468,520
10,5	2649,376	2649,376	0	2649,376
11	6033,614	6033,614	0	6033,614
11,5	10289,195	10289,195	0	10289,195
12	17361,542	17361,542	0	17361,542
12,5	12993,226	12993,226	0	12993,226
13	14502,438	14502,438	0	14502,438
13,5	0	0	0	0
14	0	0	0	0
14,5	3270,276	3270,276	0	3270,276
15	0	0	0	0
15,5	0	0	0	0
16	0	0	0	0
16,5	0	0	0	0
17	0	0	0	0
17,5	0	0	0	0
18	0	0	0	0
18,5	0	0	0	0
19	0	0	0	0
19,5	0	0	0	0
20	0	0	0	0
TOTAL	78026,425	78026,425	0	78026,425

Table 18. ECOCADIZ-RECLUTAS 2021-10 survey. Pearlside (*Maurolicus muelleri*). Estimated abundance (absolute numbers and million fish) and biomass (t) by size class (in cm). Polygons (*i.e.*, coherent or homogeneous post-strata) numbered as in **Figure 40**.

ECOCADIZ-RECLUTAS 2021-10 . <i>Maurolicus muelleri</i> . ABUNDANCE (in numbers and million fish)								
Size class	POL01	POL02	n			Millions		
			PORTUGAL	SPAIN	TOTAL	PORTUGAL	SPAIN	TOTAL
1	0	0	0	0	0	0	0	0
1,5	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
2,5	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
3,5	19445714	16794850	19445714	16794850	36240564	19	17	36
4	144627500	124911698	144627500	124911698	269539198	145	125	270
4,5	446036073	385231876	446036073	385231876	831267949	446	385	831
5	321461965	277639867	321461965	277639867	599101832	321	278	599
5,5	91759465	79250699	91759465	79250699	171010164	92	79	171
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	0	0	0	0
9	0	0	0	0	0	0	0	0
9,5	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
TOTAL n	1023330717	883828990	1023330717	883828990	1907159707	1023	884	1907
Millions	1023	884						

ECOCADIZ-RECLUTAS 2021-10 . <i>Maurolicus muelleri</i> . BIOMASS (t)					
Size class	POL01	POL02	PORTUGAL	SPAIN	TOTAL
1	0	0	0	0	0
1,5	0	0	0	0	0
2	0	0	0	0	0
2,5	0	0	0	0	0
3	0	0	0	0	0
3,5	11,604	10,022	11,604	10,022	21,626
4	112,055	96,780	112,055	96,780	208,835
4,5	435,837	376,423	435,837	376,423	812,260
5	387,045	334,283	387,045	334,283	721,328
5,5	133,569	115,361	133,569	115,361	248,930
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
8,5	0	0	0	0	0
9	0	0	0	0	0
9,5	0	0	0	0	0
10	0	0	0	0	0
TOTAL	1080,110	932,869	1080,110	932,869	2012,979

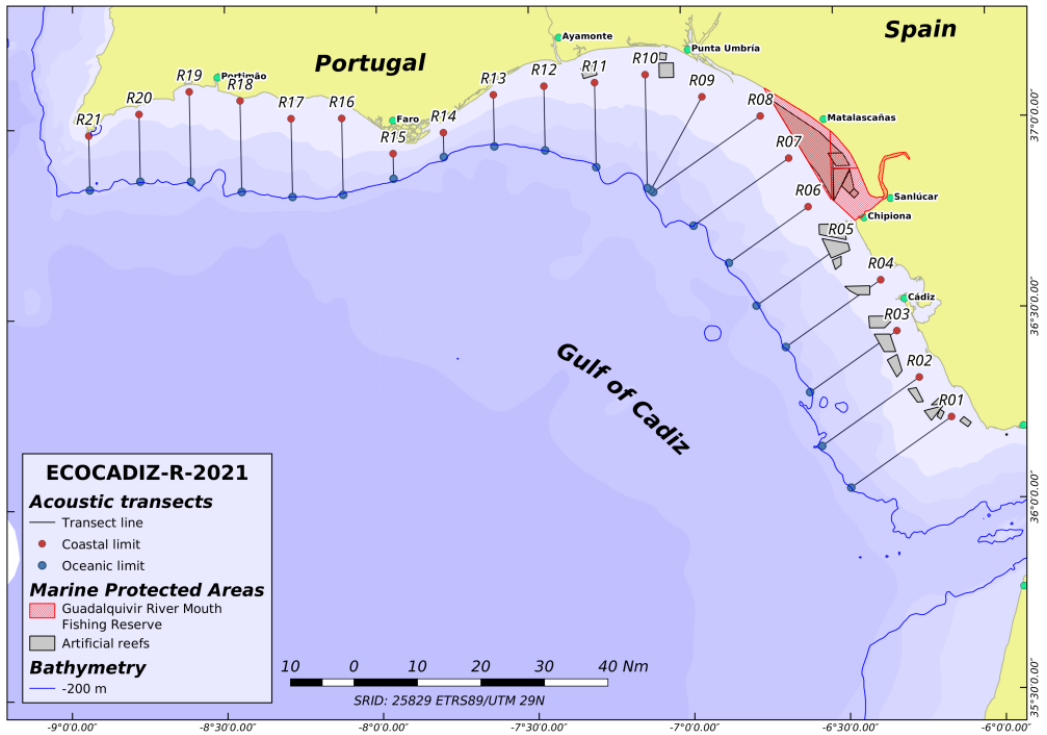


Figure 1. ECOCADIZ-RECLUTAS 2021-10 survey. Location of the acoustic transects sampled during the survey. The different protected areas inside the Guadalquivir river mouth Fishing Reserve and artificial reef polygons are also shown.

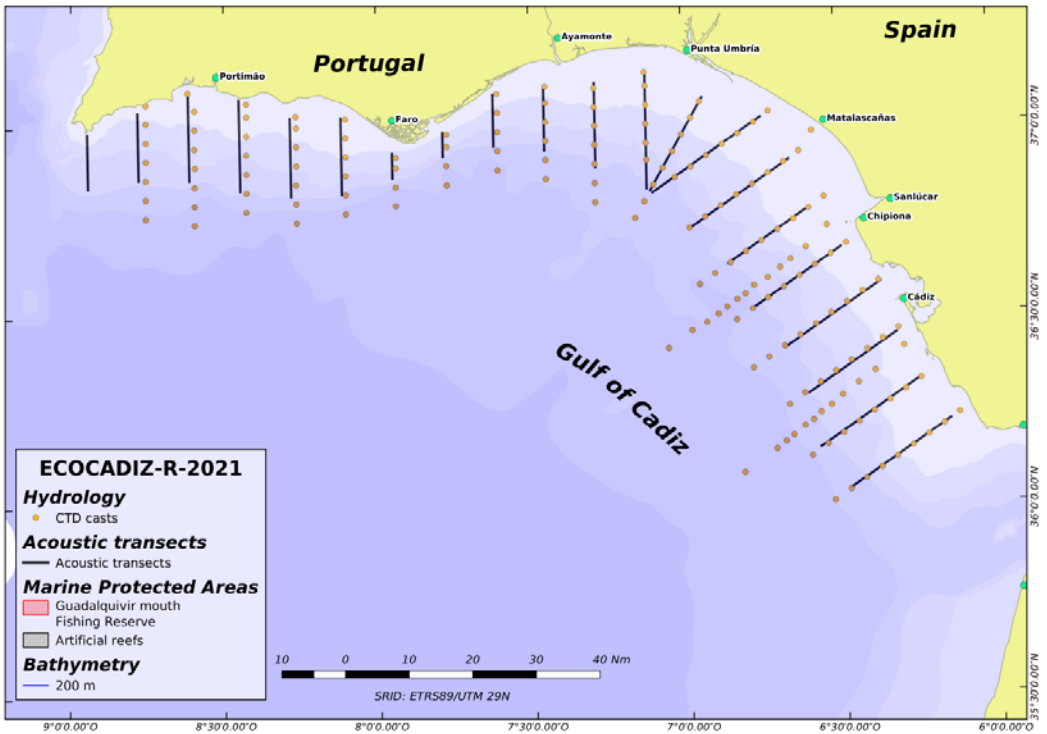


Figure 2. ECOCADIZ-RECLUTAS 2021-10 survey. Location of CTD stations.

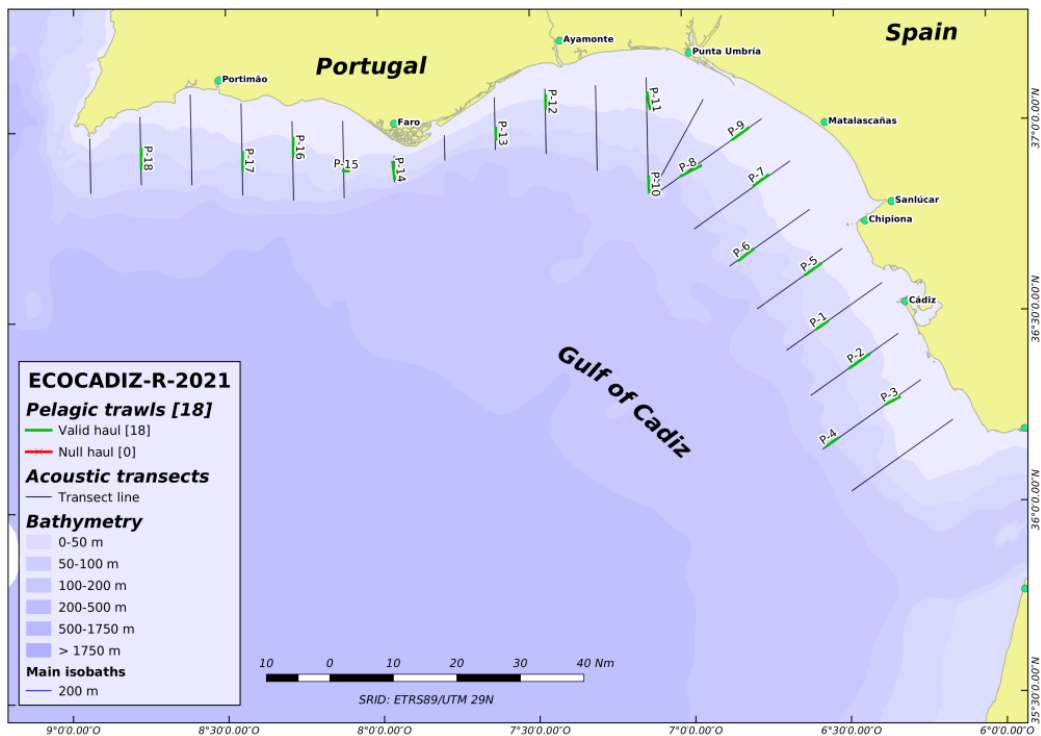


Figure 3. ECOCADIZ-RECLUTAS 2021-10 survey. Location of ground-truthing fishing hauls.

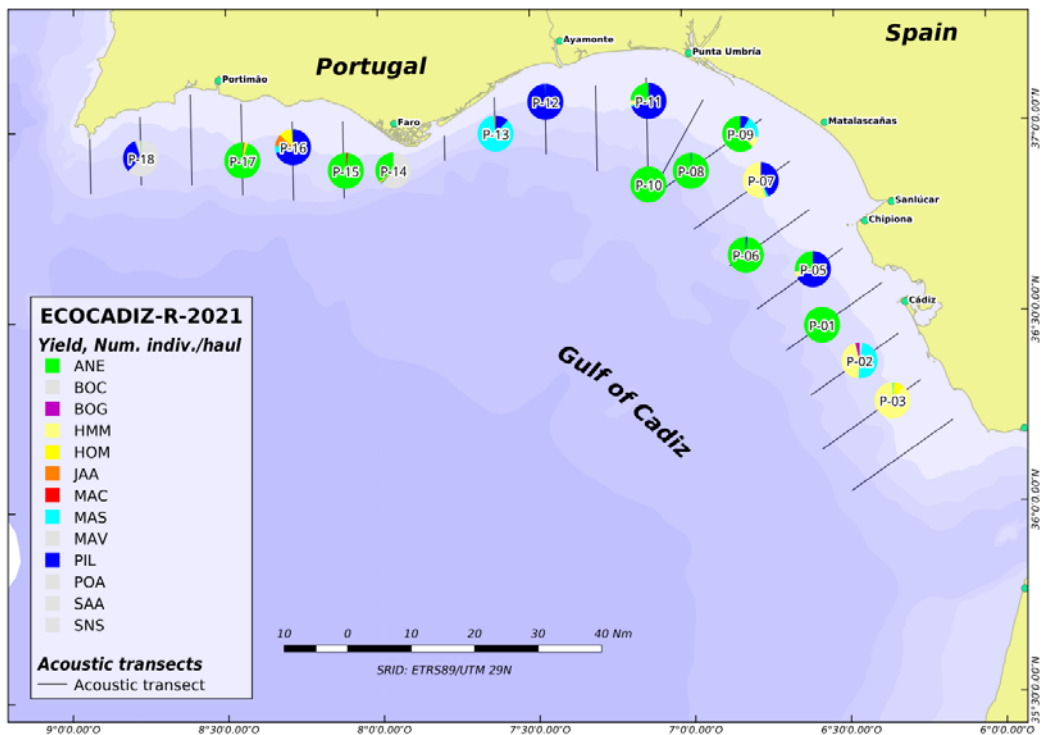


Figure 4. ECOCADIZ-RECLUTAS 2021-10 survey. Species composition (percentages in number) in valid fishing hauls.

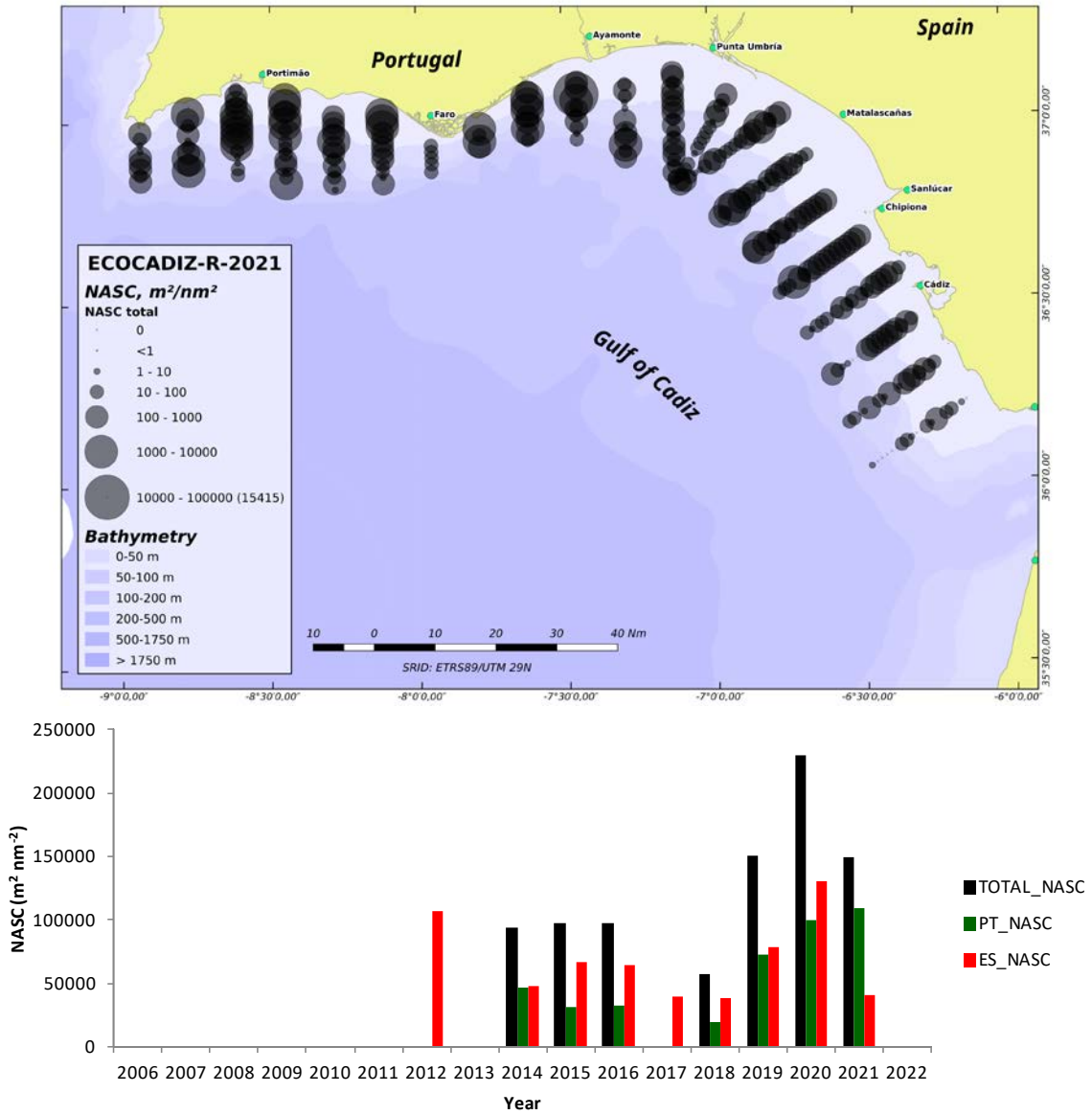


Figure 5. ECOCADIZ-RECLUTAS 2021-10 survey. Distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nm^{-2}$) attributed to the pelagic fish species assemblage.

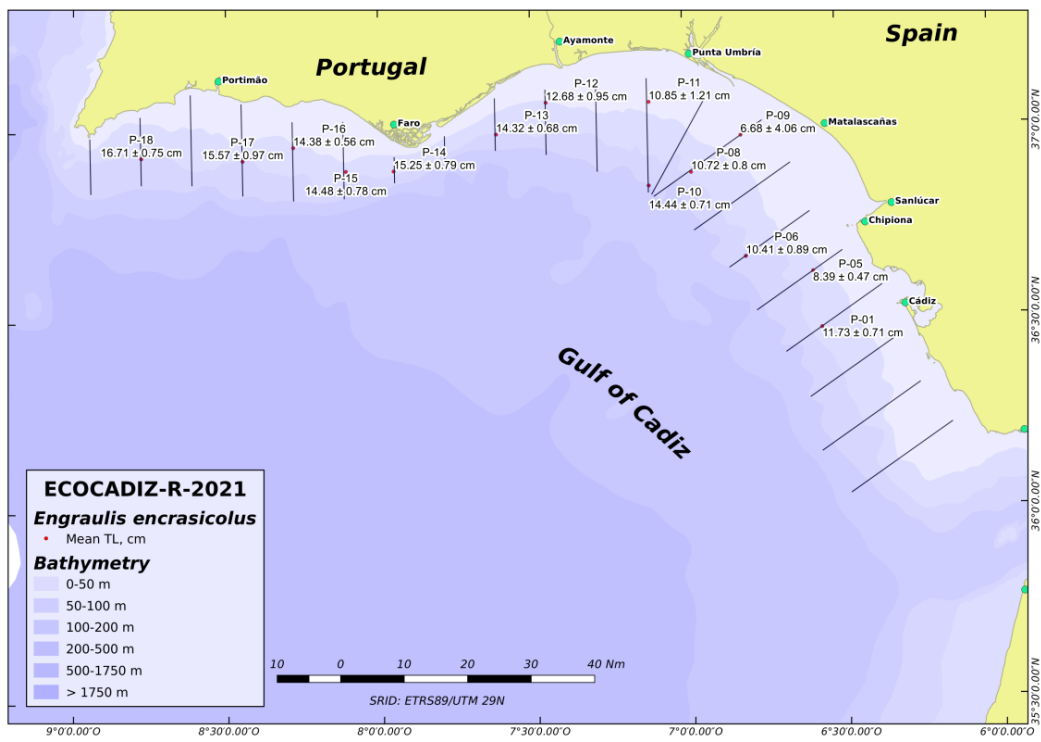
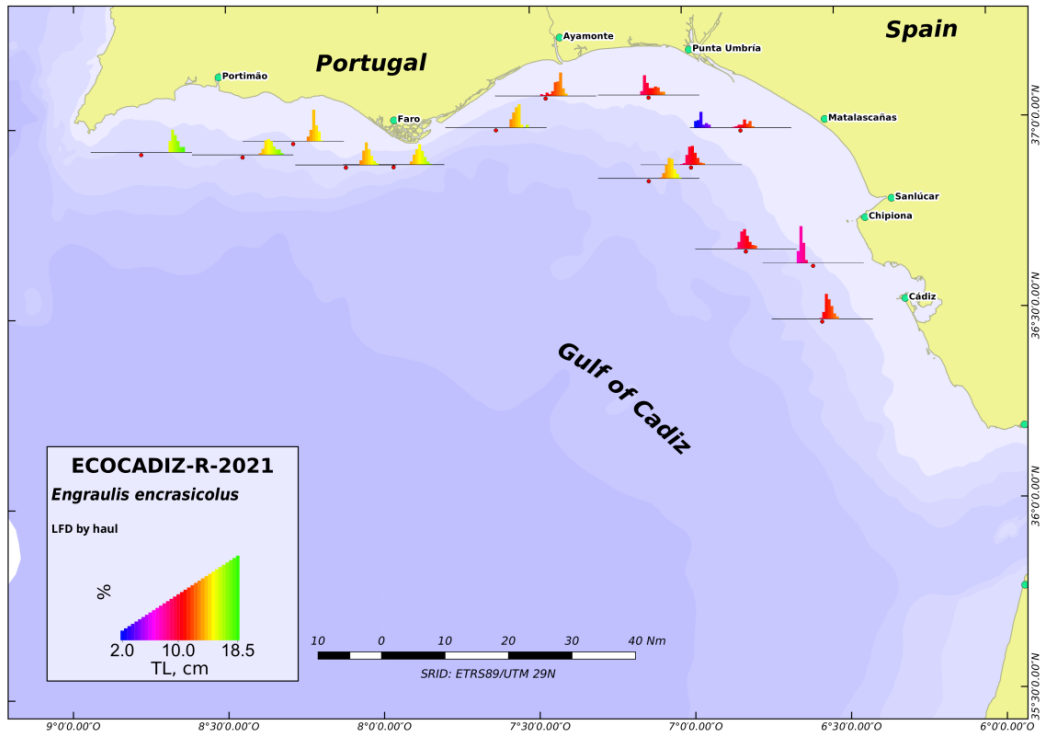


Figure 6. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

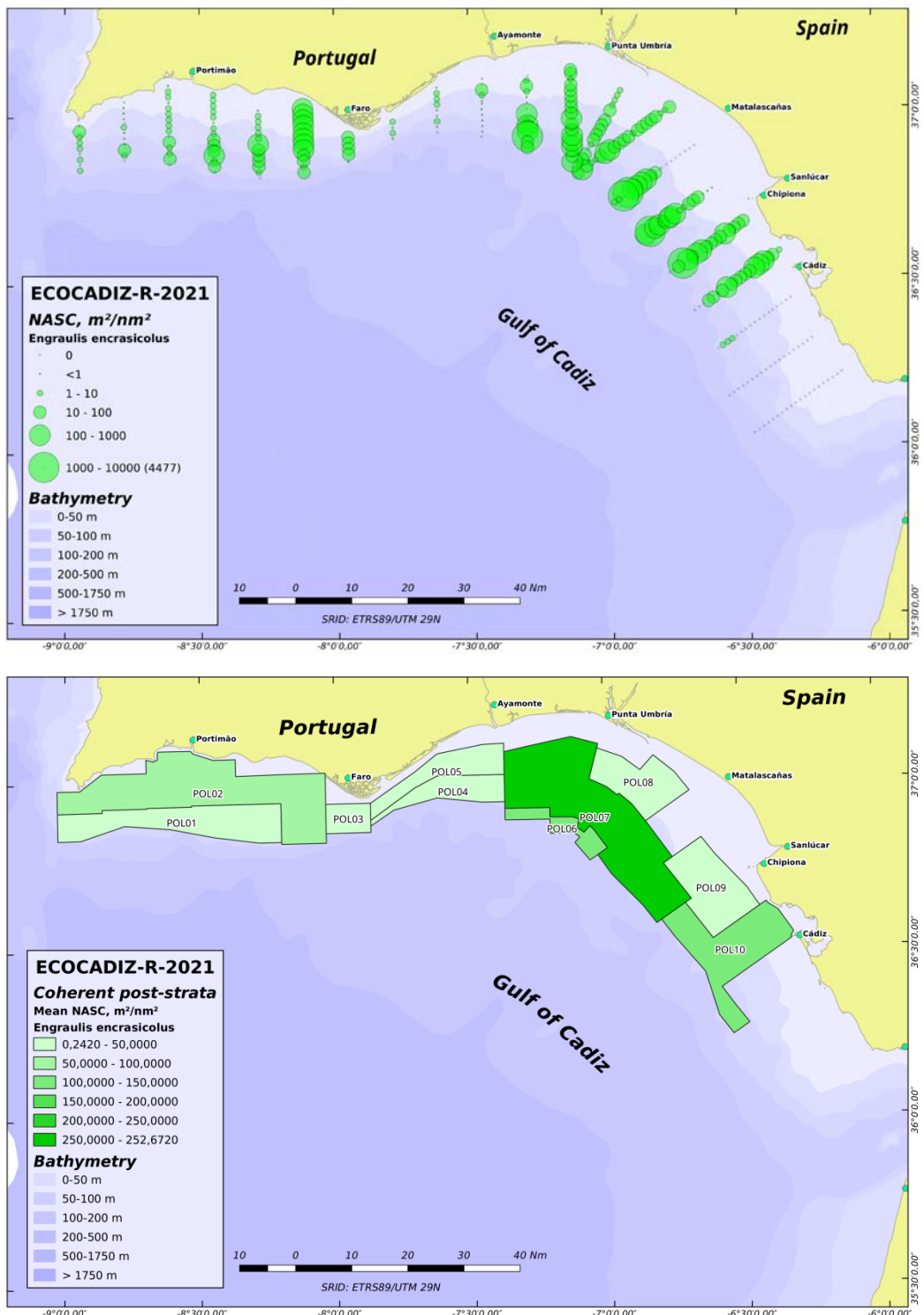


Figure 7. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Anchovy (*E. encrasicolus*)

