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Studies on life history and stock structure of marine species have evolved in the Azores region during the last 40 years. This information is essential to feed fishery stock assessment models that fit available data to determine current stock status and provide advice on the optimum (sustainable) exploitation. However, most of these data are only available in a fragmented manner in several scientific papers, books, theses and reports. In some cases, these sources of information are difficult to access. The present document aims to gather and summarize biological, ecological and fisheries-related information for the main commercially exploited species in the Azores. The species treated here have previously been selected as priority stocks for assessment and monitoring at regional level by applying a standard framework aligned with the ICES and FAO recommendations. They are: the blackspot seabream *Pagellus bogaraveo*, veined squid *Loligo forbesii*, blue jack mackerel *Trachurus picturatus*, blackbelly rosefish *Helicolenus dactylopterus*, red porgy *Pagrus pagrus*, forkbeard *Phycis phycis*, European conger *Conger conger*, alfonsino *Beryx decadactylus*, splendid alfonsino *B. splendens*, parrotfish *Sparisoma cretense*, silver scabbardfish *Lepidopus caudatus*, red scorpionfish *Scorpaena scrofa*, Atlantic chub mackerel *Scomber colias*, blacktail comber *Serranus atricauda*, offshore rockfish *Pontinus kuhlii*, amberjacks nei *Seriola* spp., common mora *Mora moro*, common spiny lobster *Palinurus elephas*, black scabbardfish *Aphanopus carbo*, rough limpet *Patella aspera*, thornback ray *Raja clavata*, and Mediterranean slipper lobster *Scyllarides latus*. The document is presented as concisely and effectively as possible. An overview table of the current data available is presented by stock.

Key words: fisheries; priority stocks; baseline information; assessment; management.

Régis Santos[1,2](e-mail: regisvinicius@gmail.com), Wendell Medeiros-Leal[1,2], Mário Pinho[1,2]. 1 IMAR Institute of Marine Research, University of the Azores, 9901-862, Horta, Portugal. 2 Okeanos RandD Centre, University of the Azores, 9901-862, Horta, Portugal.

INTRODUCTION

This synopsis is part of the PESCAz project (ref. MAR-01.03.02-FEAMP-0039) financed by the European Maritime and Fisheries Fund (EMFF) through the Regional Government of the Azores under the MAR2020 operational program. The project has as its main goal to contribute to the fulfillment of the Portuguese State's obligations regarding sustainable development, conservation of marine biological resources and fisheries management (e.g. United Nations (UN) Agenda 2030 for Sustainable Development (SDG), the Convention on Biological Diversity, and the European Union (EU) Marine Strategy Framework Directive (MSFD) and Common Fisheries Policy) in the Autonomous Region of the Azores. In the short term, the objective is to identify main fisheries stocks to be monitored, data available for each of these stocks for assessment purposes, applied methodology for assessment and the current stock status. In the long term, it is intended to evaluate which methods for assessment may be suitable for each local stock and apply them using all relevant knowledge to describe the dynamics of resources and fisheries, increasing the forecast reliability. It is expected to evolve from the short to long term objectives by coordinating the research with stakeholders, to establish training actions and participatory relationships, and gradually implement them in the stock assessment process.

The main initial contribution resulting from that project was published in Santos et al. (2020a). In this study, a logical framework for prioritizing commercially exploited stocks was described and applied in the Azores ecoregion (ICES Subdivision 27.10.a.2), including the identification of the current state of selected stocks and the main issues and gaps for assessment. The prioritization process aimed to help managers making the best use of data and resources to manage stocks and it followed the methodology recommended by Food and Agriculture Organization (FAO) and International Council for the Exploration of the Sea (ICES) to report the EU MSFD Descriptor 3 and the UN SDG Indicator 14.4.1 regarding the biological sustainability of marine fisheries. Twenty-two stocks were selected, representing 90% of total landings by commercial value (excluding straddling stocks) and it included species of major importance in terms of ecosystem role and social/cultural considerations. These priority stocks are: blackspot seabream *Pagellus bogaraveo*, veined squid *Loligo forbesii*, blue jack mackerel *Trachurus picturatus*, blackbelly rosefish *Helicolenus dactylopterus*, red porgy *Pagrus pagrus*, forkbeard *Phycis phycis*, European conger *Conger conger*, alfonsino *Beryx decadactylus*, splendid alfonsino *B. splendens*, parrotfish *Sparisoma cretense*, silver scabbardfish *Lepidopus caudatus*, red scorpionfish *Scorpaena scrofa*, Atlantic chub mackerel *Scomber colias*, blacktail comber *Serranus atricauda*, offshore rockfish *Pontinus kuhlii*, amberjacks nei *Seriola* spp., common mora *Mora moro*, common spiny lobster *Palinurus elephas*, black scabbardfish *Aphanopus carbo*, rough limpet *Patella aspera*, thornback ray *Raja clavata*, and Mediterranean slipper lobster *Scyllarides latus*. Once this stock list is defined, subsequent steps involve first-time assessments for previously not assessed stocks, updating existing assessments exploring established methods and information, and finally, upgrading assessments using new data and methods (Santos et al. 2020). For this, it is necessary to summarize all available data for assessment on life history, fishery monitoring and stock abundance data for each stock.

Aspects related to distributional patterns, age and growth parameters, reproductive aspects, and mortality rates of marine species with commercial interest have evolved in the Azores (e.g. Martins 1982, 1985a; Krug 1990; González et al. 1998; Estácio et al. 2001; Menezes et al. 2001; Carvalho et al. 2002; Abecasis et al. 2006, 2009; Pinho et al. 2014; Santos et al. 2019a, b, 2020b, c, 2021). This information is usually derived from scientific surveys (e.g. Pinho et al. 2020) and commercial landings (EU 2008). It helps to define fisheries management units (Uriarte et al. 2014) and feeds analytical stock assessment models, which guide fisheries management (Cadrin & Dickey-Collas 2015). The problem is that most of the published information is not compiled as a common source but spread in several scientific journals, books, theses and reports, which limits and hampers access. To identify inconsistencies and gaps in knowledge,

a literature and source overview is required. Only then we can efficiently indicate where future research should focus.

In this context, we have gathered and summarized biological, ecological, and fisheries-related information available for the main commercially exploited species in the Azores region (ICES Subdivision 27.10.a.2). Our account updates and expands on information in an early overview based on data collected until the early 1990s (Serrão Santos et al. 1995).

MATERIAL AND METHODS

The literature review covered all studies (scientific papers, technical reports, books and theses) performed in the Azorean region (ICES Subdivision 27.10.a.2) on distribution, habitat use, movement patterns, age, growth, length-weight relationship, mortality, reproductive aspects and feeding habits of each priority species, i.e., *Pagellus bogaraveo* (Brünnich, 1768), *Loligo forbesii* Steenstrup, 1856, *Trachurus picturatus* (Bowdich, 1825), *Helicolenus dactylopterus* (Delaroche, 1809), *Pagrus pagrus* (Linnaeus, 1758), *Phycis phycis* (Linnaeus, 1766), *Conger conger* (Linnaeus, 1758), *Beryx decadactylus* Cuvier, 1829, *B. splendens* Lowe, 1834, *Sparisoma cretense* (Linnaeus, 1758), *Lepidopus caudatus* (Euphrasen, 1788), *Scorpaena scrofa* Linnaeus, 1758, *Scomber colias* Gmelin, 1789, *Serranus atricauda* Günther, 1874, *Pontinus kuhlii* (Bowdich, 1825), *Seriola spp.* Cuvier, 1816, *Mora moro* (Risso, 1810), *Palinurus elephas* (Fabricius, 1787), *Aphanopus carbo* Lowe, 1839, *Patella aspera* Röding, 1798, *Raja clavata* Linnaeus, 1758, and *Scyllarides latus* (Latreille, 1803). Available information of ecological and biological aspects is presented as concise and effective as possible.

Explanations for various descriptors and parameters gathered and summarized in this document are given in Table 1.

Table 1. Explanations for descriptors and biological parameters presented.

Descriptor or parameter	Explanation
Scientific name	Genus and species name according to Fricke et al. (2020) and WoRMS (2020).
Common name	Portuguese and English common names according to Froese & Pauly (2019) and Palomares & Pauly (2019).
FAO code	Standard ISO 3-alpha codes taken from the ASFIS list of species for fishery statistics purposes (http://www.fao.org/fishery/collection/asfis/en).
Distribution and habitat	A global description of species distribution and habitat characteristics where they occur.
Movements and stock structure	A description of known movement patterns and stock structure of the species, focusing on stock units' delimitation (FAO 1974).
Age and growth	A general description of known life span of the species.
Reproduction	A general description of known reproductive aspects (reproductive strategy, maturity, spawning, adult sex ratio) of the species.
Feeding habits	A description of the dietary composition of the species.
Fishing importance	A description of the commercial importance of the species for the Azores and the fisheries in which they are caught.
Length-weight relationship	Length-weight relationships represented as $W = a L^b$, where W is total weight in g, L is length (total length - TL, fork length – FL, dorsal mantle length – DML, maximum shell length – MSL or carapace length – CL) in cm (or mm for limpets), and a and b are constants. The sample size, i.e. total number of individuals, (n) and the coefficient of determination (r^2) from the regression analysis are also provided.

Descriptor or parameter	Explanation
Maximum length	The largest individual ever reported in a study.
Maximum age	The oldest specimen aged in a study.
Length at 50% maturity	Length at which the probability of a species being mature is 0.5.
Age at 50% maturity	Age at which the probability of a species being mature is 0.5.
Spawning season	Describes the period during the year when the spawning activity takes place.
Fecundity	Total number of oocytes or eggs produced by individual female during a spawning season.
L_{inf}	The asymptotic length, describing the maximum size that individuals of a population would reach if they were to grow indefinitely.
k	The growth coefficient expressing the rate ($year^{-1}$) at which the asymptotic length is reached.
t_0	The hypothetical age (in years) at which species have zero length.
Mortality rate	Natural mortality (M) referred as death rate ($year^{-1}$) of individuals in a population due to natural causes. Fishing mortality (F) referred as death rate ($year^{-1}$) of individuals in a population as the result of fishing. Total mortality (Z) referred as the coefficient of proportionality accounting for the total number of deaths.
Trophic level	The rank of a species in a food web according to Froese & Pauly (2019) and Palomares & Pauly (2019).

Where information is lacking the terms “NA” or “not available” have been used to indicate a gap in current knowledge, thereby identifying where future research may be needed.

Time series summarizing the main fisheries regulations and management measures applicable for each species were constructed. Commercial landings in value and weight obtained from the Azores Auction Services (Lotaçor S.A.; https://lotacor.pt/pescado-descarregado), abundance indices (relative population number – RPN and relative population weight – RPW) derived from the Azorean spring bottom longline survey (ARQDAÇO-Q1; Pinho et al. 2020), catches per unit effort (nominal and standardized CPUE; ICES, 2020a, b) obtained through the European Commission’s Data Collection Framework (DCF/PNRD; EU 2008), and nominal catches, fishing effort and discard rates reported by governmental statistical offices and downloaded from the International Council for the Exploration of the Sea (ICES) database (https://www.ices.dk/data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx) were summarized graphically by year from 1982 to 2019.

As new management measures and scientific information are constantly becoming available, this document might inevitably be out of date to some extent by the time it is published. Thus, updated editions or complementary papers may be made available during the PESCAz project execution.