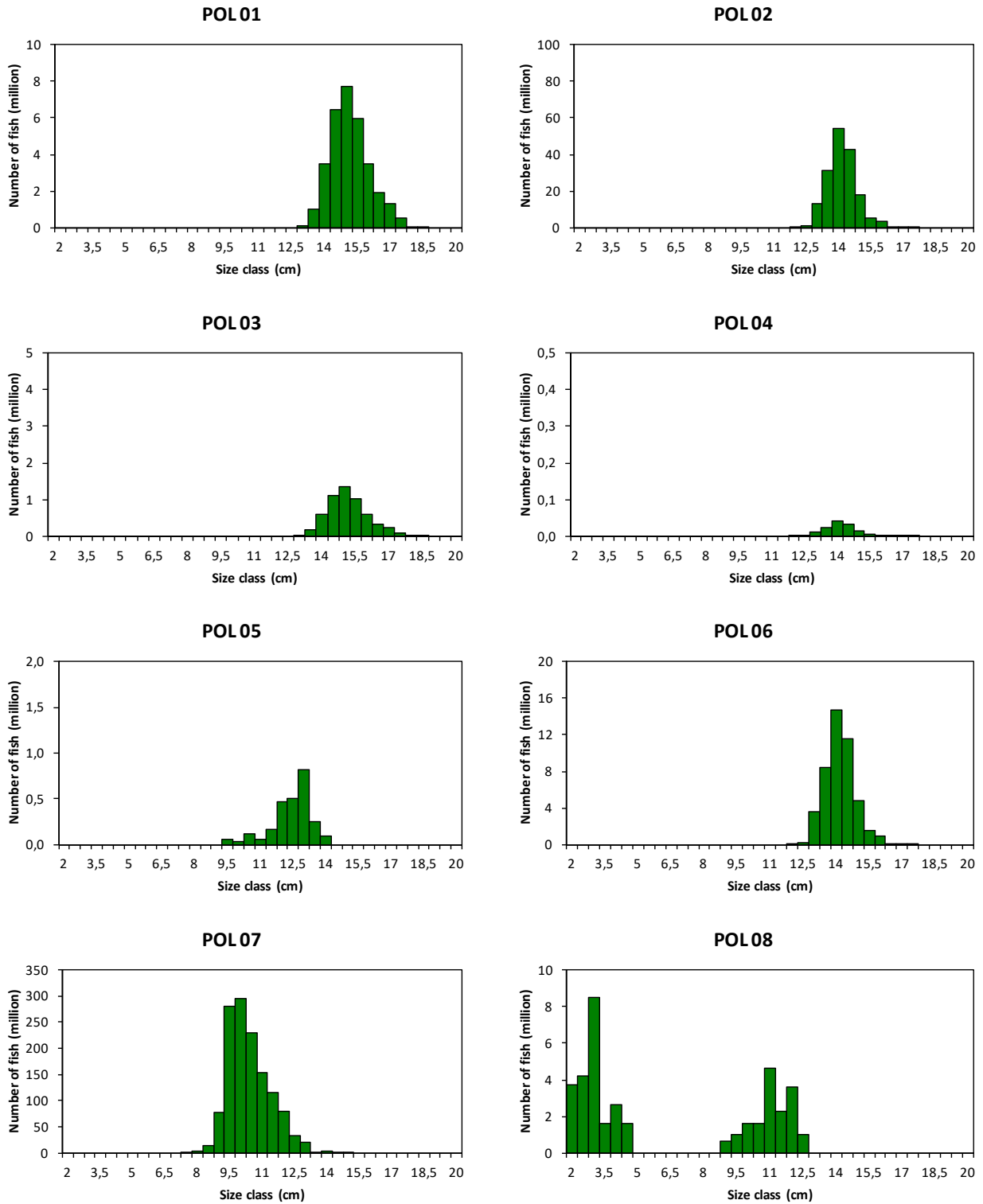


Figure 8. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 7**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Anchovy (*E. encrasicolus*)

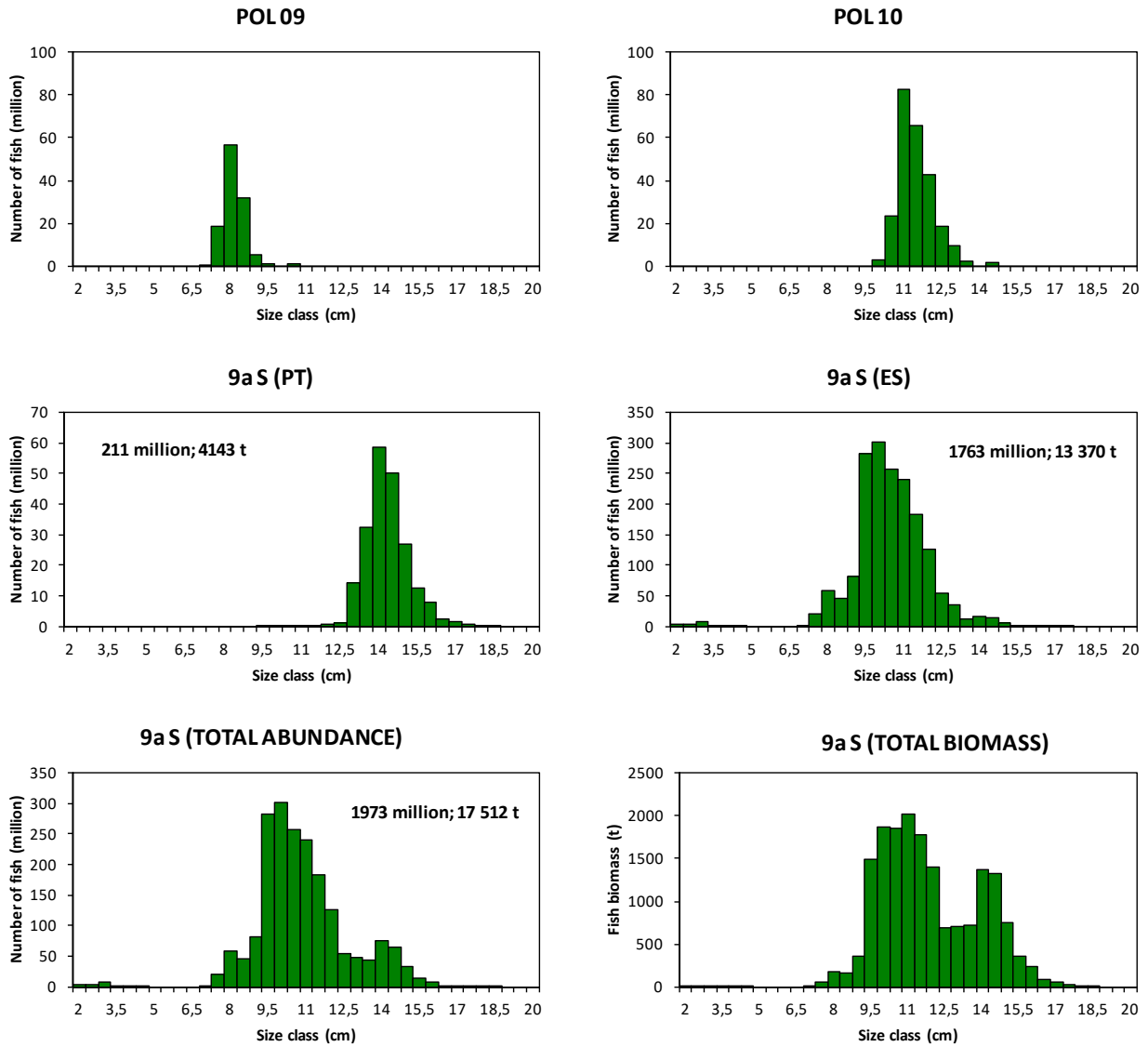


Figure 8. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10: Anchovy (*E. encrasicolus*)

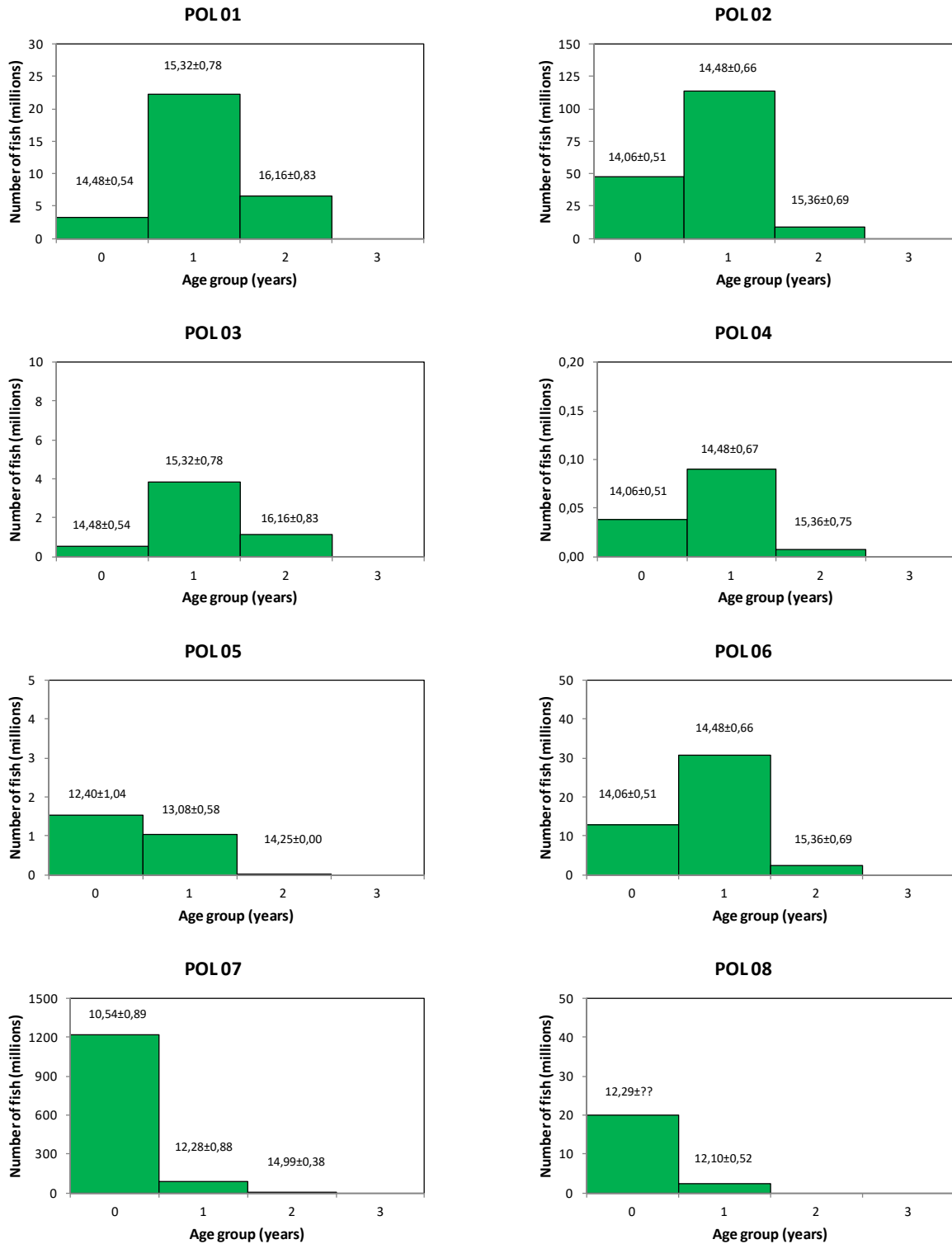


Figure 9. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 7**) and total sampled area. Post-strata ordered in the W-E direction. Mean (\pm SD) sizes of age groups are also shown. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Anchovy (*E. encrasicolus*)

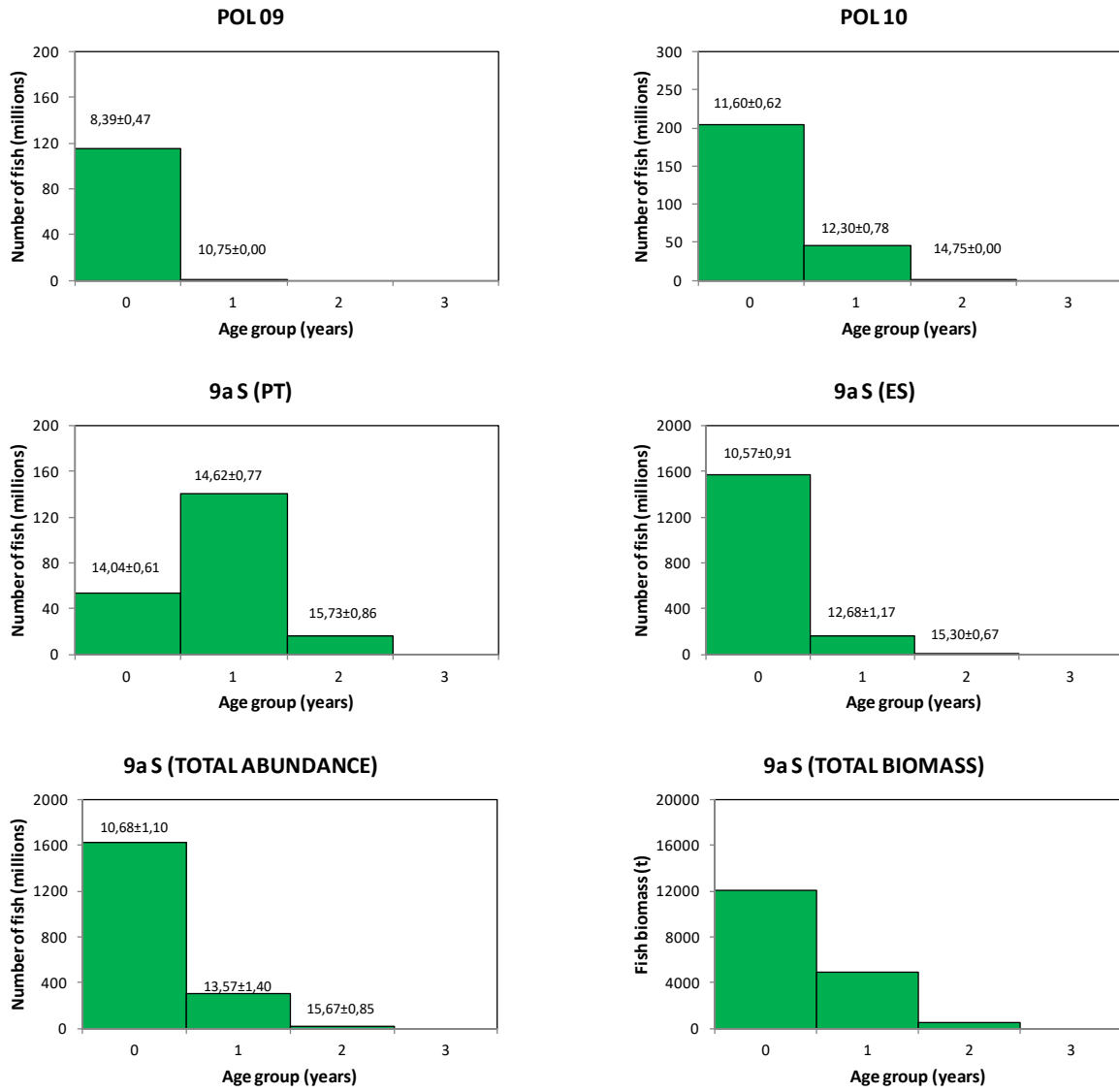


Figure 9. ECOCADIZ-RECLUTAS 2021-10 survey. Anchovy (*Engraulis encrasicolus*). Cont'd.

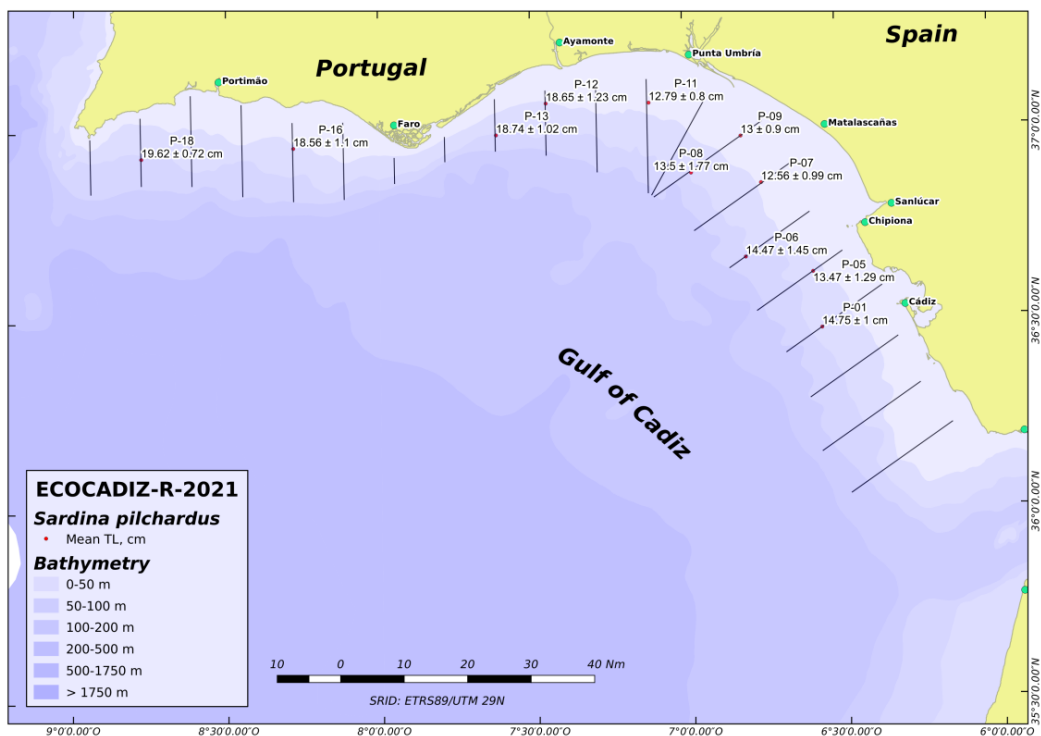
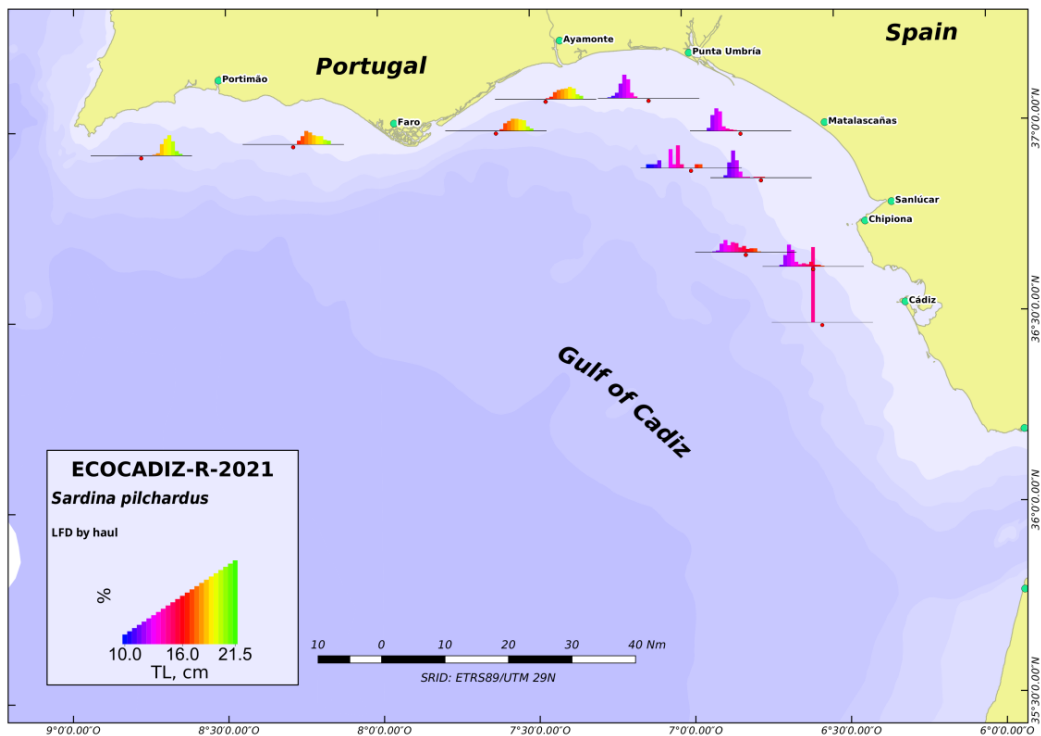


Figure 10. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

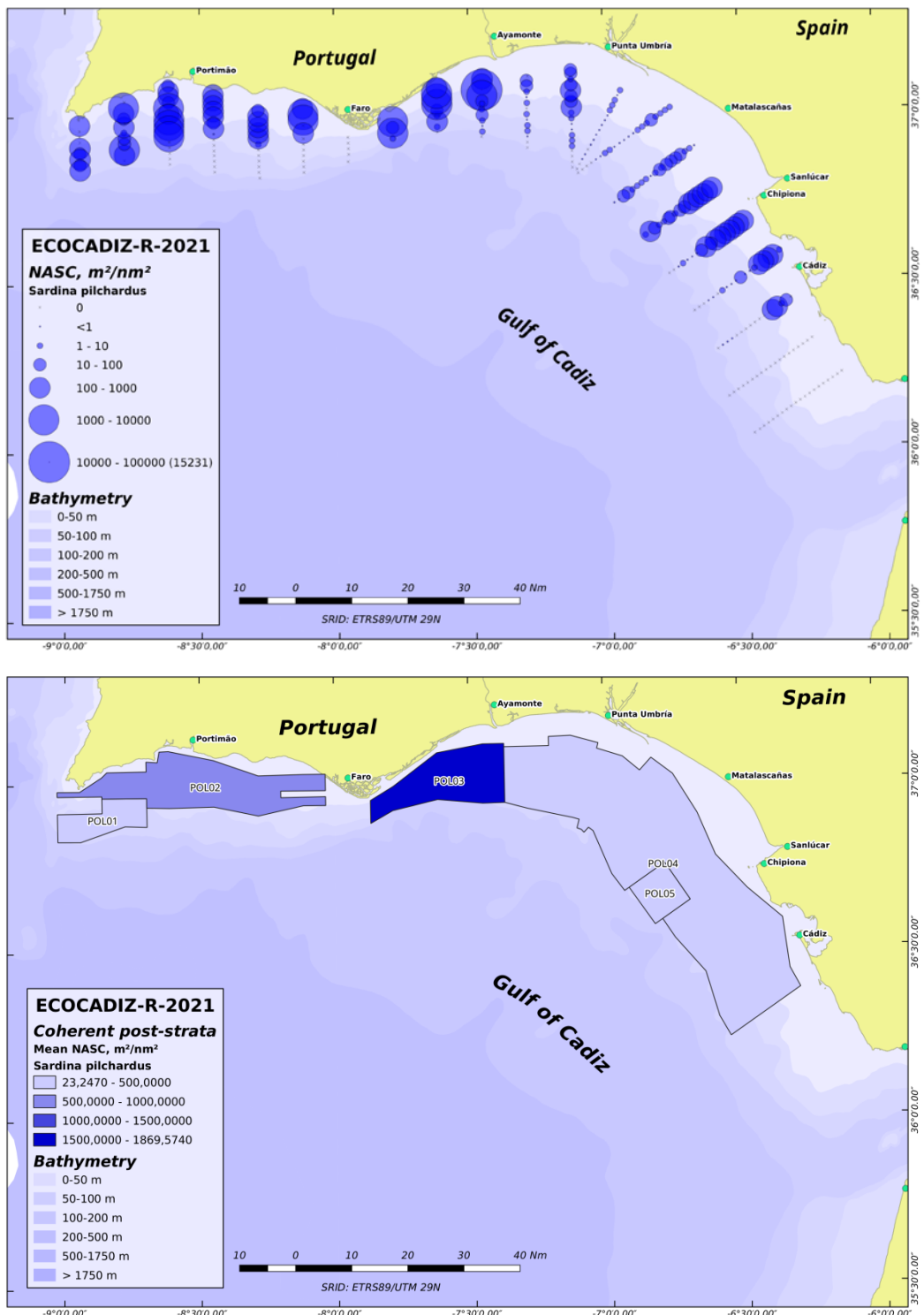


Figure 11. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Sardine (*S. pilchardus*)