SPECIES FACT SHEETS

Blackspot seabream

Scientific name: *Pagellus bogaraveo* (Brünnich, 1768)

Common name: Pt - Carapau, Goraz, Peixão; En - Blackspot seabream

FAO code: SBR

Distribution and habitat: The blackspot seabream *Pagellus bogaraveo* is a sparid fish distributed in the Northeast Atlantic, from south of Norway to Cape Blanc in Mauritania, including Azores, Madeira and Canary archipelagos, and in the Mediterranean Sea (Froese & Pauly 2019). The species occurs on mud, sand and rock bottoms at depths down to 900 m but typically found until 600 m (Santos et al. 2019a). Juveniles are found mainly in shallow and coastal zones (nursery areas), pre-adults in intermediate zones, and adults in deeper and offshore zones (spawning areas; Fischer et al. 1981; Pinho et al. 2014).

Movements and stock structure: Both genetic and tagging studies seem to support the current assumption of three stock units: a) ICES Subareas VI, VII, and VIII (see Appendix I for ICES areas delimitation); b) Subarea IX, and c) Subarea X (Azores region; ICES 2010). In the Azores, the population may have a meta-population structure owing to its discrete spatial distribution around islands and at seamounts separated by areas of deep water where the species does not occur. Migrations and recruitment processes have been thought to connect these subpopulations (Pinho et al. 2014).

Age and growth: Maximum size reported is 70 cm total length (TL) in the Bay of Biscay (ICES Subarea VIII; Guéguen 1969¸ and maximum age 20 years in the Subareas VI, VII and VIII and 10 years in Subarea IX (ICES 2010). In the Azores (ICES Subarea X), maximum size reported is 65 cm fork length (FL; Santos et al. 2019a) and maximum age 16 years (Krug et al. 1998). There are no practical differences in growth between sexes (ICES, 2012).

Reproduction: The blackspot seabream is an oviparous species with protandrous hermaphroditism; individuals are first males, then become females, at 20 cm to 30 cm FL (2-7 years of age). It has a group-synchronous ovarian development, determinate fecundity and batch spawner pattern (Micale et al. 2011). Size-at-maturity is around 30 cm FL (Froese & Pauly 2019). Spawning occurs from January to June, depending on latitude, when the adults move towards the coast up to the edge of the continental shelf (Froese & Pauly 2019). In the Azores, size-at-maturity of males is 28 cm FL and of females 32 cm FL. Spawning between December and March (ICES 2010). Females outnumber males in larger length classes (Estácio et al. 2001).

Feeding habits: Omnivorous, but feeds mainly on small fishes (e.g. myctophids, snipefish), thaliaceans, ophiuroids, gastropods and cephalopods (Morato et al. 2001a).

Fishing importance: The blackspot seabream is the main species targeted by the Azorean demersal fleet using hook and lines. Ranks first in terms of total landed value considering non-straddling stocks (6,4 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 10,57 €.

Table 2. Summary of biological parameters for blackspot seabream *Pagellus bogaraveo* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0200\ FL^{3.020}$ ($n = 666$; $r^2 = 0.98$)	Linear regression	Krug (1983)
	NA	NA	$W = 0.0124\ FL^{3.137}$ ($n = 872$; $r^2 = NA$)	Linear regression	Krug (1985)
	NA	NA	$W = 0.0124\ FL^{3.137}$ ($n = 872$; $r^2 = NA$)	Linear regression	Krug (1986b)
	NA	NA	$W = 0.0124\ FL^{3.137}$ ($n = 872$; $r^2 = NA$)	Linear regression	Krug (1989)
	NA	NA	$W = 0.0186\ FL^{3.025}$ ($n = 638$; $r^2 = 0.99$)	Linear regression	Krug (1994) – period 1
	NA	NA	$W = 0.0094\ FL^{3.218}$ ($n = 412$; $r^2 = 0.99$)	Linear regression	Krug (1994) – period 2
	NA	NA	$W = 0.0189\ FL^{3.005}$ ($n = 866$; $r^2 = NA$)	Linear regression	Silva & Menezes (1996)
	NA	NA	$W = 0.0158\ FL^{3.047}$ ($n = 1783$; $r^2 = 0.99$)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0172\ FL^{3.027}$ ($n = 3998$; $r^2 = 0.99$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	51.0 FL	Length composition	Krug (1983)
	NA	NA	54.0 FL	Length composition	Krug (1985)
	54.0 FL	50.0 FL	54.0 FL	Length composition	Krug (1986a)
	NA	NA	53.0 FL	Length composition	Krug (1986b)
	NA	NA	47.0 FL	Length composition	Silva (1986a)
	NA	NA	53.0 FL	Length composition	Krug (1989)
	54.0 FL	50.0 FL	54.0 FL	Length composition	Krug (1990)
	NA	NA	53.0 FL	Length composition	Krug (1994)
	NA	NA	50.0 FL	Length composition	Silva & Menezes (1996)
	NA	NA	54.0 FL	Length composition	Krug et al. (1998)
	NA	NA	55.0 FL	Length composition	Krug et al. (2000)
	54.0 FL	54.0 FL	54.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	56.0 FL	Length composition	Rosa et al. (2006)
	NA	NA	63.0 FL	Length composition	ICES (2010)
	NA	NA	65.0 FL	Length composition	Santos et al. (2019a)
Maximum age (y)	NA	NA	5	Whole otoliths	Krug (1983)
	NA	NA	15	Whole otoliths	Krug (1985)
	NA	NA	15	Whole otoliths	Krug (1986b)
	NA	NA	15	Whole otoliths	Krug (1989)
	NA	NA	15	Whole otoliths	Silva (1986a)