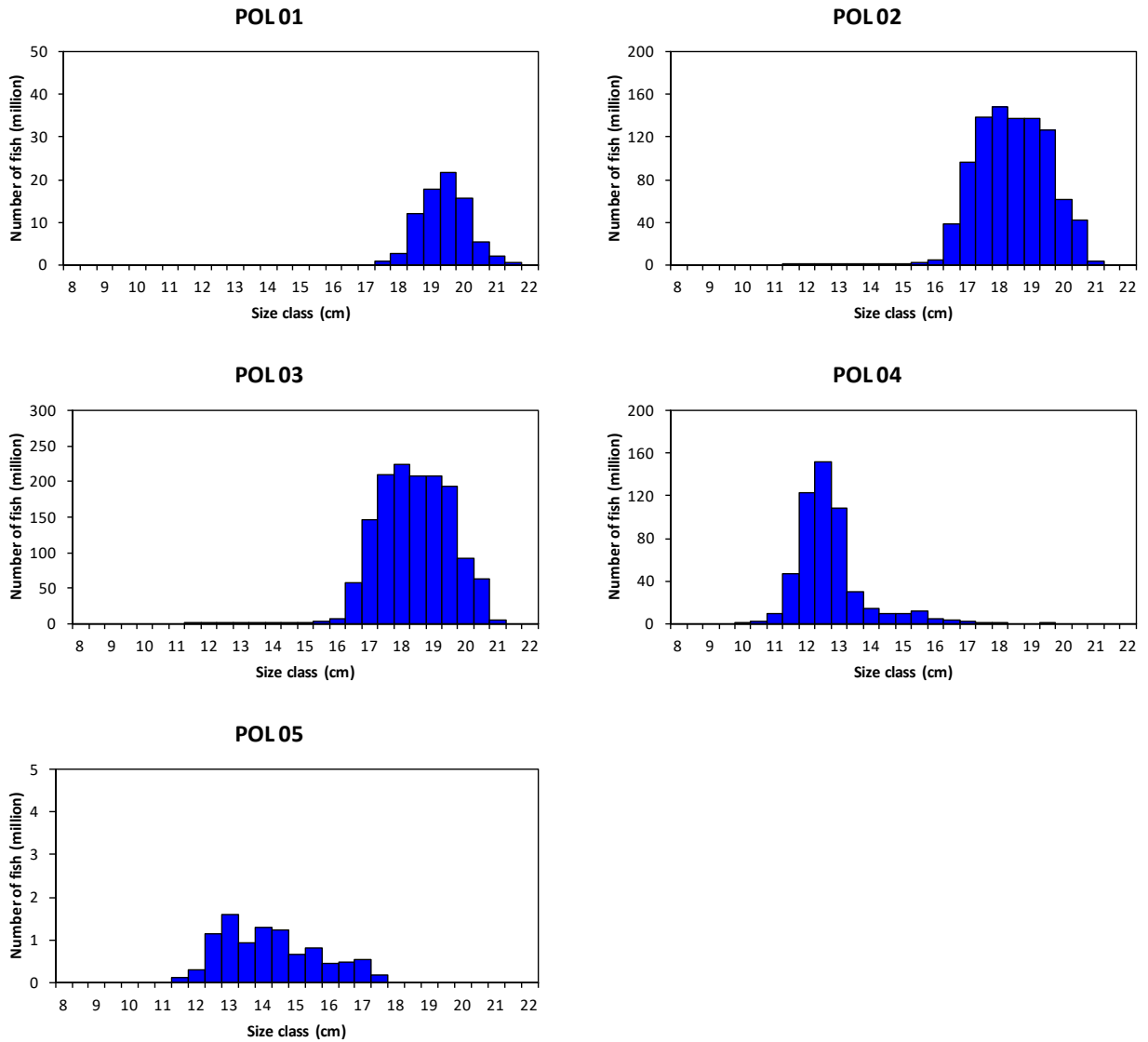


Figure 12. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 11**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Sardine (*S. pilchardus*)

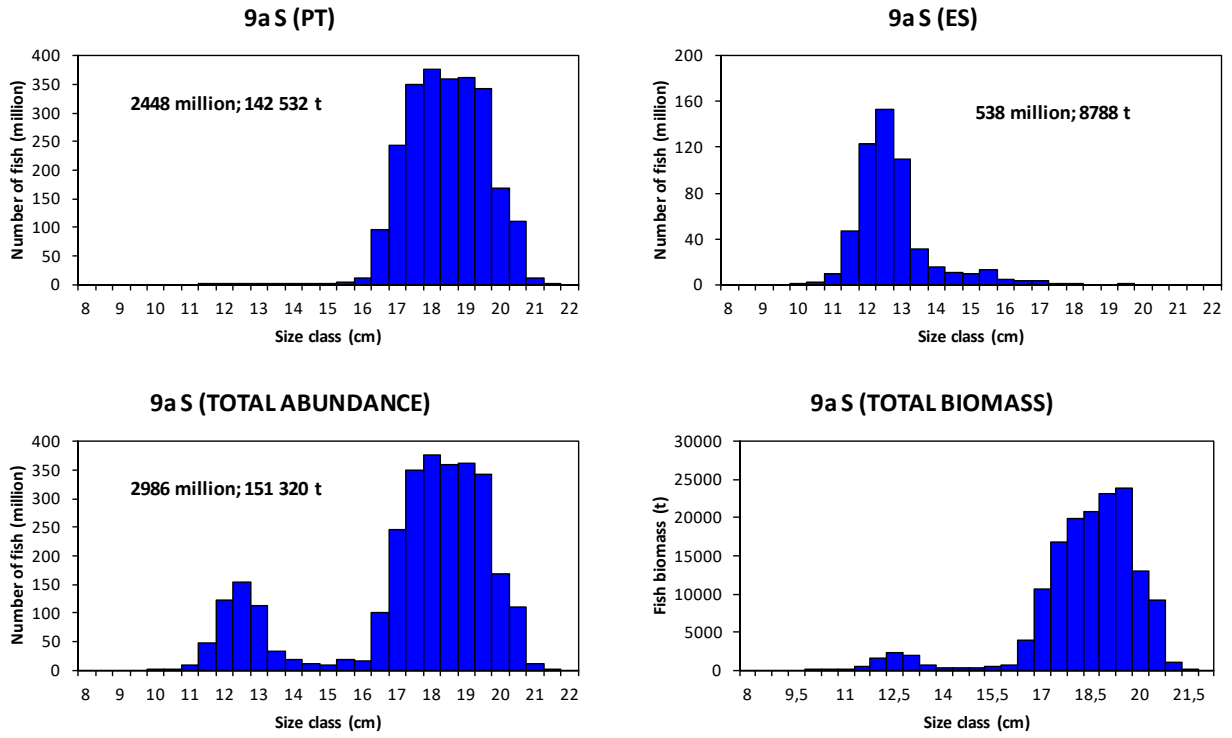


Figure 12. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10: Sardine (*S. pilchardus*)

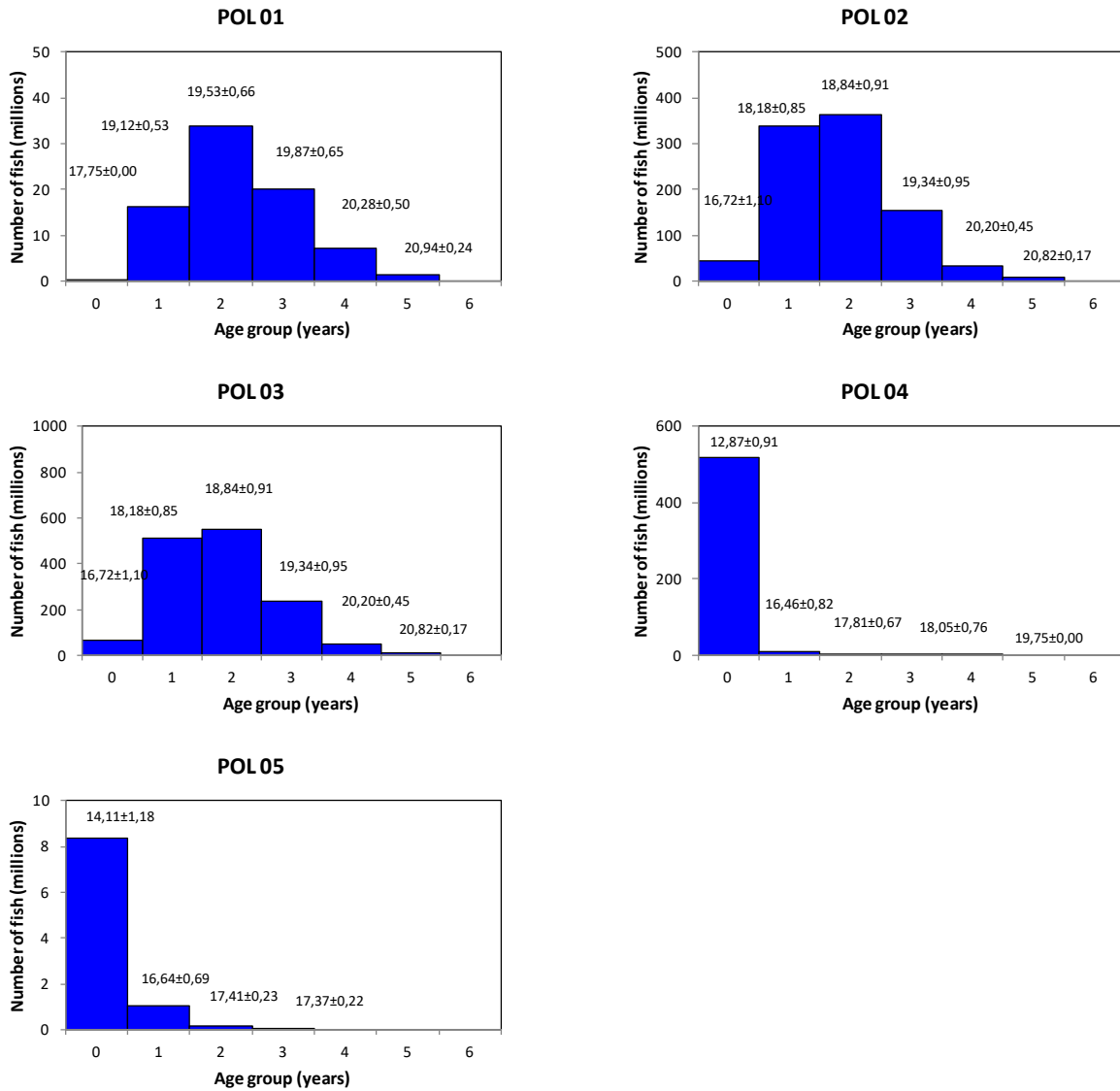


Figure 13. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 11**) and total sampled area. Post-strata ordered in the W-E direction. Mean (\pm SD) sizes of age groups are also shown. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Sardine (*S. pilchardus*)

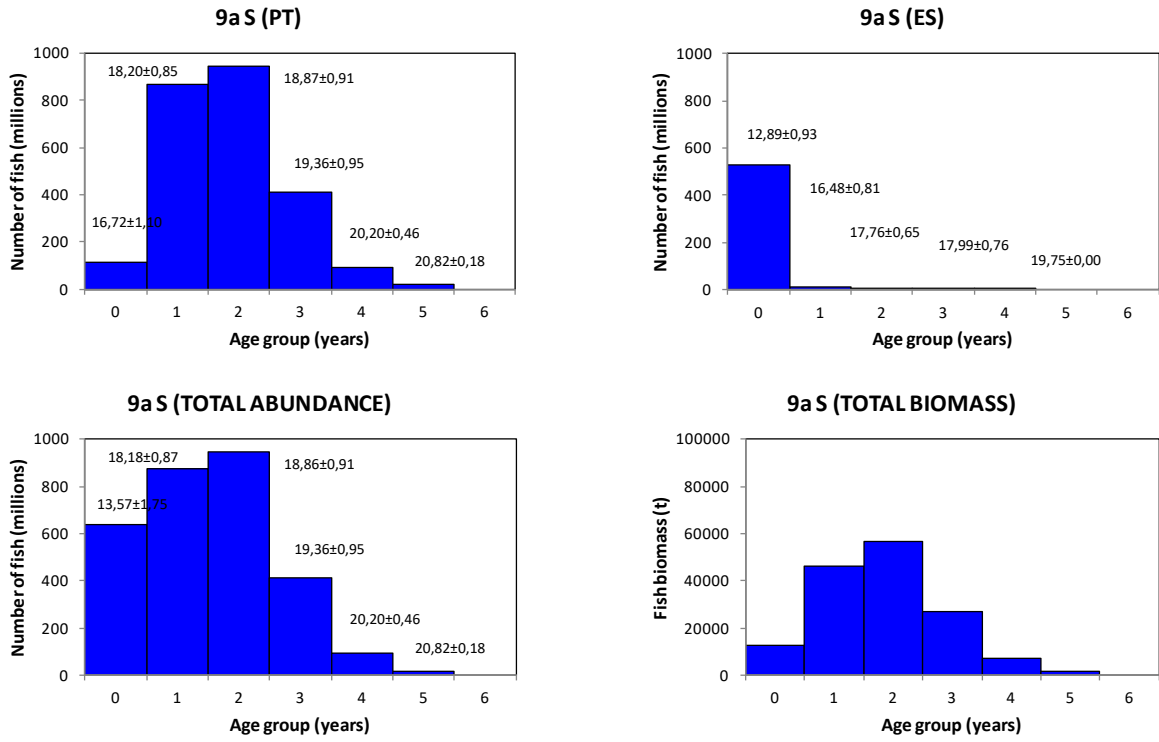


Figure 13. ECOCADIZ-RECLUTAS 2021-10 survey. Sardine (*Sardina pilchardus*). Cont'd.

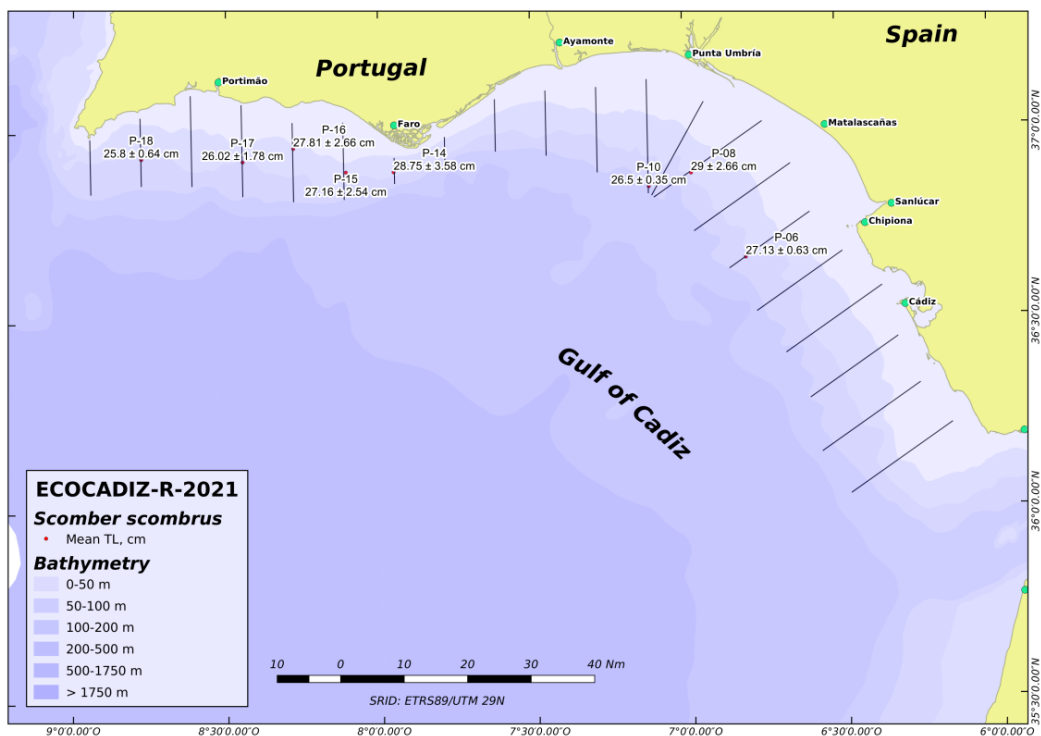
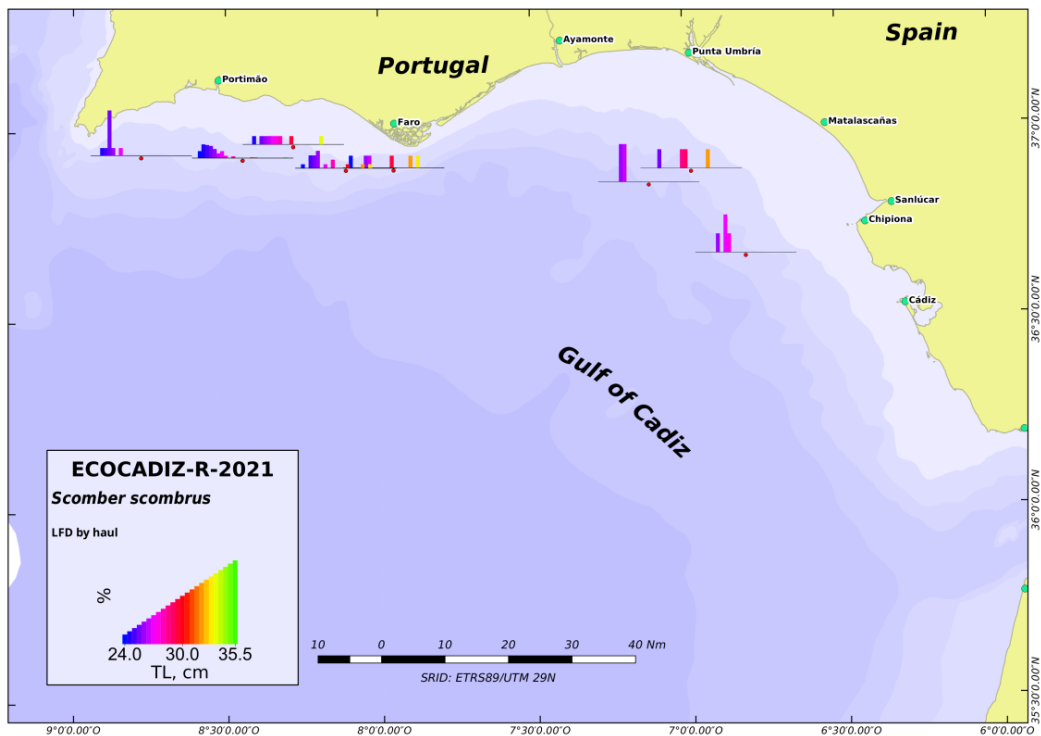


Figure 14. ECOCADIZ-RECLUTAS 2021-10 survey. Atlantic mackerel (*Scomber scombrus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

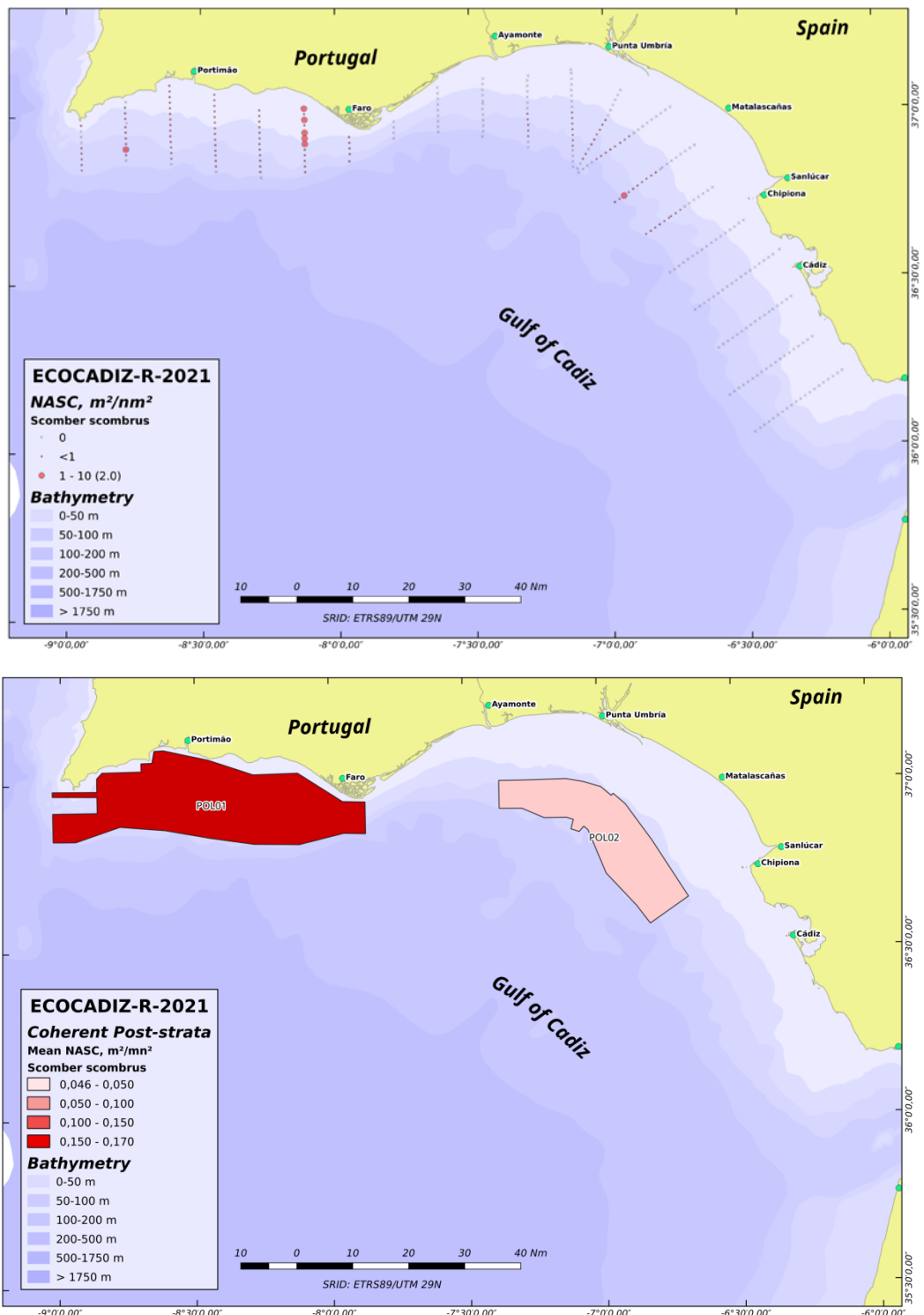


Figure 15. ECOCADIZ-RECLUTAS 2021-10 survey. Atlantic mackerel (*Scomber scombrus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Atlantic mackerel (*S. scombrus*)