Parameter	Value			Method	Source
	Female	Male	Combined		
	NA	NA	15	Whole otoliths	Krug (1994) – period 1
	NA	NA	12	Whole otoliths	Krug (1994) – period 2
	NA	NA	16	Whole otoliths	Krug et al. (1998)
	NA	NA	16	Whole otoliths	Krug et al. (2000)
	NA	NA	16	Whole otoliths	Menezes et al. (2001)
Length (cm) at 50% maturity	NA	NA	24.0-25.0 FL	MSF	Krug (1983)
	29.0 FL	27.0 FL	NA	MSF	Krug (1986a)
	29.0 FL	27.0 FL	NA	MSF	Krug (1986b)
	NA	NA	29.0 FL	MSF	Silva (1986a)
	34.6 FL	27.7 FL	NA	MSF	Krug (1990)
	32.3-34.4 FL	26.4-28.2 FL	NA	MSF	Krug (1994)
	29.2 FL	26.2 FL	NA	MSF	Mendonça et al. (1998)
	29.2 FL	26.2 FL	NA	MSF	Krug et al. (2000)
	29.2 FL	26.2 FL	NA	MSF	Estácio et al. (2001)
	32.0 FL	28.0 FL	30.0 FL for hermaphrodites	MSF	ICES (2010)
Age (y) at 50% maturity	NA	NA	4	ALK	Krug (1983)
	5	4	NA	ALK	Krug (1986a)
	5	4	NA	ALK	Krug (1986b)
	NA	NA	5	ALK	Silva (1986a)
	8	5	NA	ALK	Krug (1990)
	4	3	NA	ALK	Mendonça et al. (1998)
	4	3	NA	ALK	Krug et al. (2000)
	4	3	NA	ALK	Estácio et al. (2001)
Spawning season	NA	NA	(Peak: Mar)	MSF, GSI	Krug (1983)
	Jan-Apr (Peak: Feb-Mar)	Jan-Apr (Peak: Feb-Mar)	NA	MSF, GSI	Krug (1986a)
	Jan-Apr (Peak: Feb-Mar)	Jan-Apr (Peak: Feb-Mar)	NA	MSF, GSI	Krug (1986b)
	NA	NA	Dec-Mar	GSI	Silva (1986a)
	Jan-Apr (Peak: Feb-Mar)	Jan-Apr (Peak: Feb-Mar)	NA	MSF, GSI	Krug (1990)
	Dec-Apr (Peak: Jan-Mar)	Nov-Apr (Peak: Jan-Mar)	NA	MSF, GSI	Krug (1994)

Parameter	Value			Method	Source
	Female	Male	Combined		
	Dec-Apr (Peak: Jan-Mar)	Nov-Apr (Peak: Jan-Mar)	NA	MSF, GSI	Krug (1998)
	NA	NA	Jan-Apr (Peak: Feb-Mar)	GSI	Mendonça et al. (1998)
	Dec-Mar (Peak: Feb-Mar)	Dec-Mar (Peak: Feb-Mar)	NA	MSF, GSI	Menezes et al. (2001)
	NA	NA	Dec-Mar (Peak: Jan-Mar)	MSF	ICES (2010)
Fecundity (thousands of oocytes)	73-1500			Ovary analysis	Krug (1986a)
	73-1500			Ovary analysis	Krug (1986b)
	73-1500			Ovary analysis	Krug (1990)
	92-1125			Ovary analysis	Krug (1994)
	92-1125			Ovary analysis	Krug (1998)
L_{inf}	NA	NA	54.26 FL	Direct readings – Whole otoliths	Krug (1985)
	NA	NA	54.69 FL	Back calculation – Dahl-Lea equation	Krug (1985)
	NA	NA	54.26 FL	Direct readings – Whole otoliths	Krug (1986b)
	NA	NA	54.69 FL	Back calculation – Dahl-Lea equation	Krug (1986b)
	NA	NA	54.26 FL	Direct readings – Whole otoliths	Silva (1986a)
	NA	NA	54.69 FL	Back calculation – Dahl-Lea equation	Silva (1986a)
	NA	NA	58.50 FL	Direct readings – Whole otoliths	Krug (1989)
	NA	NA	57.45 FL	Back calculation – Dahl-Lea equation	Krug (1989)
	NA	NA	58.89 FL	Direct readings – Whole otoliths	Krug (1994) – period 1
	NA	NA	64.18 FL	Direct readings – Whole otoliths	Krug (1994) – period 2
	NA	NA	51.21 FL	Back calculation – Dahl-Lea equation	Krug (1994) – period 1
	NA	NA	55.70 FL	Back calculation – Dahl-Lea equation	Krug (1994) – period 2
	NA	NA	51.60 FL	Length-frequency analysis	Krug (1994) – period 1
	NA	NA	81.10 FL	Length-frequency analysis	Krug (1994) – period 2
	NA	NA	54.90 FL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	72.10 FL	Length-frequency analysis	Krug et al. (1998)
	NA	NA	54.90 FL	Direct readings – Whole otoliths	Krug et al. (2000)
	61.39 FL	52.27 FL	56.67 FL	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	56.72 FL	Direct readings – Whole otoliths	ICES (2010)