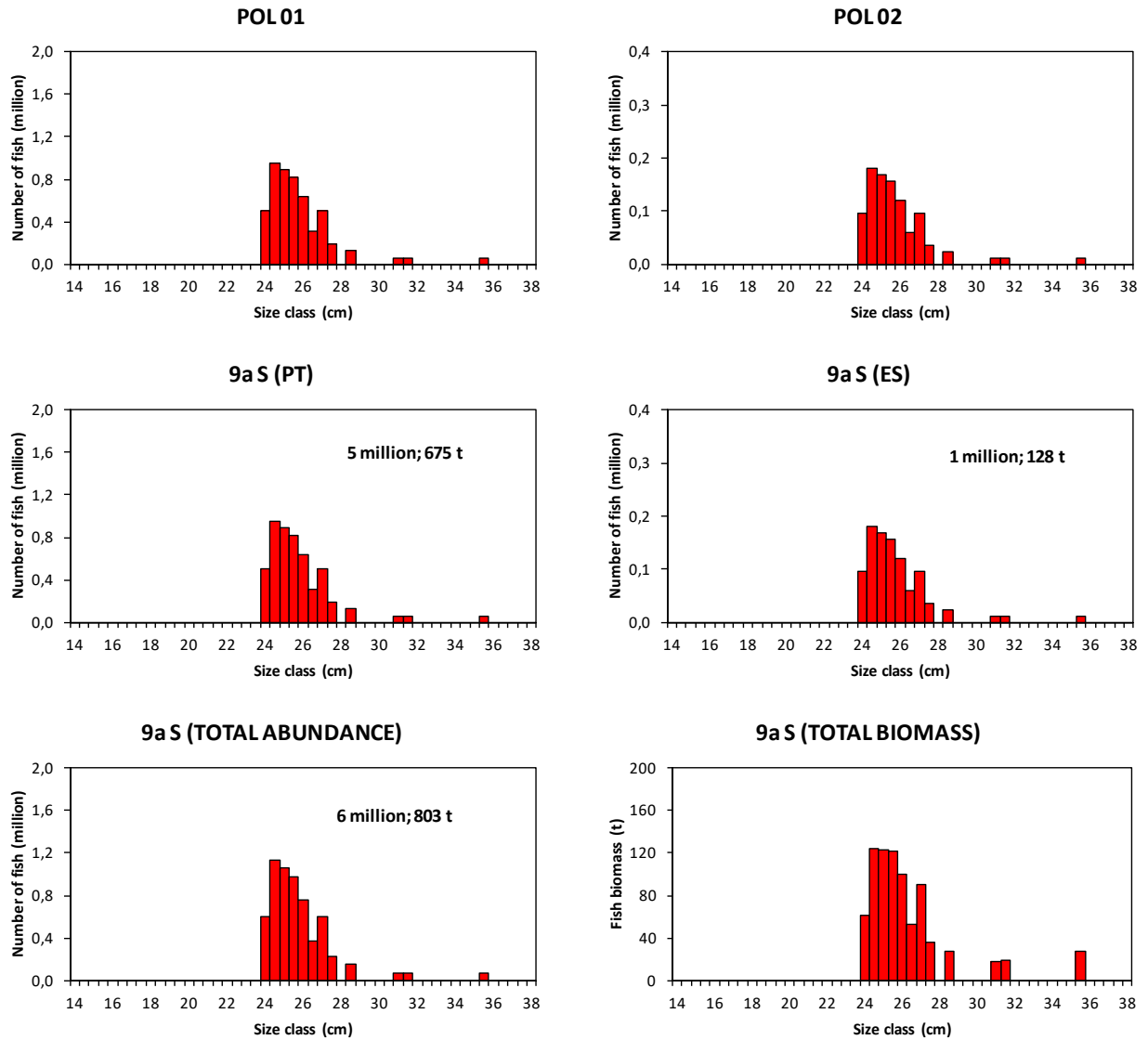


Figure 16. ECOCADIZ-RECLUTAS 2021-10 survey. Atlantic mackerel (*Scomber scombrus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 15**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

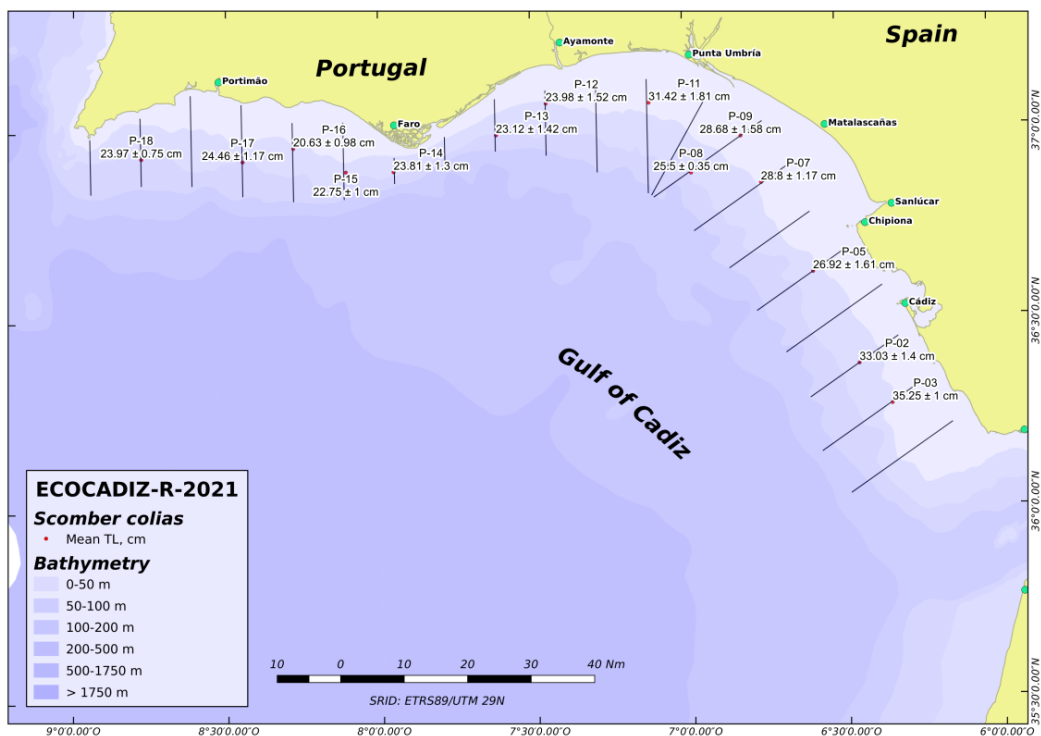
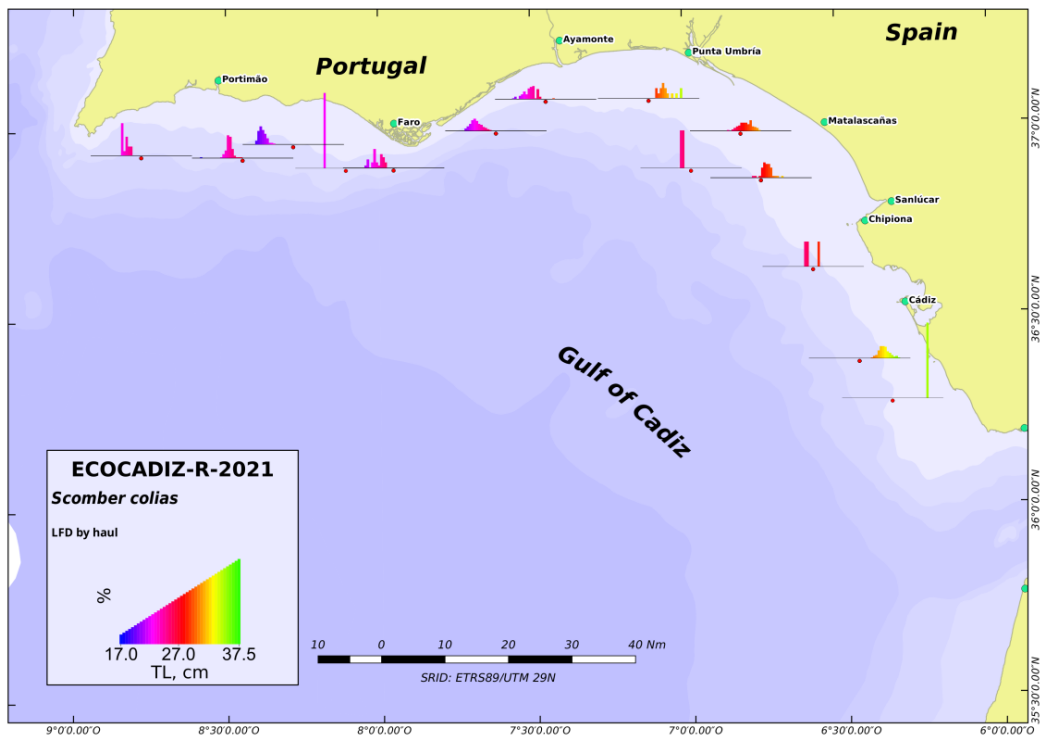


Figure 17. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

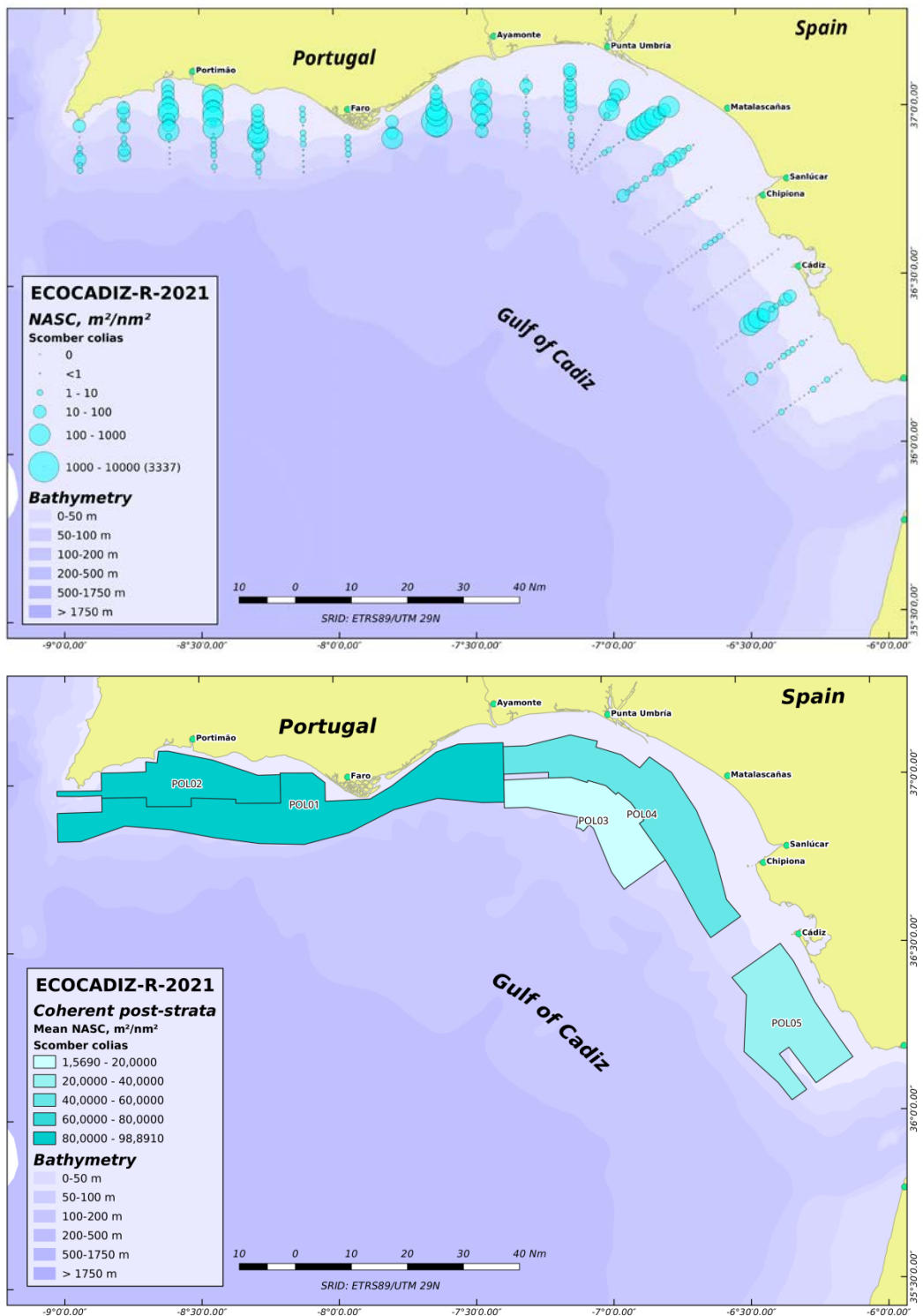


Figure 18. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Chub mackerel (*S. colias*)

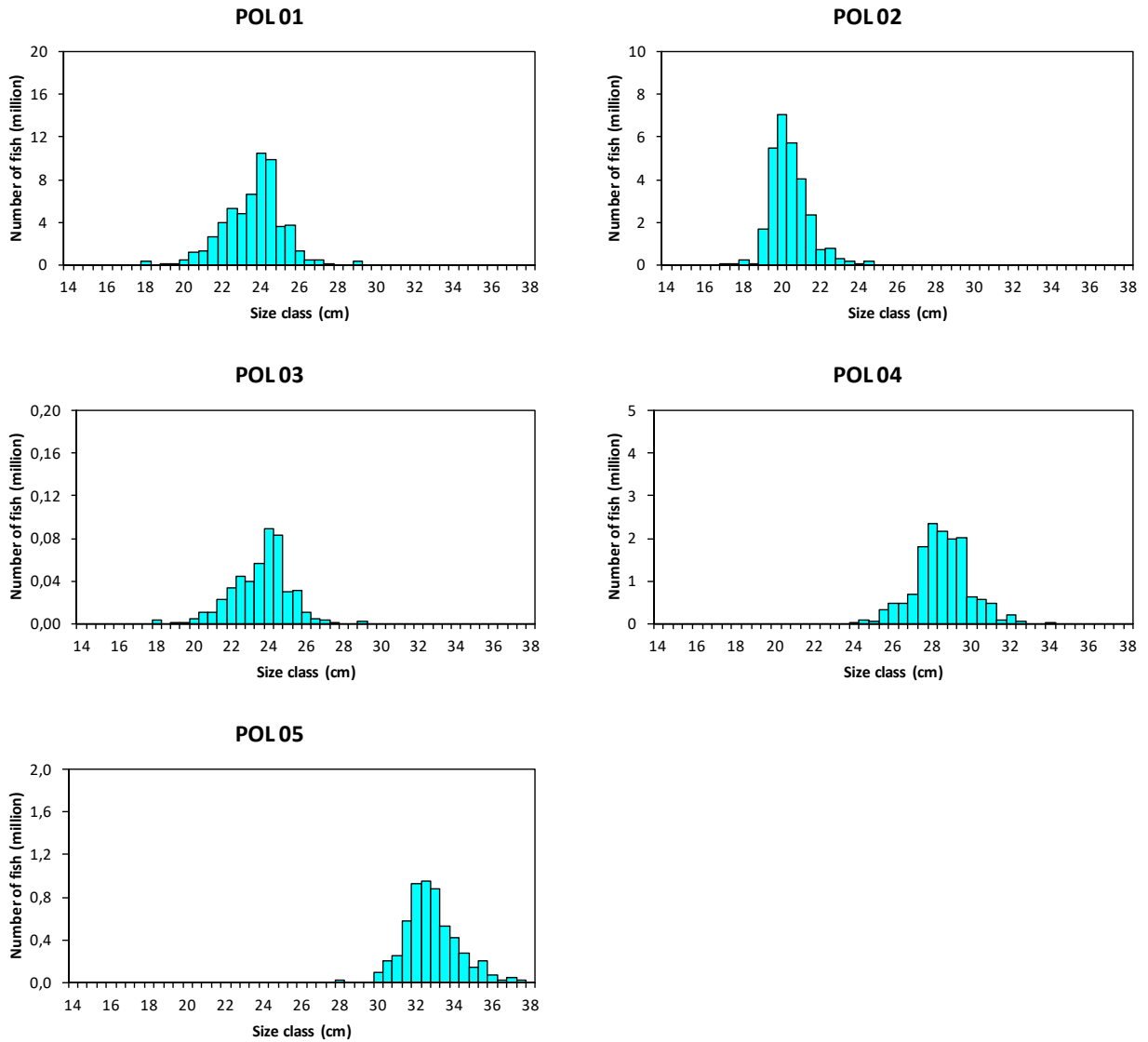


Figure 19. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 18**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Chub mackerel (*S. colias*)

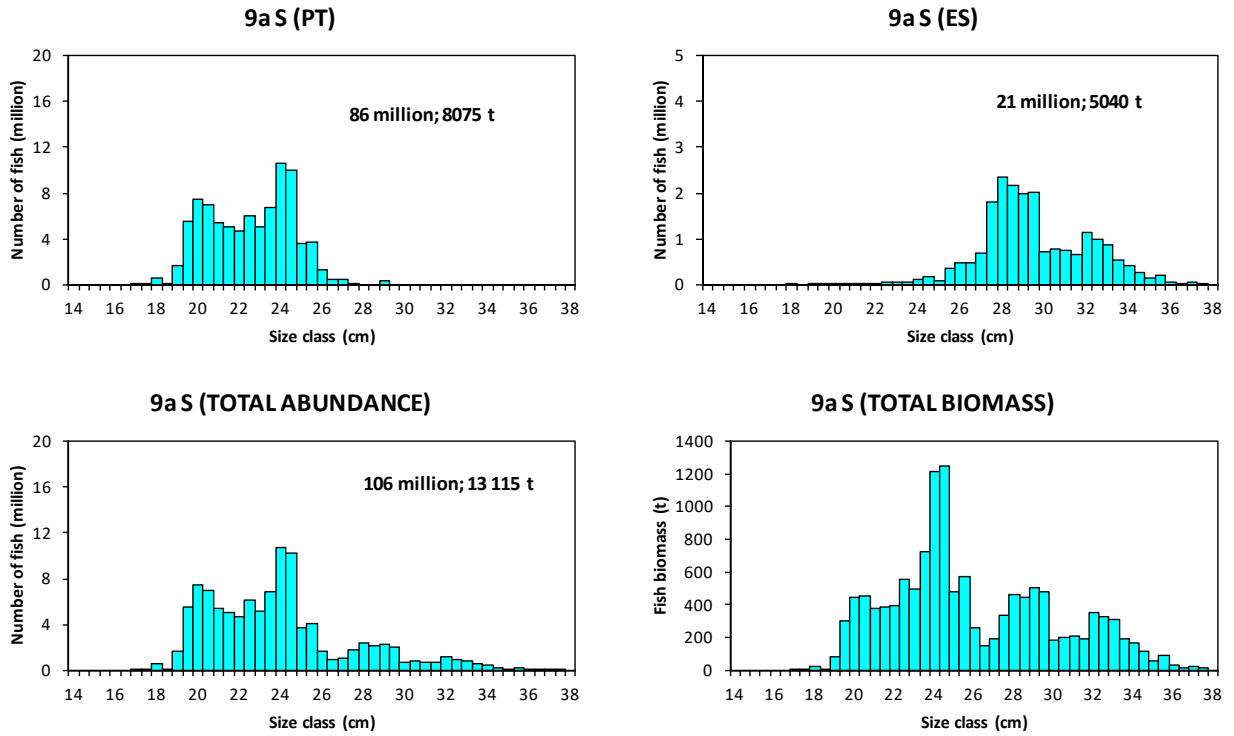


Figure 19. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Cont'd.

ECOCADIZ-RECLUTAS 2021-10: Chub mackerel (*S. colias*)

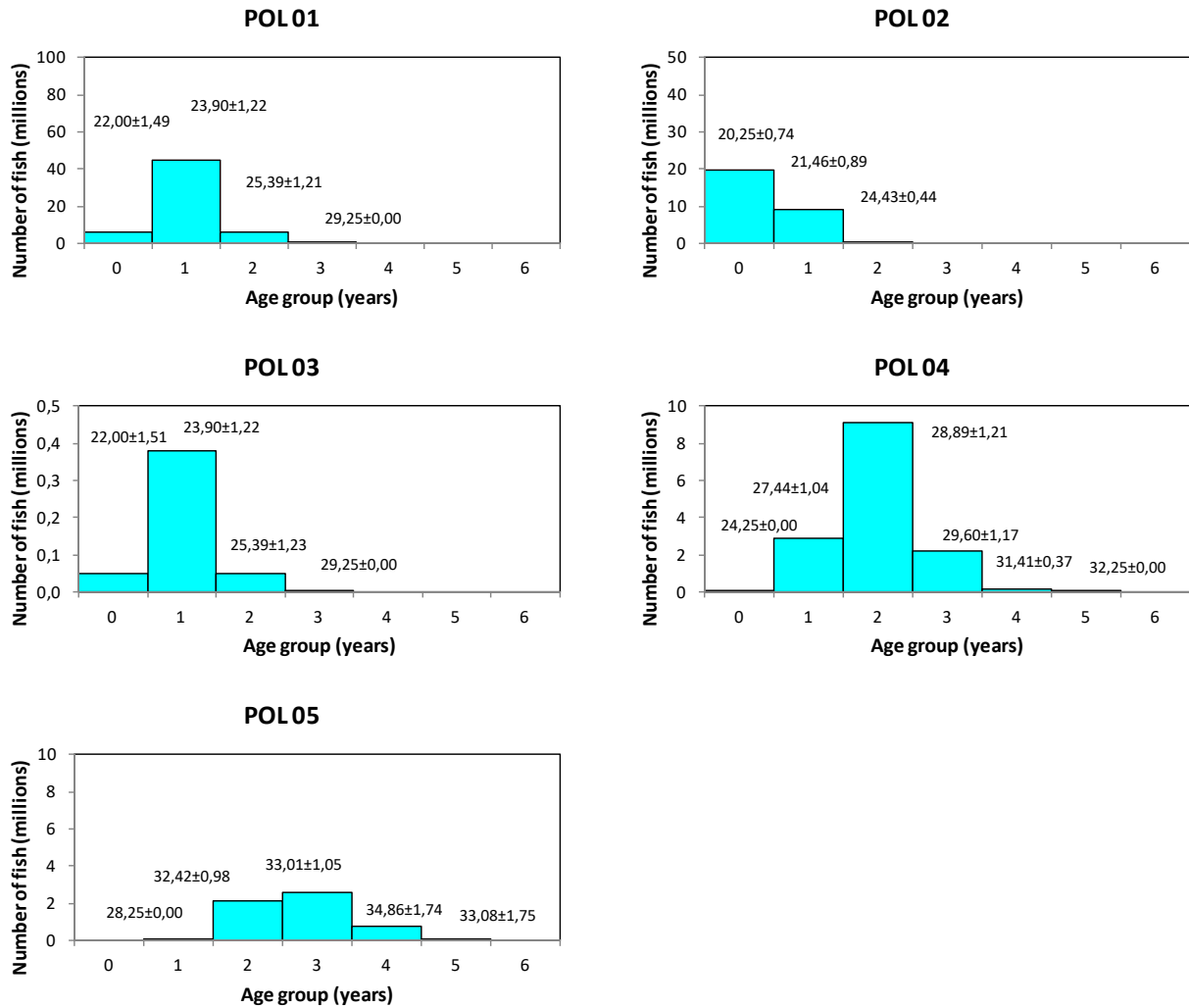


Figure 20. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Estimated abundances (number of fish in millions) by age group (years) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 18**) and total sampled area. Post-strata ordered in the W-E direction. Mean (\pm SD) sizes of age groups are also shown. The estimated biomass (t) by age group for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Chub mackerel (*S. colias*)

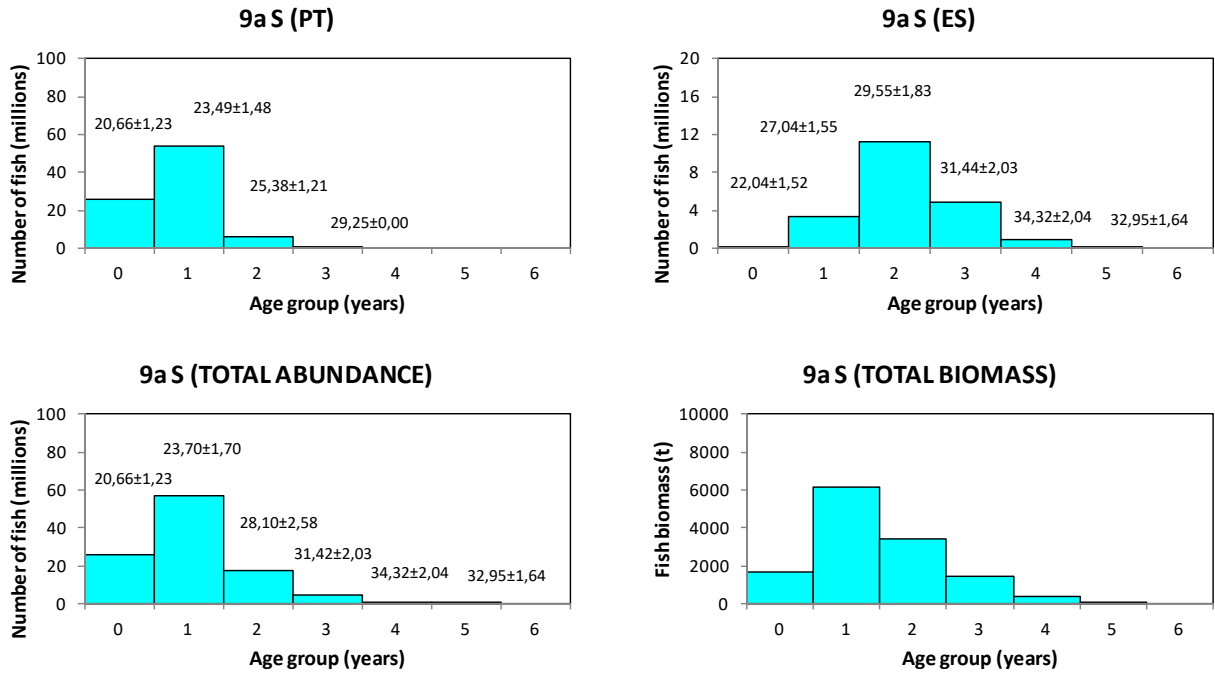


Figure 20. ECOCADIZ-RECLUTAS 2021-10 survey. Chub mackerel (*Scomber colias*). Cont'd.

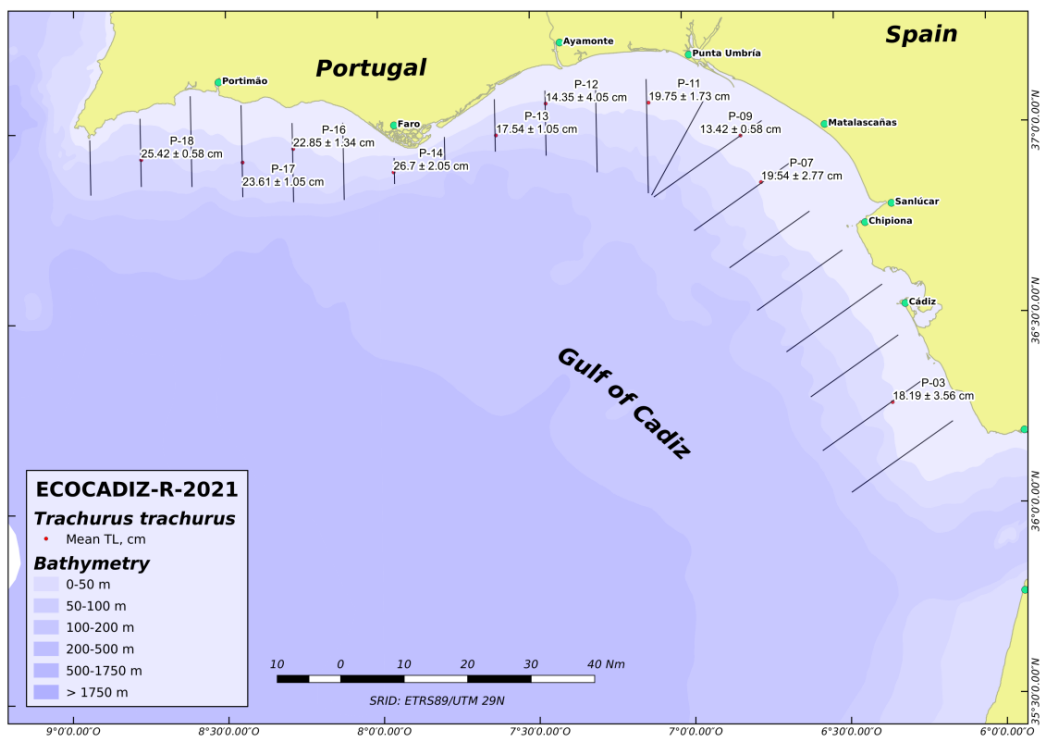
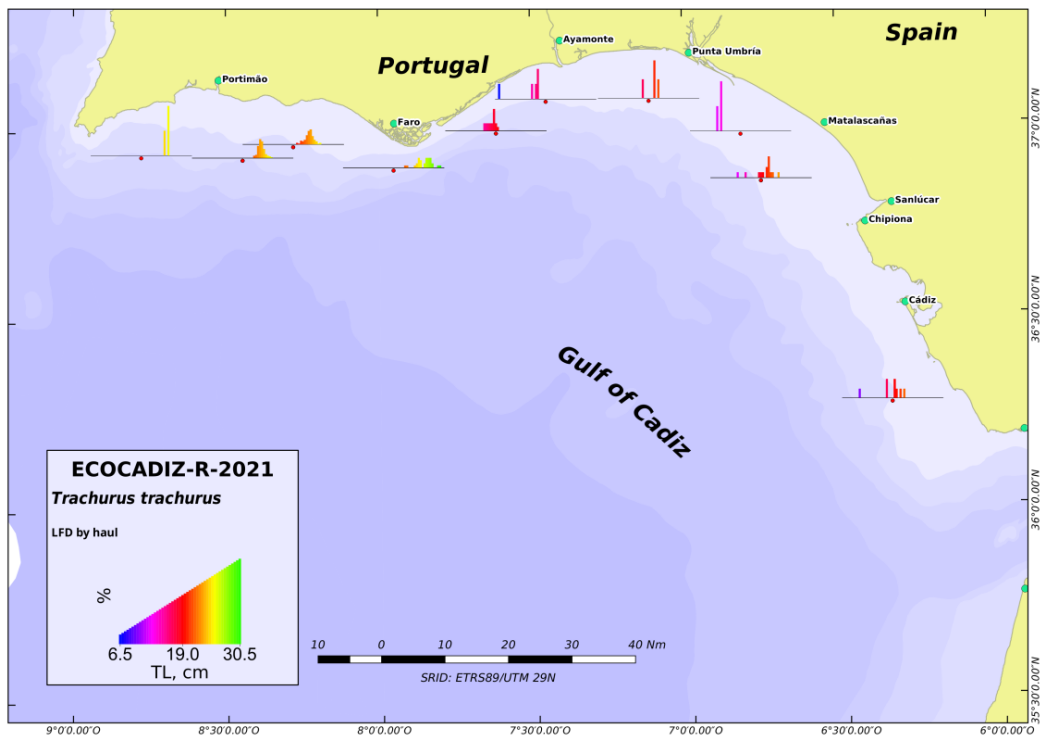


Figure 21. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

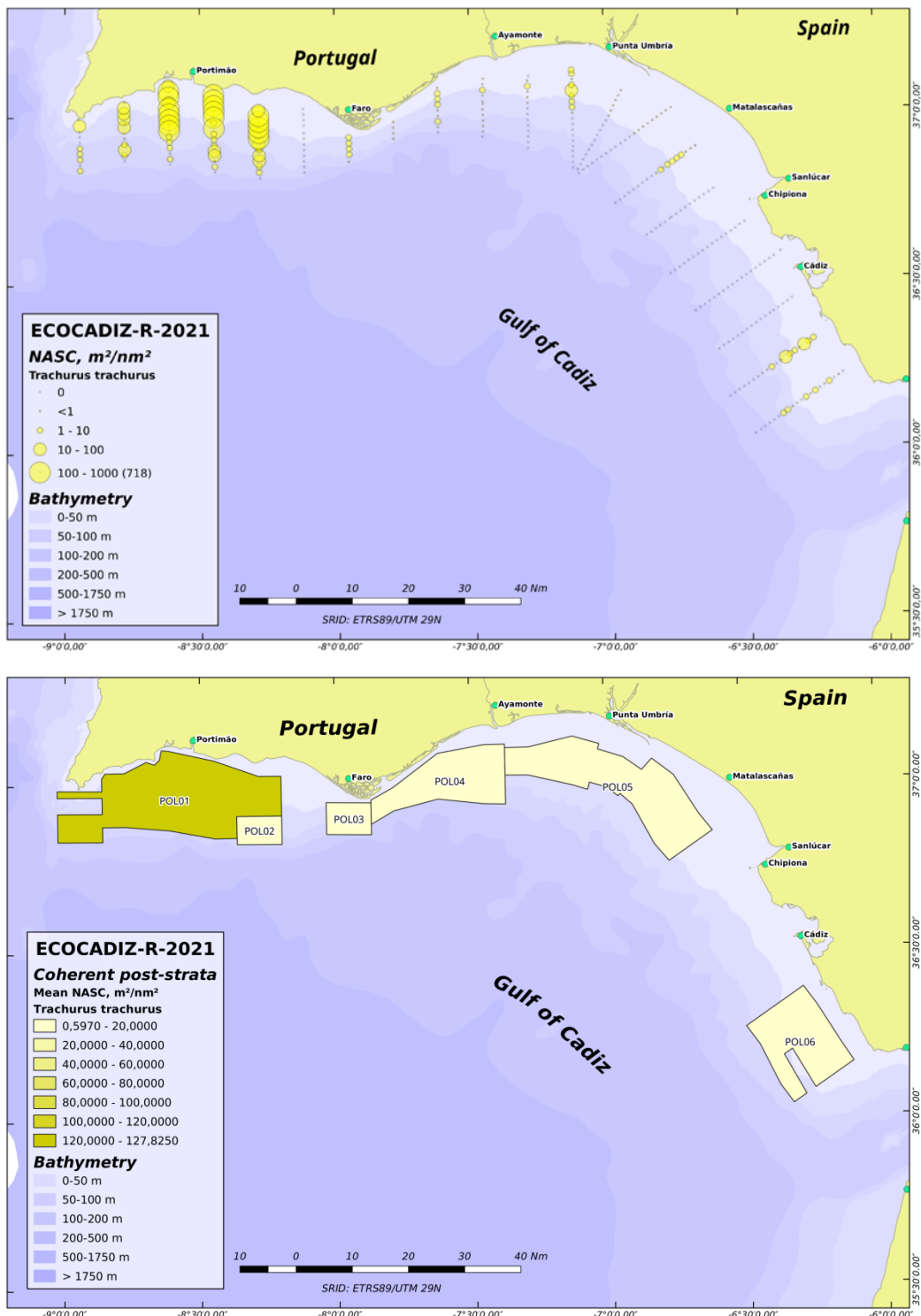


Figure 22. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Horse mackerel (*T. trachurus*)

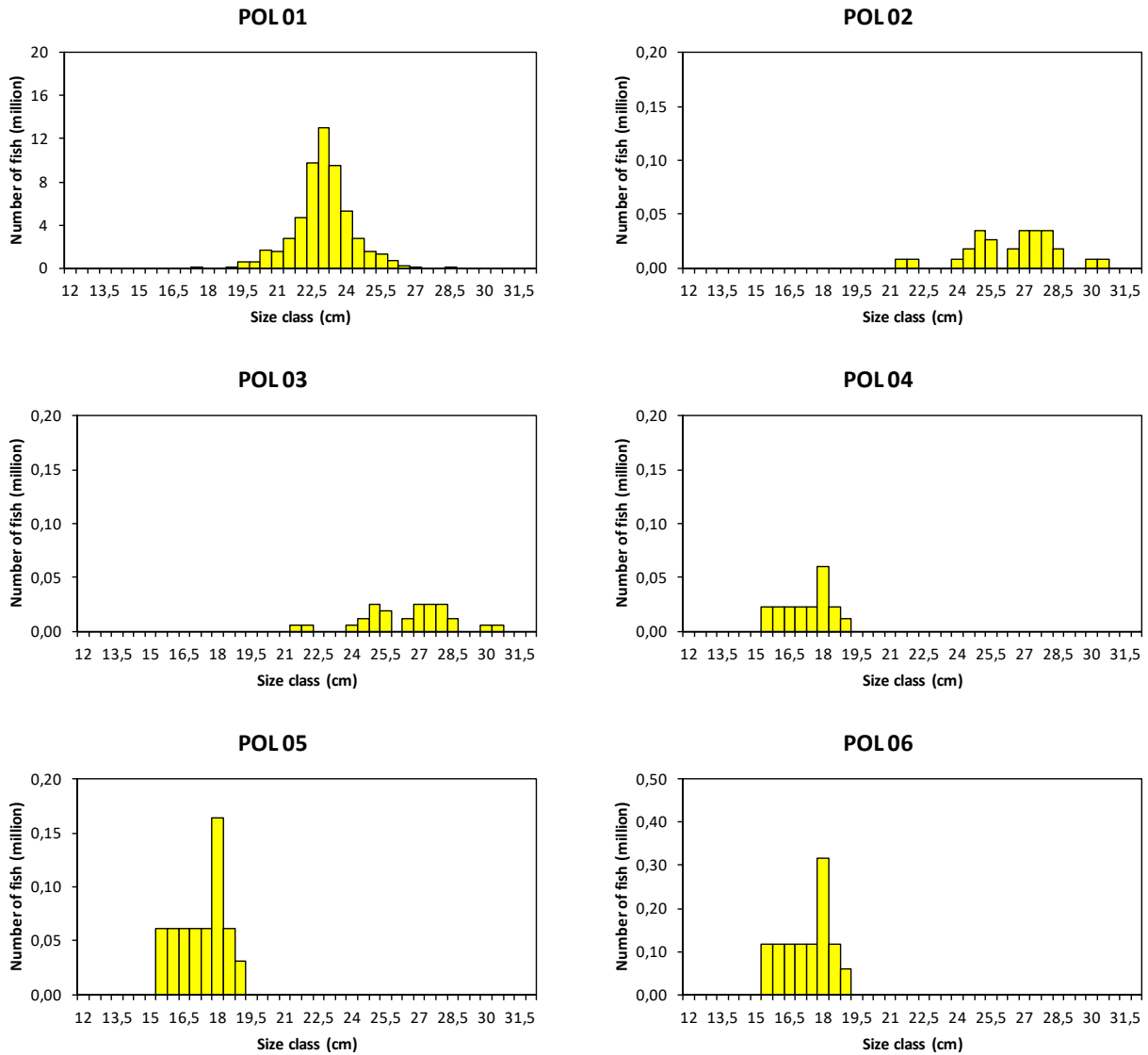


Figure 23. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 22**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Horse mackerel (*T. trachurus*)

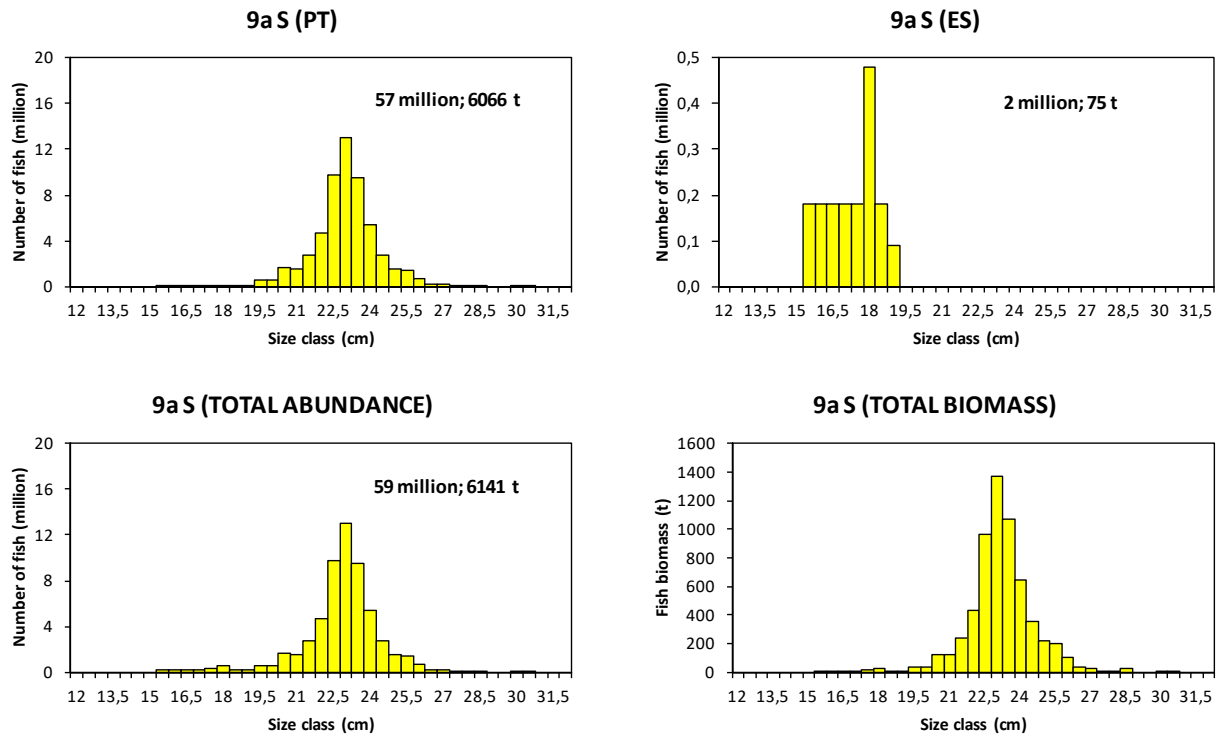


Figure 23. ECOCADIZ-RECLUTAS 2021-10 survey. Horse mackerel (*Trachurus trachurus*). Cont'd.

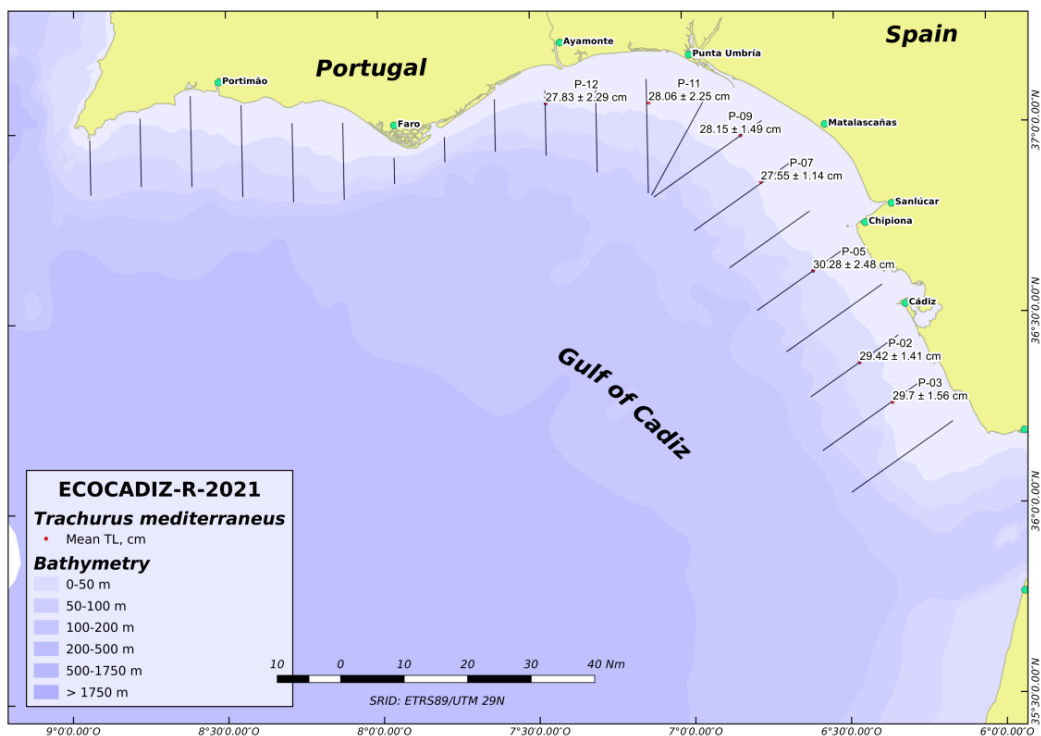
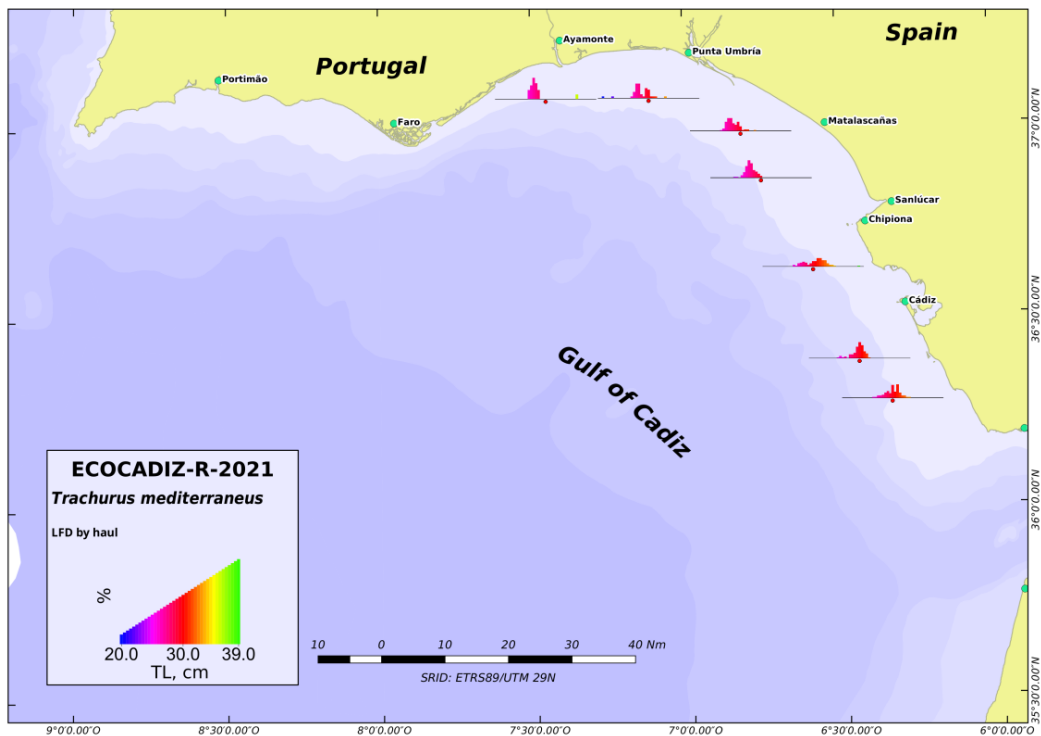


Figure 24. ECOCADIZ-RECLUTAS 2021-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

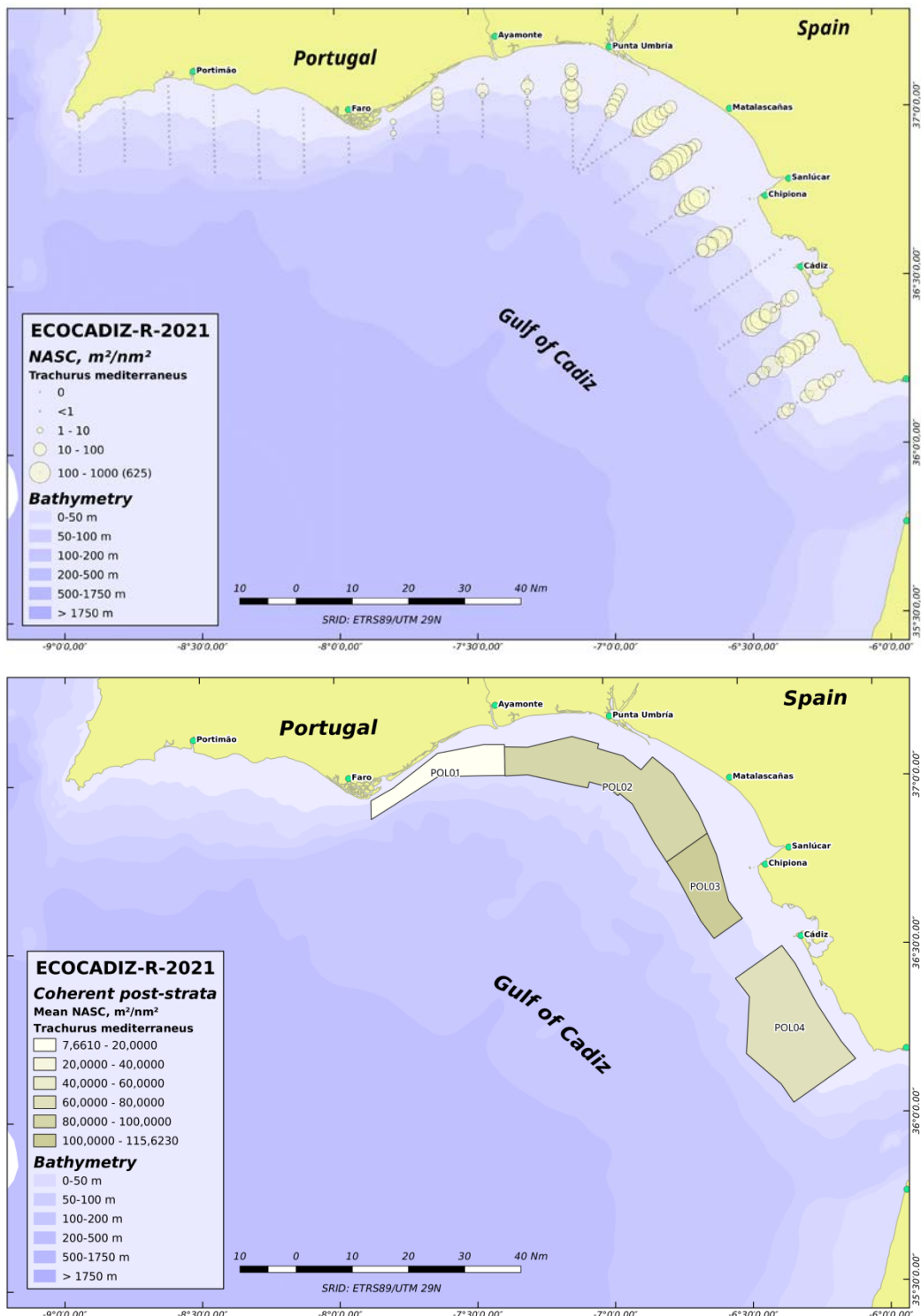


Figure 25. ECOCADIZ-RECLUTAS 2021-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, *NASC*, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Mediterranean horse mackerel (*T. mediterraneus*)