Parameter	Value			Method	Source
	Female	Male	Combined		
k	NA	NA	0.12	Direct readings – Whole otoliths	Krug (1985)
	NA	NA	0.12	Back calculation – Dahl-Lea equation	Krug (1985)
	NA	NA	0.12	Direct readings – Whole otoliths	Krug (1986b)
	NA	NA	0.12	Back calculation – Dahl-Lea equation	Krug (1986b)
	NA	NA	0.12	Direct readings – Whole otoliths	Silva (1986a)
	NA	NA	0.12	Back calculation – Dahl-Lea equation	Silva (1986a)
	NA	NA	0.12	Whole otoliths	Krug (1989)
	NA	NA	0.1	Back calculation – Dahl-Lea equation	Krug (1989)
	NA	NA	0.12	Direct readings – Whole otoliths	Krug (1994) – period 1
	NA	NA	0.12	Direct readings – Whole otoliths	Krug (1994) – period 2
	NA	NA	0.14	Back calculation – Dahl-Lea equation	Krug (1994) – period 1
	NA	NA	0.15	Back calculation – Dahl-Lea equation	Krug (1994) – period 2
	NA	NA	0.14	Length-frequency analysis	Krug (1994) – period 1
	NA	NA	0.06	Length-frequency analysis	Krug (1994) – period 2
	NA	NA	0.13	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.07	Length-frequency analysis	Krug et al. (1998)
	NA	NA	0.13	Direct readings – Whole otoliths	Krug et al. (2000)
	0.1	0.17	0.14	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	0.13	Direct readings – Whole otoliths	ICES (2010)
t_0	NA	NA	-1.46	Direct readings – Whole otoliths	Krug (1985)
	NA	NA	-0.75	Back calculation – Dahl-Lea equation	Krug (1985)
	NA	NA	-1.46	Direct readings – Whole otoliths	Krug (1986b)
	NA	NA	-0.75	Back calculation – Dahl-Lea equation	Krug (1986b)
	NA	NA	-1.55	Direct readings – Whole otoliths	Krug (1989)
	NA	NA	-1.13	Back calculation – Dahl-Lea equation	Krug (1989)
	NA	NA	-0.91	Direct readings – Whole otoliths	Krug (1994) – period 1
	NA	NA	-0.39	Direct readings – Whole otoliths	Krug (1994) – period 2
	NA	NA	-0.75	Back calculation – Dahl-Lea equation	Krug (1994) – period 1
	NA	NA	-0.34	Back calculation – Dahl-Lea equation	Krug (1994) – period 2

Parameter	Value			Method	Source
	Female	Male	Combined		
	NA	NA	-1.51	Length-frequency analysis	Krug (1994) – period 1
	NA	NA	-2.49	Length-frequency analysis	Krug (1994) – period 2
	NA	NA	-1.83	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-3.43	Length-frequency analysis	Krug et al. (1998)
	NA	NA	-1.83	Direct readings – Whole otoliths	Krug et al. (2000)
	-2.4	-0.51	-1.08	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	-1.96	Direct readings – Whole otoliths	ICES (2010)
	NA	NA	-1.46	Direct readings – Whole otoliths	ICES (2010)
Mortality rate	NA	NA	Z = 0.75 (F = 0.45; M = 0.30)	Z, F: VPA; M: Tanaka (1960)	Krug & Silva (1988)
	NA	NA	Z = 0.97 (F = 0.67; M = 0.30)	Z: F + M; F: Beverton & Holt (1959); M: Tanaka (1960)	Silva (1988)
	NA	NA	(F = 0.05-0.70; M = 0.20)	Z, F: VPA; M: Tanaka (1960)	Krug & Silva (1989)
	NA	NA	Z = 1.00 (F = 0.80; M = 0.20)	Z, F: VPA; M: Tanaka (1960)	Krug (1994)
	NA	NA	Z = 0.40 (F = 0.20; M = 0.20)	Z, F: Catch curve; M: Tanaka (1960)	Pinho (2003)
	NA	NA	Z = 0.50 (F = 0.30; M = 0.20)	Z, F: Catch curve; M: Tanaka (1960)	ICES (2010)
	NA	NA	Z = 0.60 (F = 0.40; M = 0.20)	Z, F: Catch curve; M: combined methods	ICES (2015a)
	NA	NA	Z = 0.66 (F = 0.40; M = 0.26)	Z: Catch curve; F: Thompson & Bell (1934); M: Gislason et al. (2010)	Novoa-Pabon (2015)
	NA	NA	Z = 0.63 (F = 0.43; M = 0.20)	Z: Catch curve; F: Thompson & Bell (1934); M: Gislason et al. (2010)	ICES (2020a)
Trophic level (mean ± s.e.)	NA	NA	3.73 ± 0.56	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: FL: Fork Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; VPA: Virtual Population Analysis; NA: Not Available.

Table 3. Summary of management regulations affecting the blackspot seabream *Pagellus bogaraveo* fishery in the Azores region.

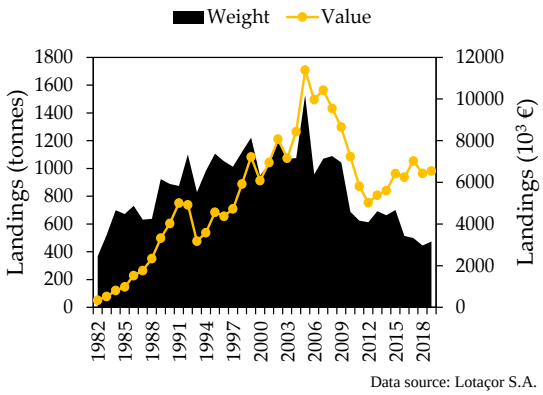
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2002	Regulation (EC) No. 2340/2002 of 16 December 2002	Total allowable catch (TAC/quota)
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size = 12 mm for bottom longline and handlines. Fishing area restriction for longline (allowed to operate outside the 3NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2006	Ordinance No. 40/2006 of 4 May of 2006	Quota allocation between the Azores islands
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Ordinance No. 1/2010 of 18 January 2010	Minimum landing size (MLS) = 30 cm TL or 400 g
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2015	Ordinance No. 74/2015 of 15 June 2015	Closed period (15 Jan – 29 Feb)
2016	Ordinance No. 88/2016 of 12 August 2016	MLS = 32 cm TL or 500 g
2016	Ordinance No. 120/2016 of 27 December 2016	MLS = 33 cm TL or 550 g
2017	Ordinance No. 13/2017 of 31 January 2017	Revocation of the closed period
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

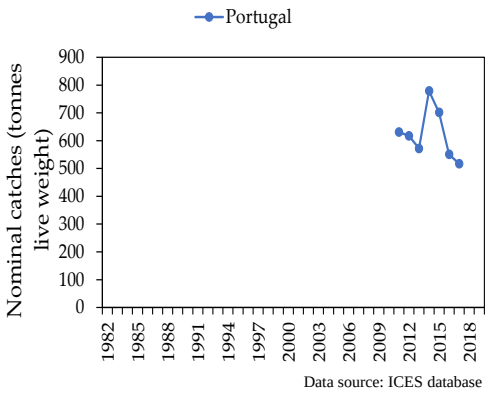
Note: NM: Nautical Miles; TL: Total Length.