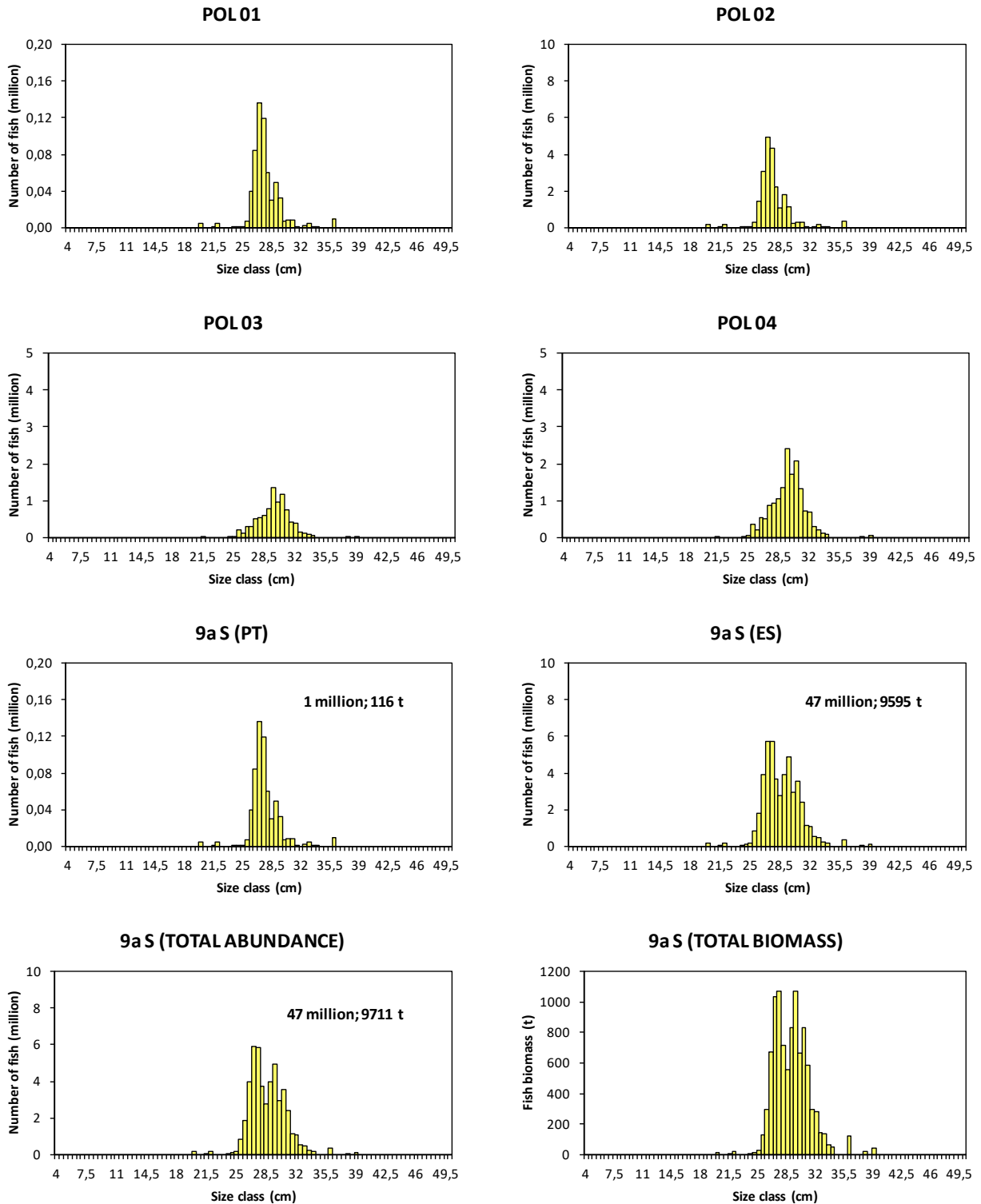


Figure 26. ECOCADIZ-RECLUTAS 2021-10 survey. Mediterranean horse mackerel (*Trachurus mediterraneus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 25**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

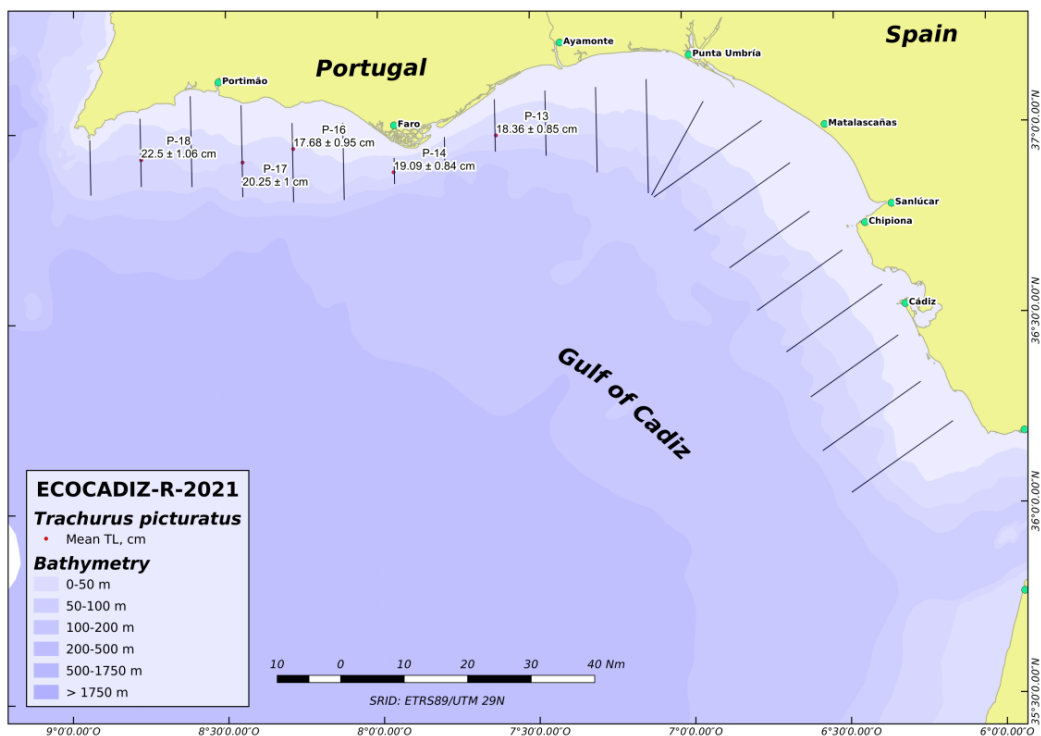
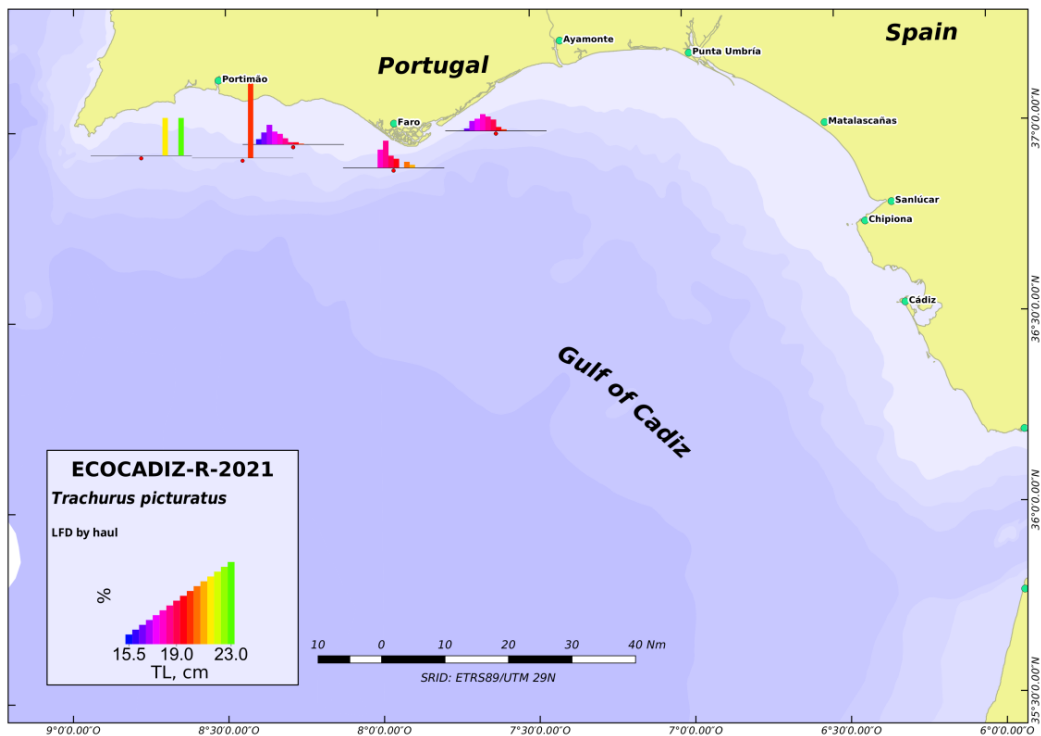


Figure 27. ECOCADIZ-RECLUTAS 2021-10 survey. Blue jack mackerel (*Trachurus picturatus*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

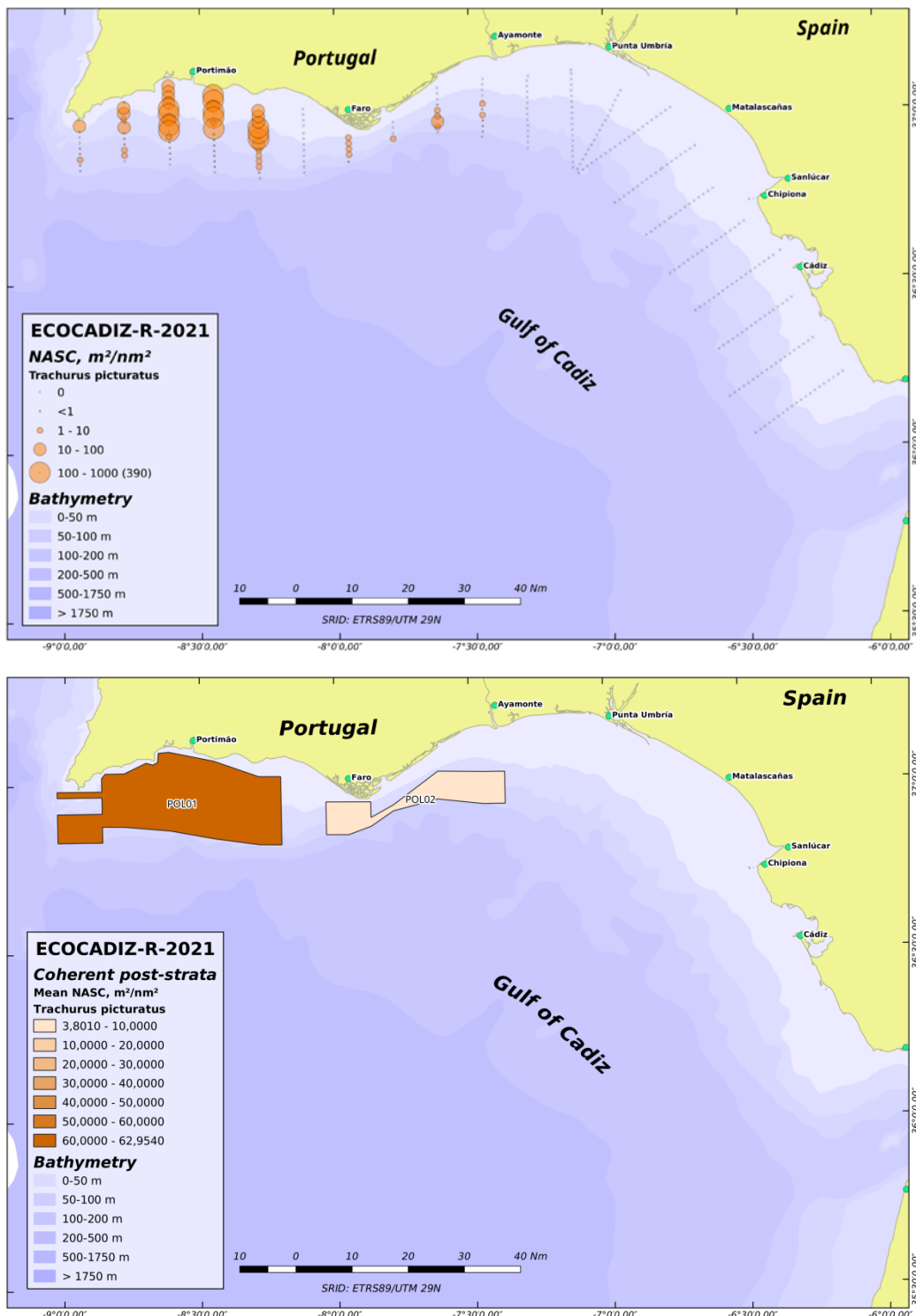


Figure 28. ECOCADIZ-RECLUTAS 2021-10 survey. Blue jack mackerel (*Trachurus picturatus*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Blue Jack mackerel (*T. picturatus*)

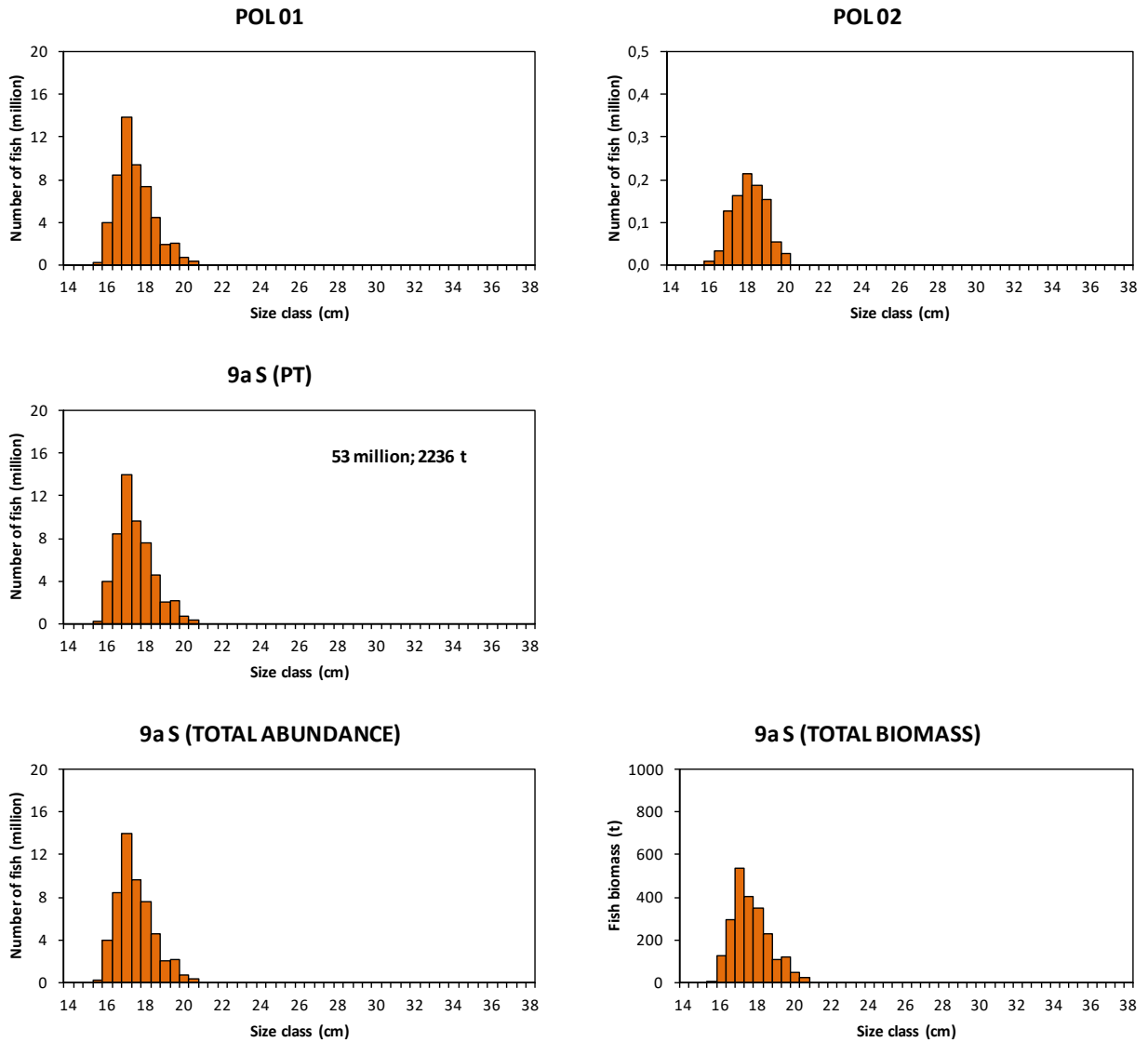


Figure 29. ECOCADIZ-RECLUTAS 2021-10 survey. Blue jack mackerel (*Trachurus picturatus*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 28**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

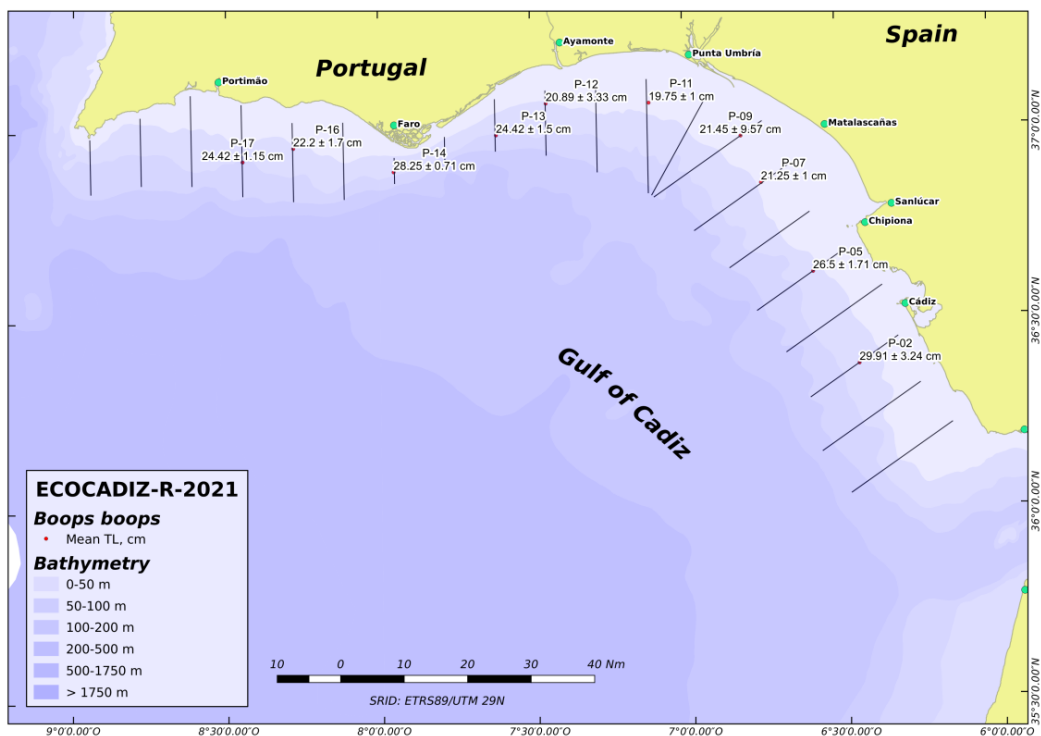
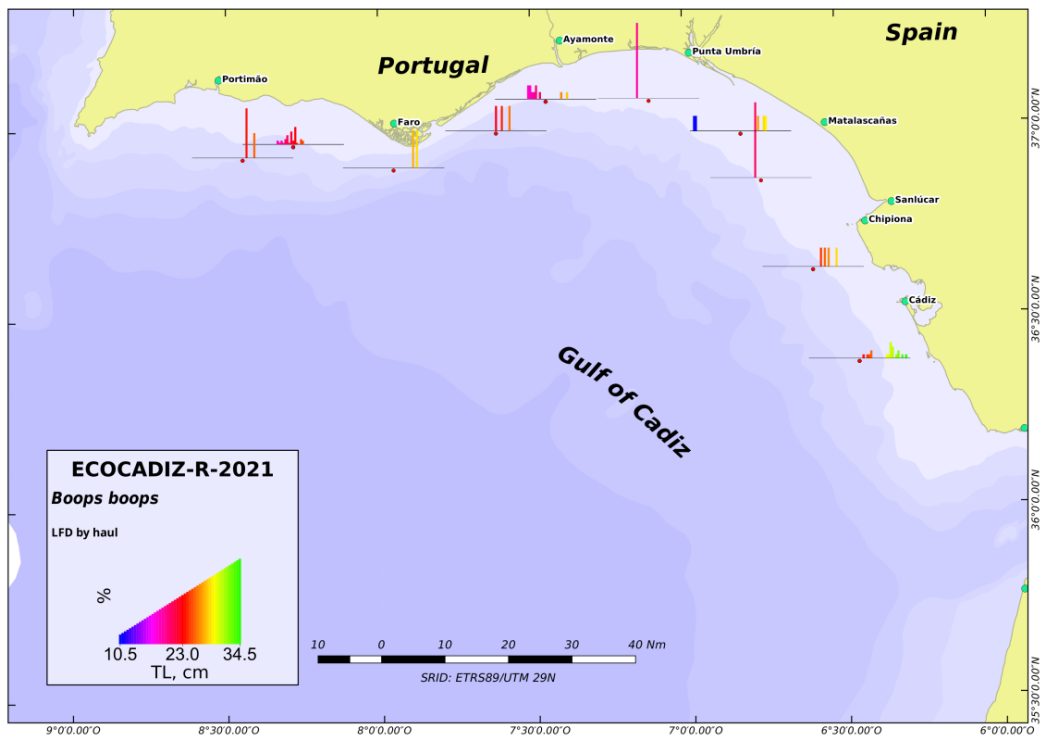


Figure 30. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Top: length frequency distributions in fishing hauls. Bottom: mean ± sd length by haul.