Table 4. Time-series of total allowable catches (in tonnes) for the blackspot seabream *Pagellus bogaraveo* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2003	1136
2004	1136
2005	1136
2006	1136
2007	1136
2008	1136
2009	1136
2010	1136
2011	1136
2012	1136
2013	1022
2014	920
2015	678
2016	507
2017	517
2018	517
2019	576
2020	553

Note: * TAC/quota for European Commission's vessels operating in the ICES Subarea X.





[Discard rate]
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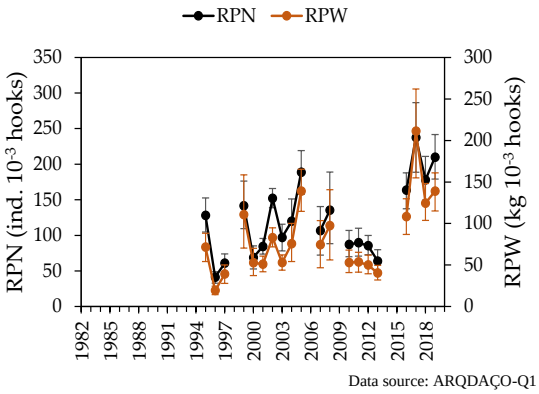
[Fishing effort]
NA



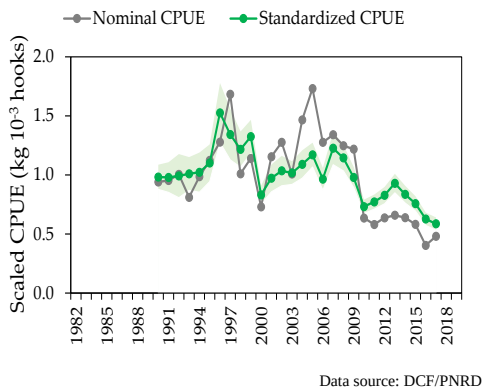


Fig. 1. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for blackspot seabream *Pagellus bogaraveo* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Veined squid

Scientific name: *Loligo forbesii* Steenstrup, 1856

Common name: Pt – Lula, Lula-mansa; En – Veined squid

FAO code: SQF

Distribution and habitat: The veined squid *Loligo forbesii* is a loliginid species distributed in the Northeast Atlantic, from c. 20° N on the west African coast to c. 60° N on the southwest coast of Norway, including Azores, Madeira and Canary archipelagos, and in the Mediterranean Sea (Palomares & Pauly 2019). The species occurs on a variety of substrate types (mud, sand and rock) at depths down to 431 m (Smith et al. 2013; Torres et al. 2017). During the day, veined squids aggregate near the bottom, dispersing at night throughout the water column (Roper et al. 1984).

Movements and stock structure: Both genetic and body morphometric studies seem to support differences between populations inhabiting waters around the Azores (ICES Subarea X) and those along the European and northwest African coasts (Pierce et al. 1994; Brierley et al. 1993; 1995). Large distance and oceanic depths separating these regions may present an effective barrier to the migration. However, it is still unclear whether the veined squids in the Azores differ significantly from other NE Atlantic island groups, such as Madeira (Brierley et al. 1995).

Age and growth: Maximum dorsal mantle length (DML) reported is 90 cm (Roper et al. 1984). Maximum age, 18 months in the European coast (Galician waters; Rocha & Guerra 1999) and Mediterranean Sea (Agus et al. 2018) and 12 months in Irish waters (Collins et al. 1995). There is a general consensus that veined squids can live 15–16 months, with most animals being no more than a year old (Jereb et al. 2015). In the Azores, maximum size reported is 90 cm DML (Martins 1982) and maximum age 17 months (Estácio 1996). Males grow faster and attain a larger size than females.

Reproduction: The veined squid is an oviparous species, with asynchronous oocyte maturation and annual life cycle. It is generally described as semelparous, with an intermittent and terminal spawning, i.e. the females lay eggs in batches and die shortly after completion of spawning (Jereb et al. 2015). Size-at-maturity and timing of peak spawning activity vary across areas (Jereb et al. 2015). In the Azores, males and females became mature before reaching 200 mm DML (Porteiro & Martins 1994). Males outnumber females in the adult stage (Roper et al. 1984).

Feeding habits: Omnivorous, but feeds mainly on small and juvenile fishes (e.g. *Trachurus picturatus*, *Boops boops*, *Lepidopus caudatus*), and to a minor extent on other cephalopods, crustaceans, and polychaetes; cannibalism is common (Martins 1982).

Fishing importance: The fishery is considered artisanal (vessels less than 12 m in length, equipped with handlines and home-made jigs) and opportunistic (the fisherman jig for squid only when they are found in high abundances) in the region (Martins 1982). It is a highly regarded sea food on the Azorean market and ranks second in terms of total landed value considering non-straddling stocks (2,9 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 6,16 €.

Table 4. Summary of biological parameters for veined squid *Loligo forbesii* from the Azores region.