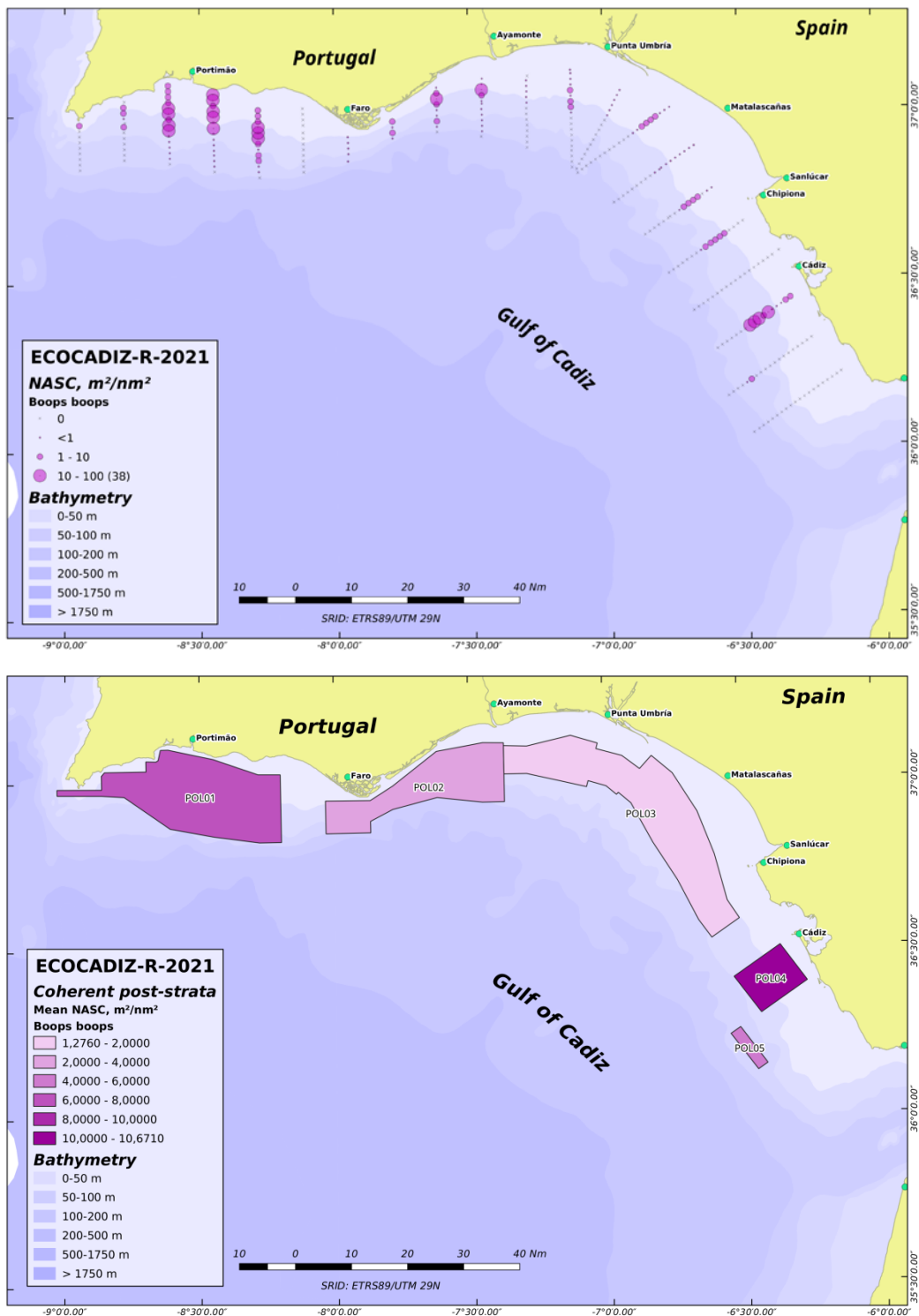


Figure 31. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Bogue (*B. boops*)

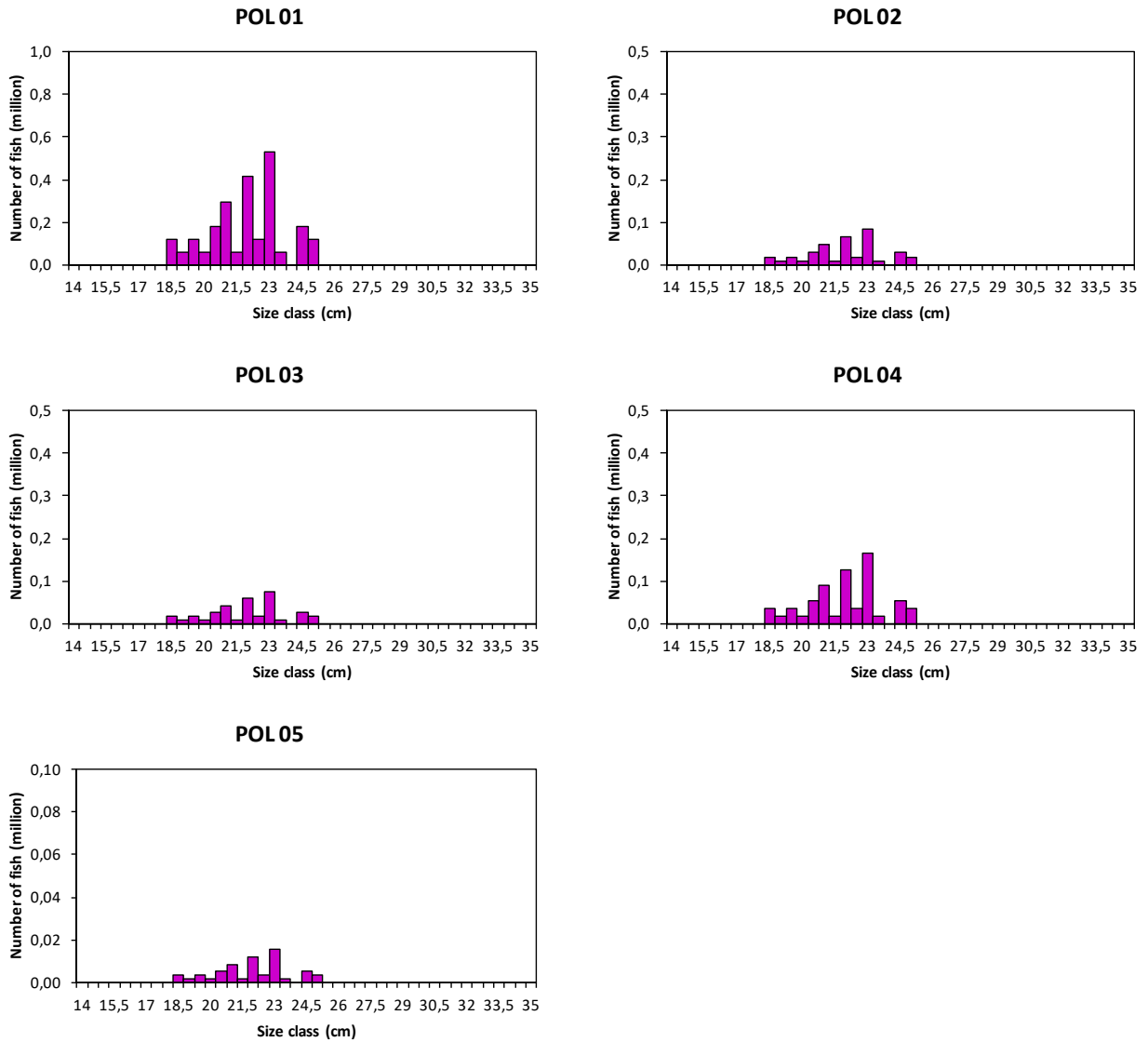


Figure 32. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 31**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

ECOCADIZ-RECLUTAS 2021-10: Bogue (*B. boops*)

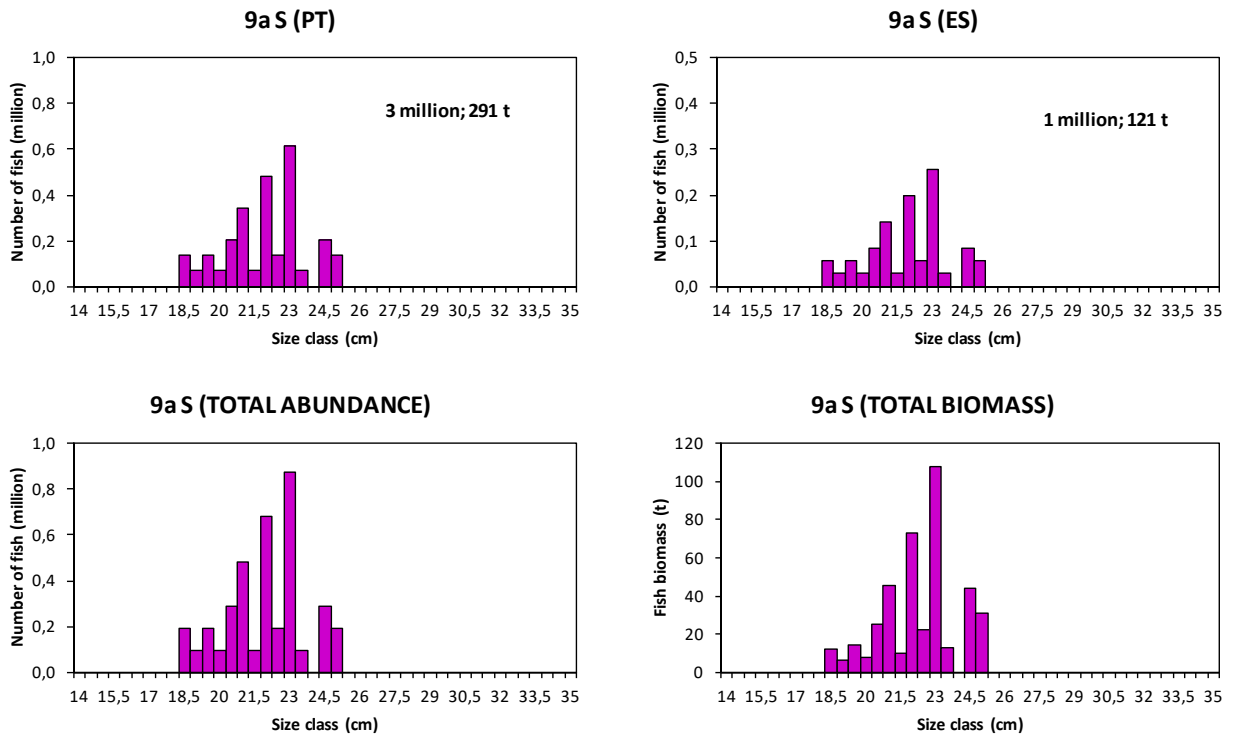


Figure 32. ECOCADIZ-RECLUTAS 2021-10 survey. Bogue (*Boops boops*). Cont'd.

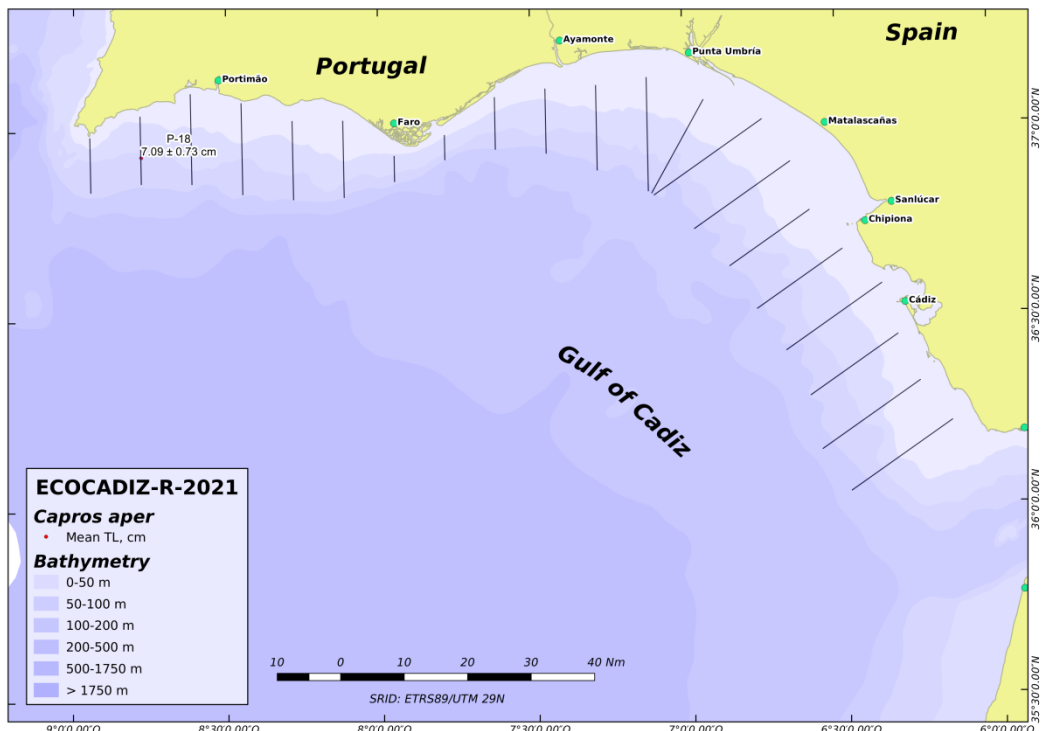
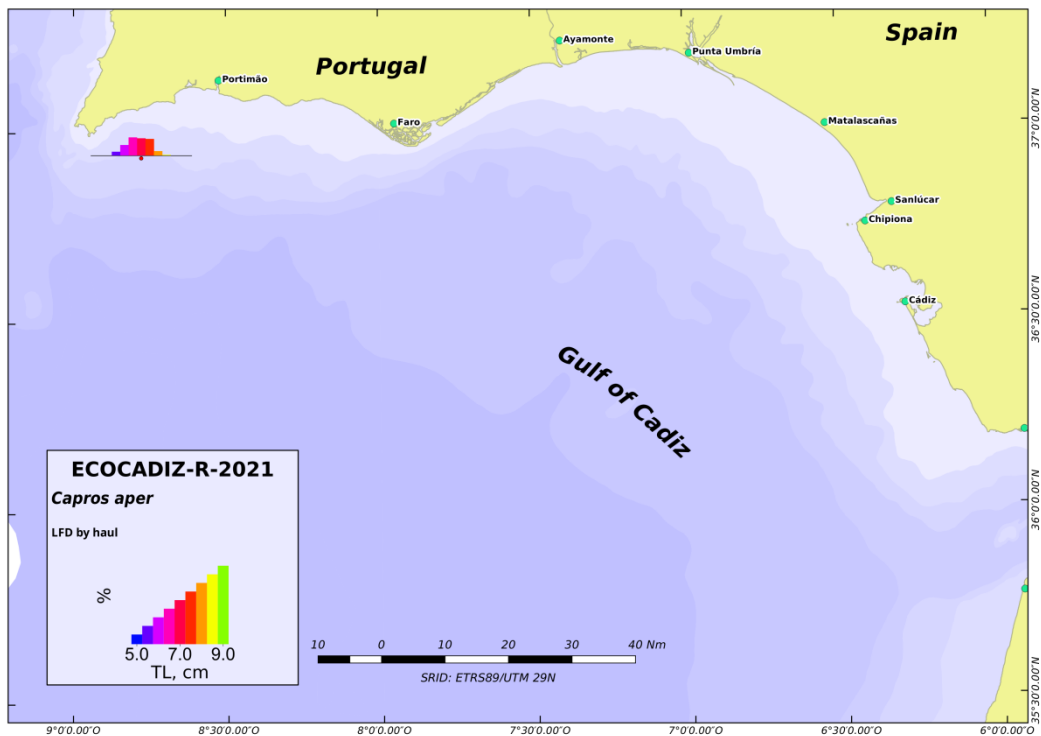


Figure 33. ECOCADIZ-RECLUTAS 2021-10 survey. Boarfish (*Capros aper*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

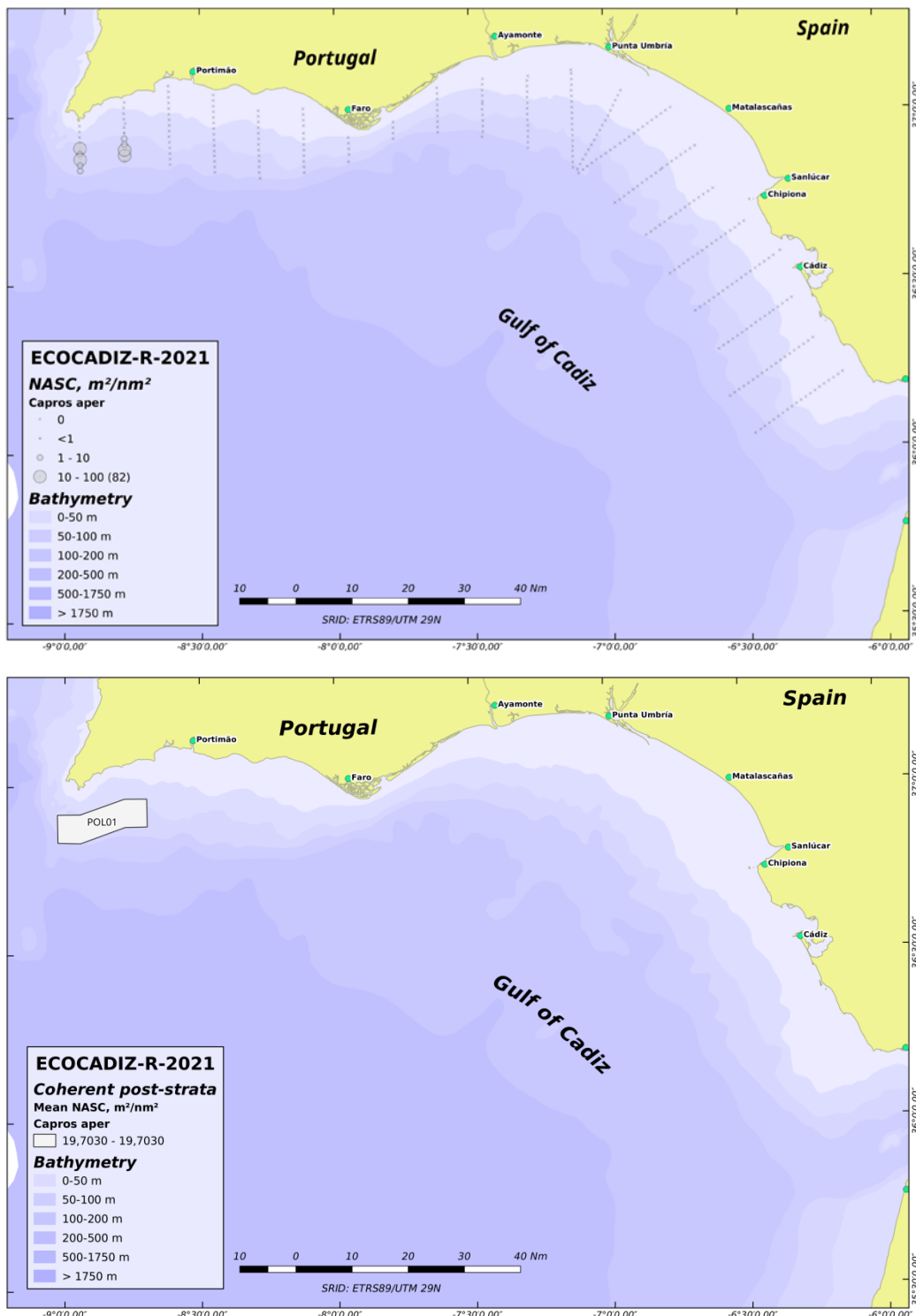


Figure 34. ECOCADIZ-RECLUTAS 2021-10 survey. Boarfish (*Capros aper*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Boarfish (*C. aper*)

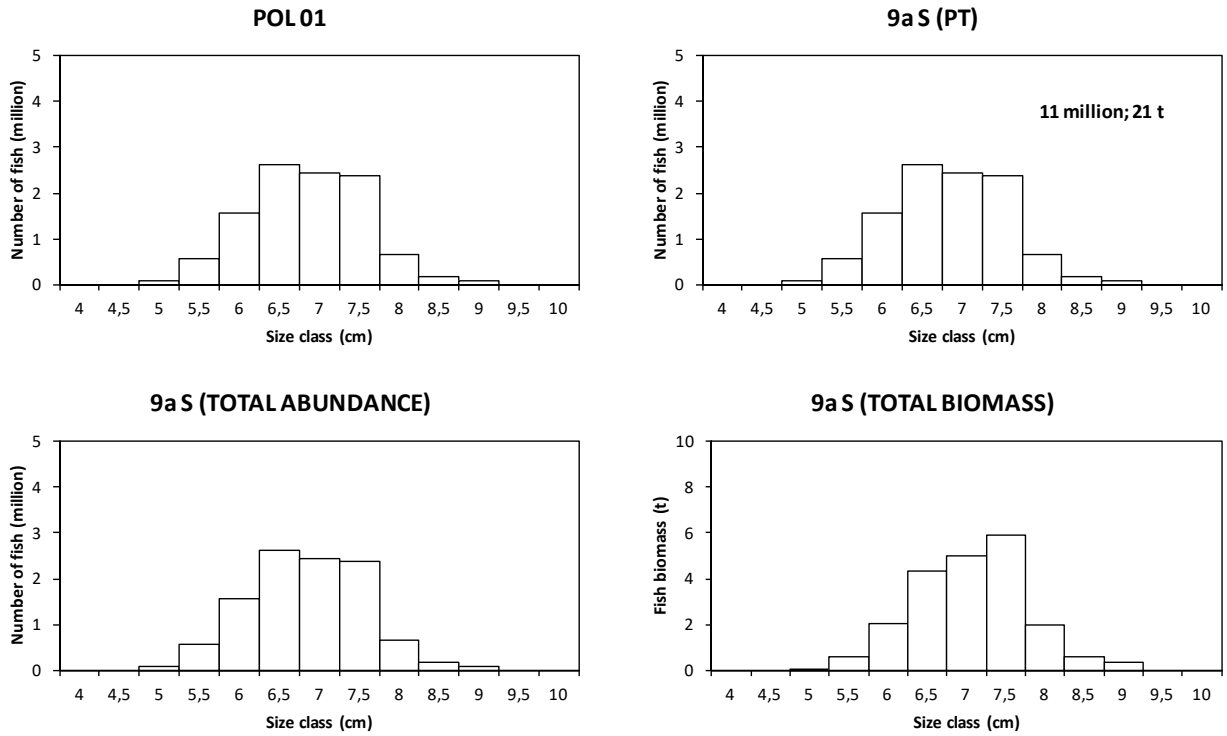


Figure 35. ECOCADIZ-RECLUTAS 2021-10 survey. Boarfish (*Capros aper*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 34**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

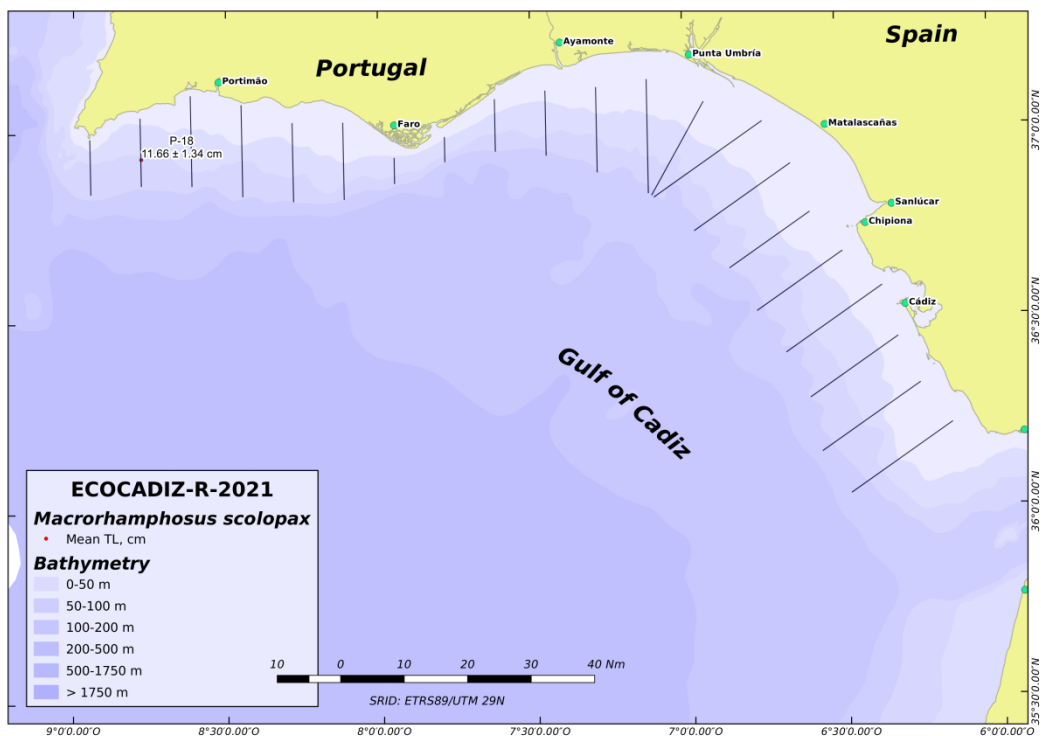
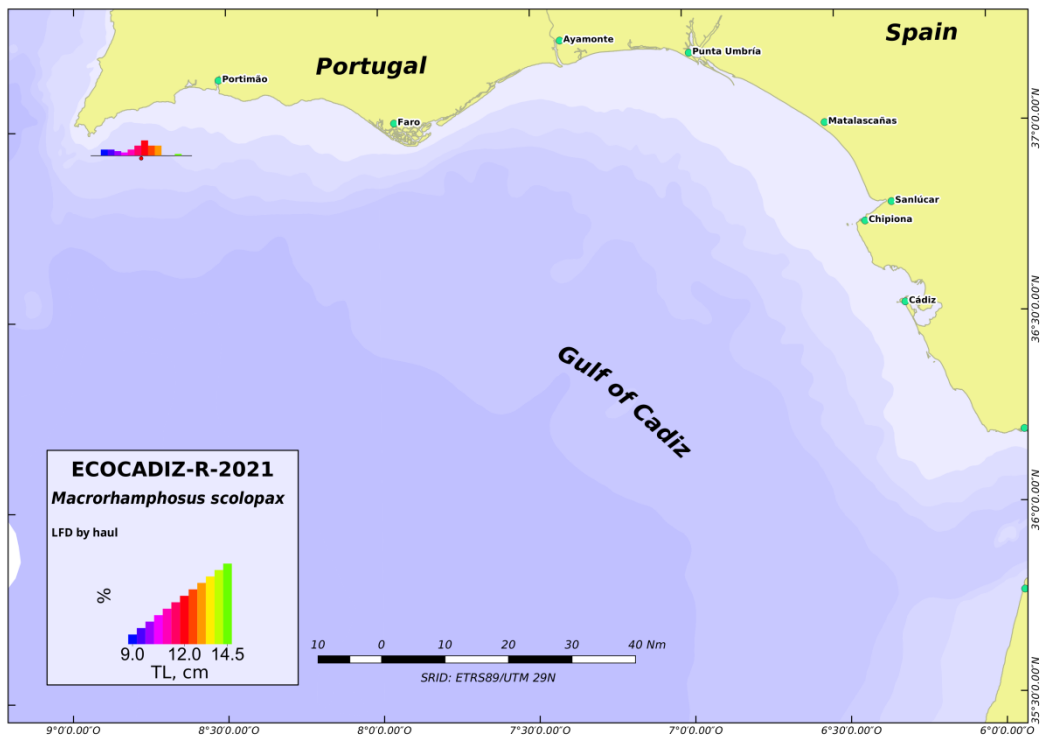


Figure 36. ECOCADIZ-RECLUTAS 2021-10 survey. Longspine snipefish (*Macroramphosus scolopax*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

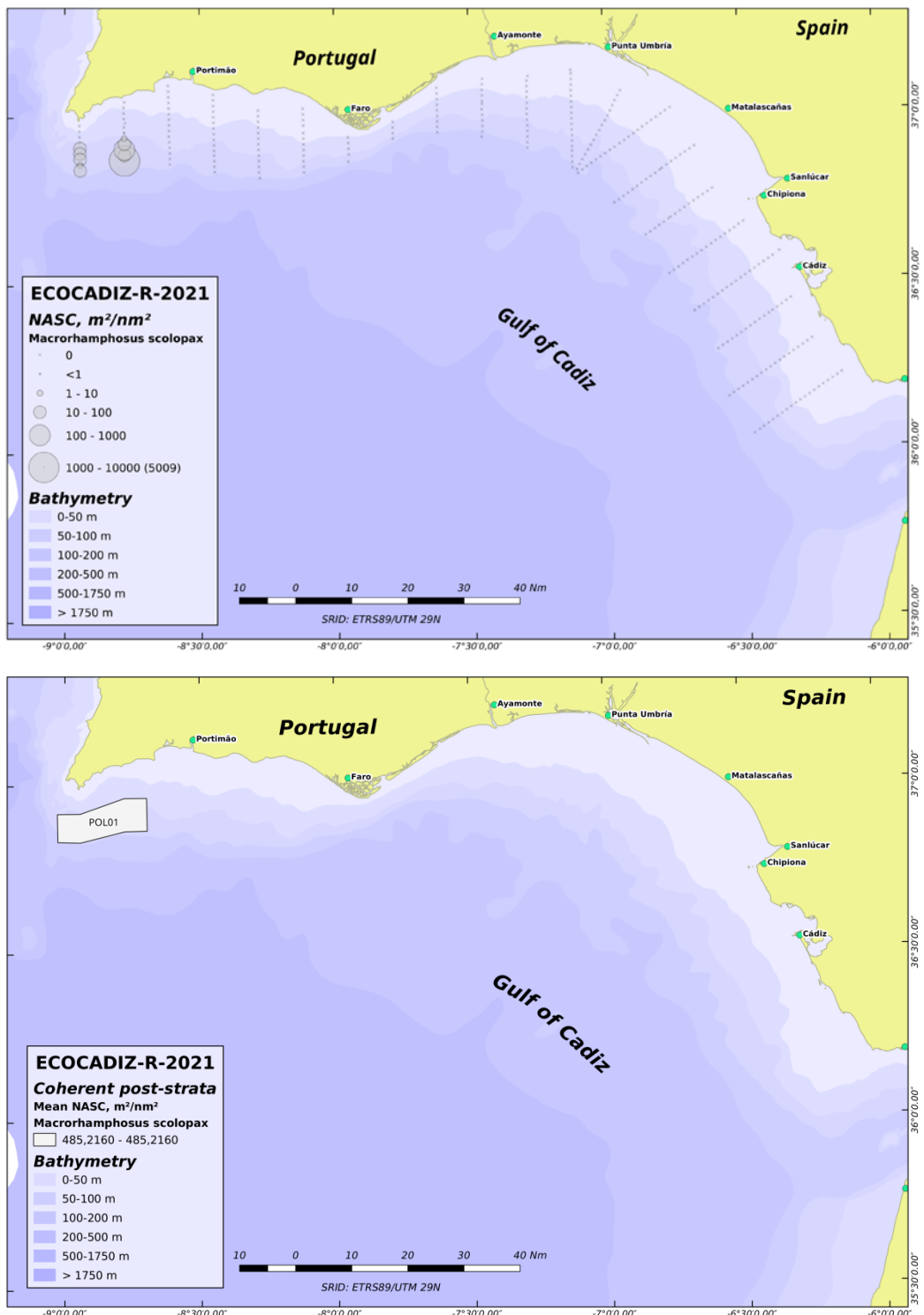


Figure 37. ECOCADIZ-RECLUTAS 2021-10 survey. Longspine snipefish (*Macroramphosus scolopax*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, $NASC$, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Longspine snipefish (*M. scolopax*)

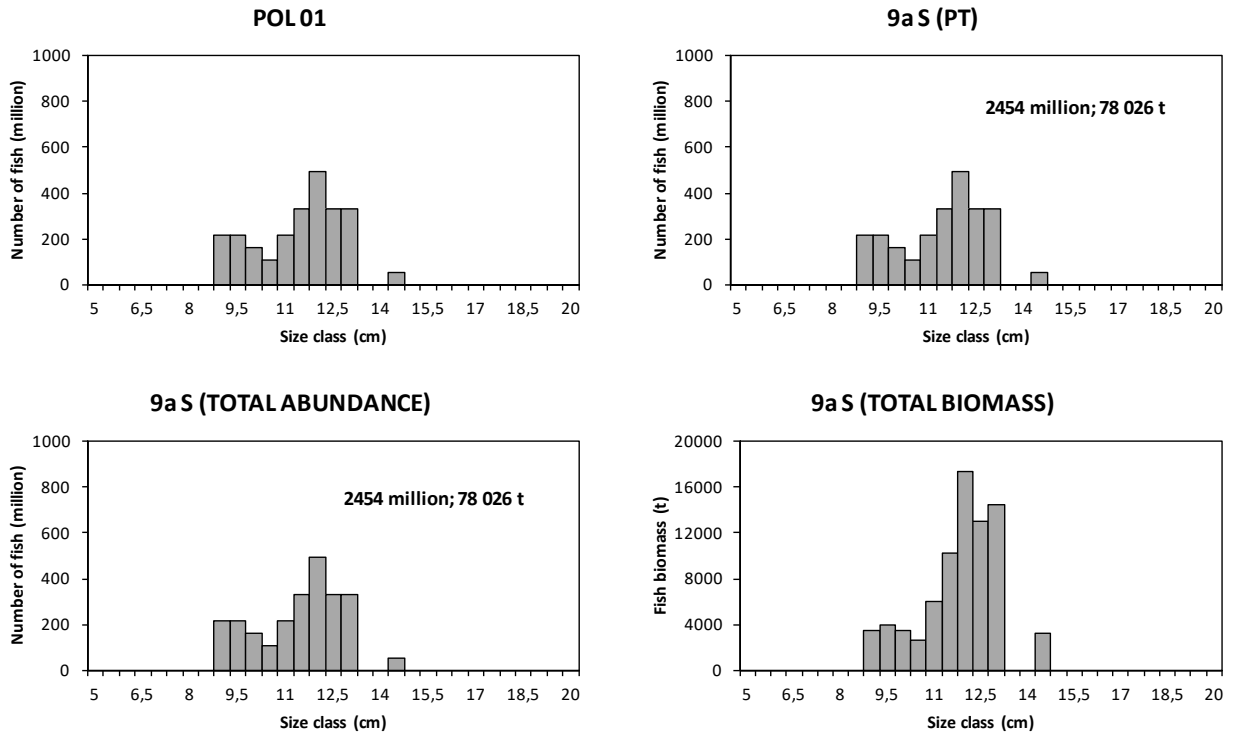


Figure 38. ECOCADIZ-RECLUTAS 2021-10 survey. Longspine snipefish (*Macroramphosus scolopax*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 37**) and total sampled area. Post-strata ordered in the W-E direction. 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.

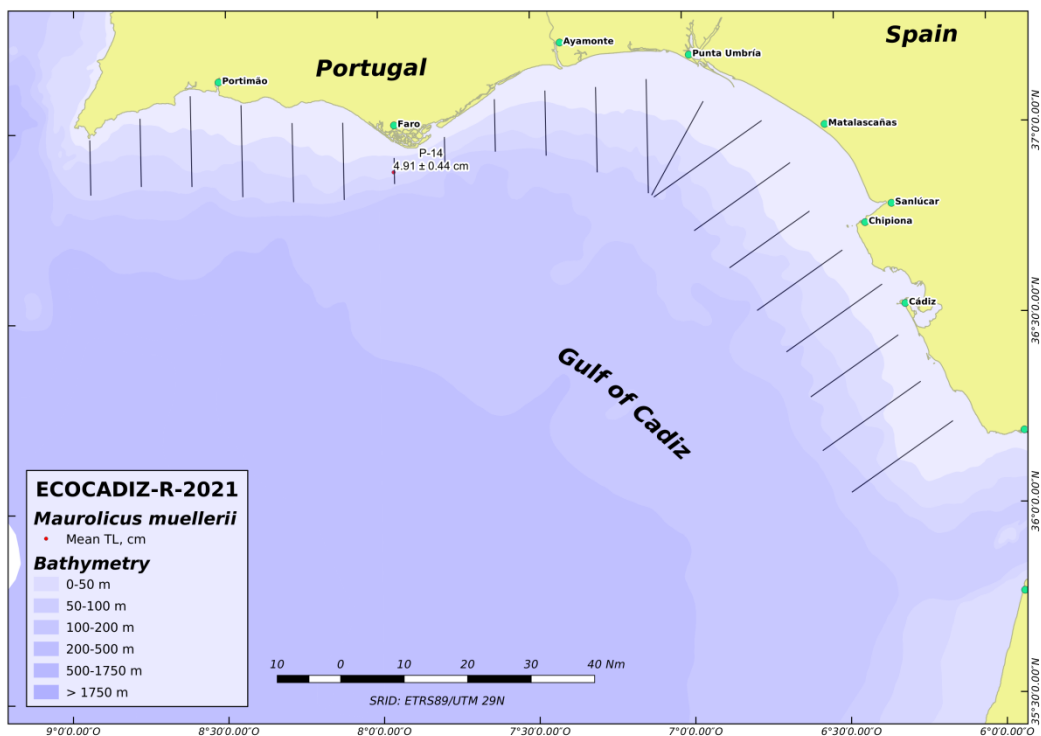
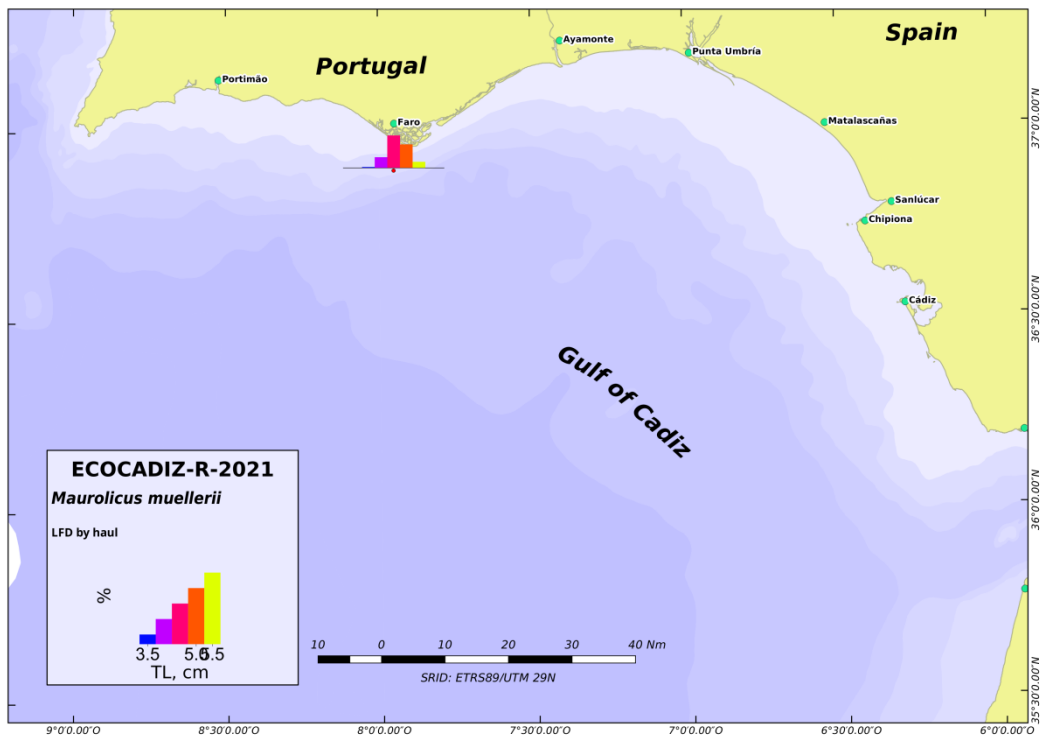


Figure 39. ECOCADIZ-RECLUTAS 2021-10 survey. Pearlside (*Maurolicus muellerii*). Top: length frequency distributions in fishing hauls. Bottom: mean \pm sd length by haul.

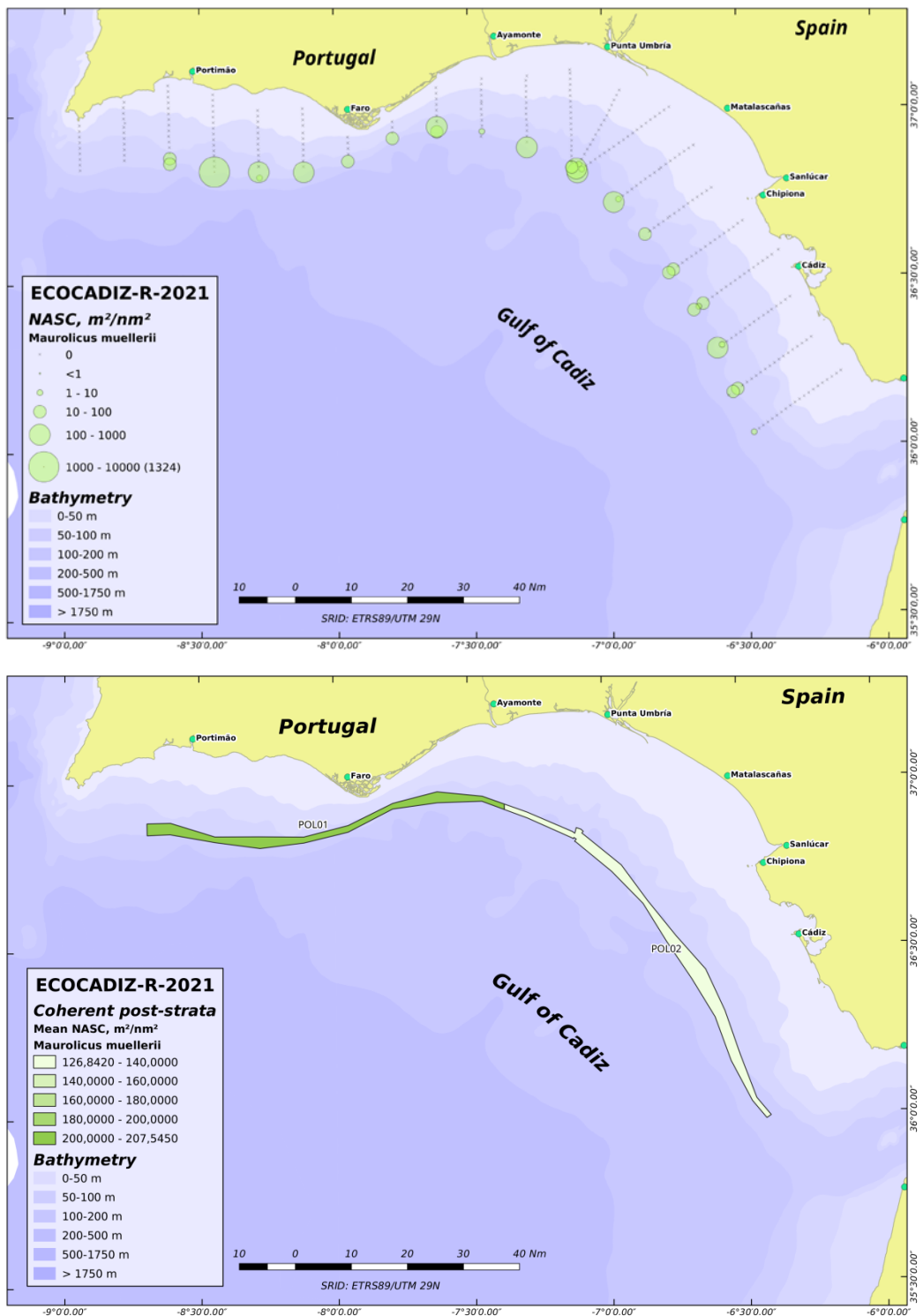


Figure 40. ECOCADIZ-RECLUTAS 2021-10 survey. Pearlside (*Maurolicus muellerii*). Top: distribution of the total backscattering energy (Nautical area scattering coefficient, NASC, in $m^2 nmi^{-2}$) attributed to the species. Bottom: distribution of homogeneous size-based post-strata used in the biomass/abundance estimates. Colour scale according to the mean value of the backscattering energy attributed to the species in each stratum.

ECOCADIZ-RECLUTAS 2021-10: Pearlside (*M. muelleri*)

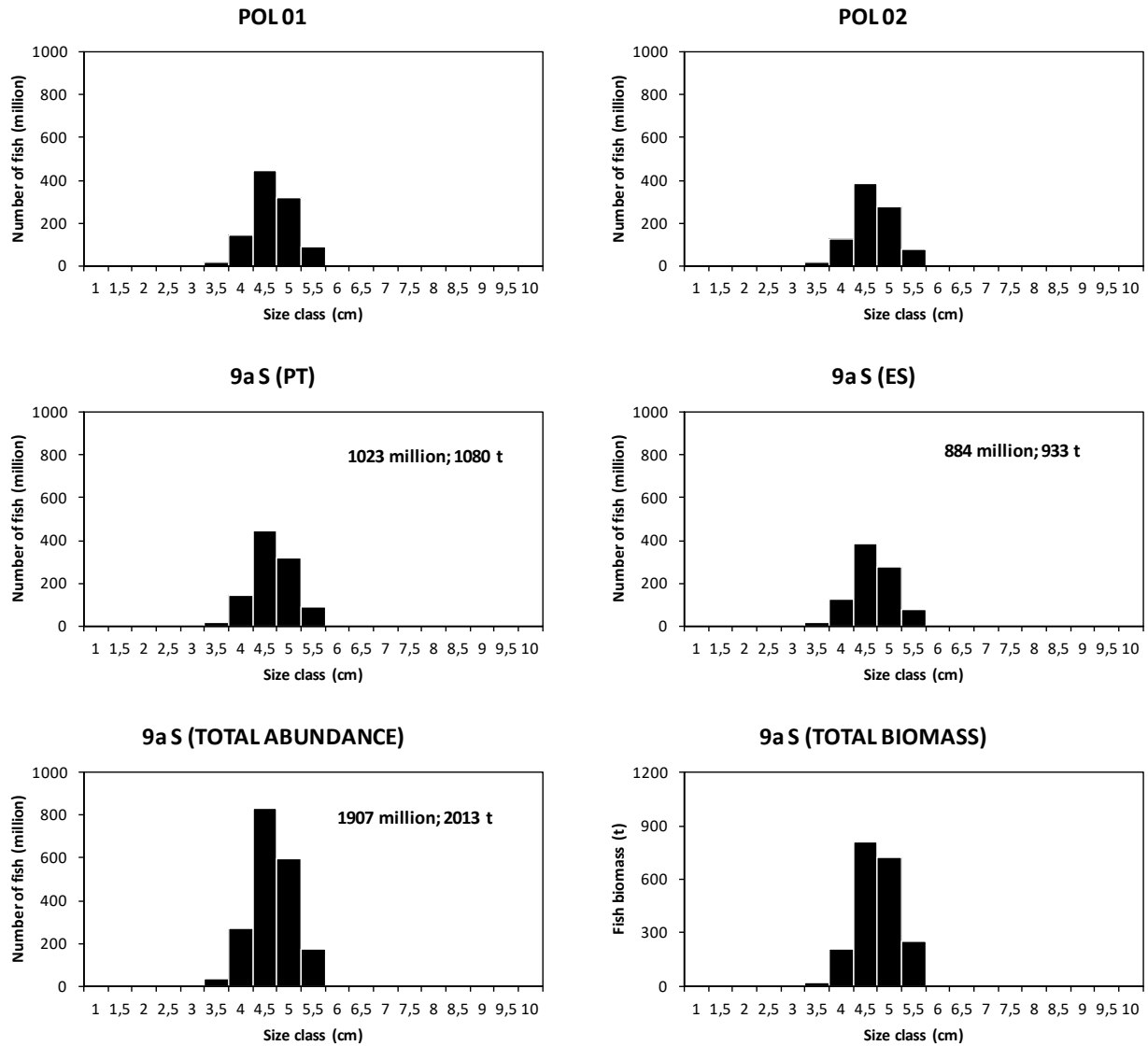


Figure 41. ECOCADIZ-RECLUTAS 2021-10 survey. Pearlside (*Maurolicus muelleri*). Estimated abundances (number of fish in millions) by length class (cm) by homogeneous post-stratum (POL01-POLn, numeration as in **Figure 40**) and total sampled area. Post-strata ordered in the W-E direction. The estimated biomass (t) by size class for the whole sampled area is also shown for comparison. Note the different scales in the y axis.

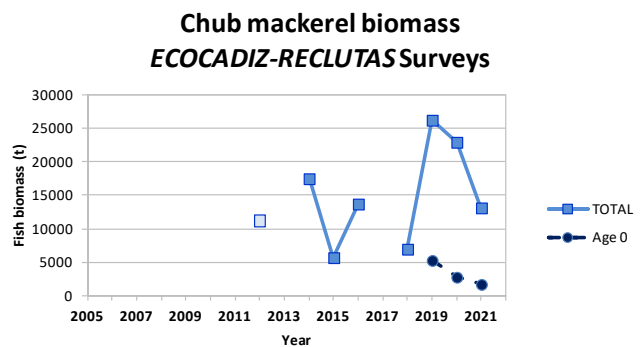
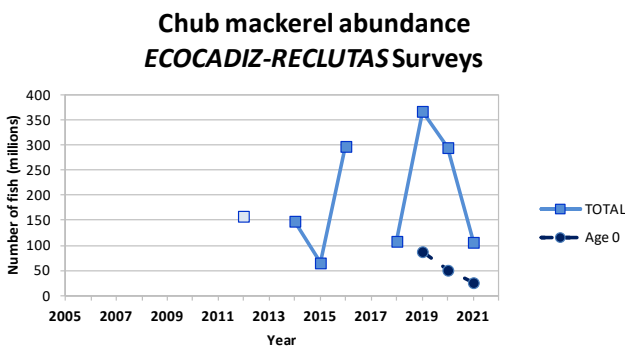
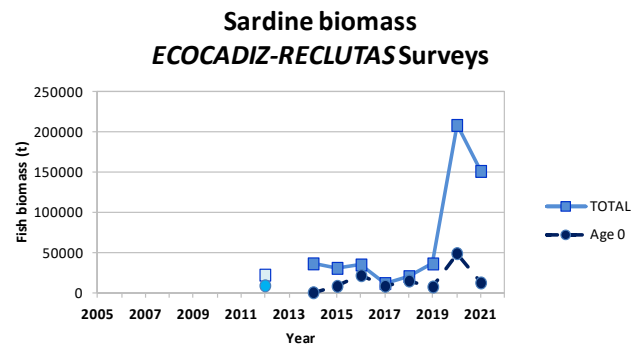
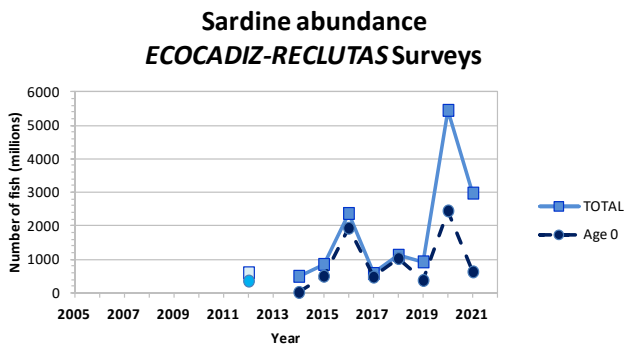
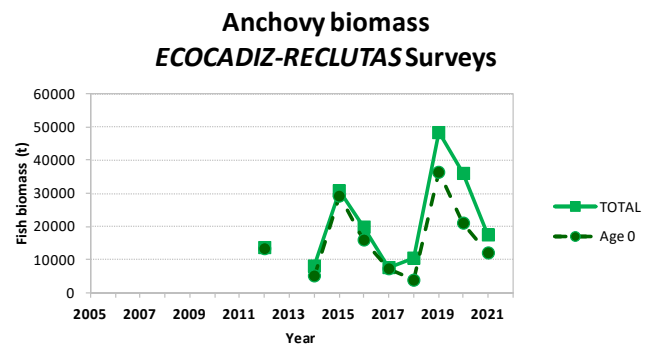
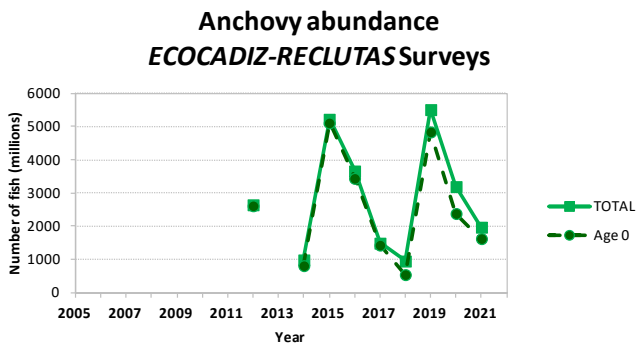


Figure 42. ECOCADIZ-RECLUTAS surveys series. Historical series of autumn acoustic estimates of anchovy, sardine and chub mackerel abundance (million) and biomass (t) in Sub-division 9.a South. The estimates correspond to the total population and age 0 fish. The 2012 survey only surveyed the Spanish waters. No survey was conducted in 2013. Although a survey was conducted in 2017, the survey was interrupted for a serious breakdown of the vessel's propulsion system and no estimates were computed. The 2018 estimates should be considered with caution because a possible under-estimation. Age data for chub mackerel started to be available since 2019 on.