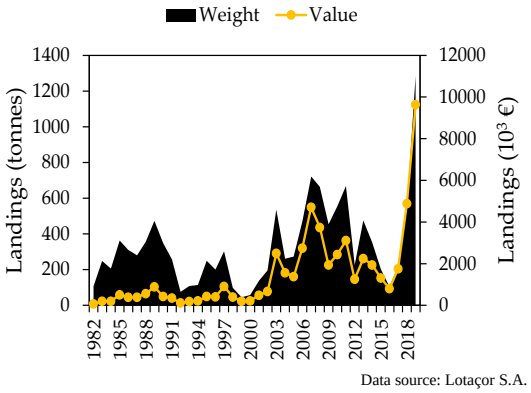
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.425\ DML^{2.184}$ (n = 215; $r^2 = 0.98$)	$W = 0.548\ DML^{2.084}$ (n = 313; $r^2 = 0.99$)	NA	Linear regression	Martins (1982)
	NA	NA	$W = 0.007\ DML^{1.987}$ (n = 55; $r^2 = 0.93$)	Linear regression	Estácio (1996)
Maximum length (cm)	41.0 DML	90.0 DML	90.0 DML	Length composition	Martins (1982)
	34.7 DML	68.8 DML	68.8 DML	Length composition	Estácio (1996)
Maximum age (y)	NA	1.3	NA	Statoliths	Martins (1982)
	NA	NA	1.4	Statoliths	Estácio (1996)
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	Intermittent (Peak: Mar-May)	Intermittent (Peak: Mar-May)	NA	MSF	Martins (1982)
	Intermittent (Peak: Nov-May)	Intermittent	NA	MSF, GSI	Porteiro & Martins (1994)
	NA	NA	Intermittent (Peak: Oct-Nov and May)	FSI	Estácio (1996)
Fecundity (number of eggs; mean ± SD)	2317 ± 1364			Oviduct analysis	Santos (1993)
	2368 ± 1466			Captive egg masses	Pham et al. (2008)
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.29 ± 0.82	Trophic level estimated from a number of food items using a randomized resampling routine.	Palomares & Pauly (2019)

Note: DML: Dorsal Mantle Length; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; FSI: First Statolith Increment; NA: Not Available.

Table 5. Summary of management regulations affecting the veined squid *Loligo forbesii* fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Fishing area restriction by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Squid fishing within 3 NM subject to license
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM). Squid fishing within 3 NM subject to license
2018	Ordinance No. 116/2018 of 25 October 2018	Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing). Squid fishing within 2 NM subject to license

Note: NM: Nautical Miles.



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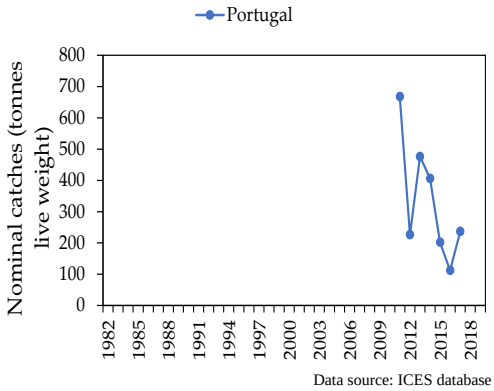

Data source: ICES database

[Discard rate]
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[Fishing effort]
NA

[Survey-derived abundance index]
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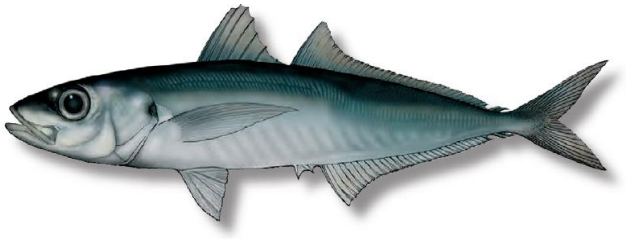
[Nominal and standardized CPUE]
NA

Fig. 2. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for veined squid *Loligo forbesii* in the Azores region. NA: Not Available.

Blue jack mackerel

Scientific name: *Trachurus picturatus* (Bowdich, 1825)

Common name: Pt – Chicharro, Chicharro-do-alto; En – Blue jack mackerel



FAO code: JAA

Distribution and habitat: The blue jack mackerel *Trachurus picturatus* is a carangid fish distributed in the Northeast Atlantic, from southern Bay of Biscay to southern Morocco including Macaronesian archipelagos, Tristan de Cunha and Gough Islands, and in the western part of the Mediterranean Sea (Froese & Pauly 2019). The species occurs in depths to at least 370 m (Carpenter & De Angelis 2016). Juveniles are found mainly in shallow and coastal zones (nursery and growth areas) and adults in offshore zones (feeding areas; Menezes et al. 2001).

Movements and stock structure: Body morphometric, otolith shape and genetic studies indicate that even though the species seems to function as a NE Atlantic population (absence of genetic differentiation among samples in the whole range), phenotypic stocks seem to exist, as a result of local adaption to different environments (Moreira et al. 2020a). Migrations processes have been thought to connect these subpopulations (Moreira et al. 2020b).

Age and growth: Maximum size reported is 65 cm fork length (FL) and maximum age 18 years in the Azores (ICES Subarea X; Garcia et al. 2015). This species grows rapidly during the first year of life and much more slowly after year 3-4 (ICES 2015c). There are no practical differences in growth between sexes (Vasconcelos et al. 2006).

Reproduction: The blue jack mackerel is an oviparous species with asynchronous ovarian development, indeterminate fecundity and batch spawner pattern (Vasconcelos et al. 2017). It becomes mature between 2 and 5 years of age. Spawns from August to May, depending on latitude (Froese & Pauly 2019). In the Azores, size-at-maturity of males is 29 cm FL and of females 28 cm FL (Garcia et al. 2015). Spawning occurs between December and May (Garcia et al. 2015). Overall, males outnumber females (Jurado-Ruzafa & García Santamaría 2013; Garcia et al. 2015).

Feeding habits: Feeds mainly on crustaceans (Carpenter & De Angelis 2016); copepods, euphasids, pteropods, fish larvae, *T. picturatus* juv. (Martins 1978).

Fishing importance: Targeted by the Azorean fleet that operates with several types of surface nets, the most important a boat-operated purse-seine, which mainly targets juvenile fish. Hook-and-line (bottom longline and handline) fisheries also catch this species, but not as a target species (ICES 2019). Ranks third in terms of total landed value considering non-straddling stocks (1,4 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 1,68 €.

Table 6. Summary of biological parameters for blue jack mackerel *Trachurus picturatus* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0068\ FL^{3.141}$ (n = 586; r^2 = NA)	Linear regression	Westhaus-Ekau & Ekau (1982)
	NA	NA	$W = 0.0081\ FL^{3.110}$ (n = 1934; r^2 = 0.99	Linear regression	Isidro (1990a)
	NA	NA	$W = 0.0060\ FL^{3.190}$ (n = 1934; r^2 = 0.99	Linear regression	Isidro (1990b)
	NA	NA	$W = 0.0172\ FL^{3.027}$ (n = 211; r^2 = 0.96)	Linear regression	Rosa et al. (2006)
	$W = 0.0080\ FL^{3.113}$ (n = 1195; r^2 = 0.99)	$W = 0.0090\ FL^{3.069}$ (n = 1333; r^2 = 0.99)	$W = 0.0090\ FL^{3.087}$ (n = 2528; r^2 = 0.99)	Linear regression	Garcia et al. (2015)
	NA	NA	$W = 0.0072\ FL^{3.146}$ (n = 3372; r^2 = 0.99)	Linear regression	ICES (2015b)
Maximum length (cm)	NA	NA	54.0 TL	Length composition	Martins (1978)
	48.0 TL	46.0 TL	48.0 TL	Length composition	Westhaus-Ekau & Ekau (1982)
	NA	NA	43.0 FL	Length composition	Isidro (1990a)
	NA	NA	42.0 FL	Length composition	Isidro (1990b)
	NA	NA	42.5 FL	Length composition	Isidro (1996)
	NA	NA	53.0 FL	Length composition	Rosa et al. (2006)
	49.8 FL	54.2 FL	65.0 FL	Length composition	Garcia et al. (2015)
Maximum age (y)	14	13	14	Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	9	Sliced otoliths	Isidro (1990a)
	NA	NA	9	Sliced otoliths	Isidro (1990b)
	NA	NA	18	Whole otoliths	ICES (2015b)
	NA	NA	18	Whole otoliths	Garcia et al. (2015)
Length (cm) at 50% maturity	NA	NA	21.0 TL	MSF	Westhaus-Ekau & Ekau (1982)
	NA (14.0 FL*)	NA (15.0 FL*)	NA	MSF	Isidro (1990b)
	27.7 FL	28.8 FL	NA	MSF	Garcia et al. (2015)
	NA	NA	28.5 FL	MSF	ICES (2015b)
Age (y) at 50% maturity	NA	NA	2.0	ALK	Westhaus-Ekau & Ekau (1982)
	4.4	5.1	NA	ALK	Garcia et al. (2015)
Spawning season	NA	NA	Feb-Jul	MSF	Westhaus-Ekau & Ekau (1982)
	Feb-Mar	Feb-Mar	Feb-Mar	GSI	Isidro (1990b)
	Dec-May (Peak: Mar)	Dec-May (Peak: Feb)	NA	GSI	Garcia et al. (2015)
Fecundity (thousands of oocytes)	NA				

Parameter	Value			Method	Source
	Female	Male	Combined		
L_{inf}	NA	NA	51.05 TL	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	52.90 FL	Direct readings – Sliced otoliths	Isidro (1990a)
	NA	NA	59.90 FL	Direct readings – Sliced otoliths	Isidro (1990b)
	NA	NA	62.65 FL	Direct readings – Whole otoliths	ICES (2015b)
	62.10 FL	64.40 FL	58.30 FL	Direct readings – Whole otoliths	Garcia et al. (2015)
	51.40 FL	60.20 FL	52.90 FL	Back calculation – Monastyrsky equation	Garcia et al. (2015)
k	NA	NA	0.14	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	0.20	Direct readings – Sliced otoliths	Isidro (1990a)
	NA	NA	0.20	Direct readings – Sliced otoliths	Isidro (1990b)
	NA	NA	0.08	Direct readings – Whole otoliths	ICES (2015b)
	0.08	0.07	0.09	Direct readings – Whole otoliths	Garcia et al. (2015)
	0.12	0.08	0.11	Back calculation – Monastyrsky equation	Garcia et al. (2015)
t_0	NA	NA	-1.58	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	-0.23	Direct readings – Sliced otoliths	Isidro (1990a)
	NA	NA	-0.23	Direct readings – Sliced otoliths	Isidro (1990b)
	NA	NA	-2.82	Direct readings – Whole otoliths	ICES (2015b)
	-3.11	-3.34	-2.67	Direct readings – Whole otoliths	Garcia et al. (2015)
	-2.18	-2.78	-2.45	Back calculation – Monastyrsky equation	Garcia et al. (2015)
Mortality rate	NA	NA	M = 0.20-0.30	Hoenig (1983), Jensen (1996)	ICES (2015c)
Trophic level (mean ± s.e.)	NA	NA	3.32 ± 0.42	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: FL: fork length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; M: Natural Mortality; NA: Not Available.
* Estimated value corresponds to the length at first maturity.

Table 7. Summary of management regulations affecting the blue jack mackerel *Trachurus picturatus* fishery in the Azores region.

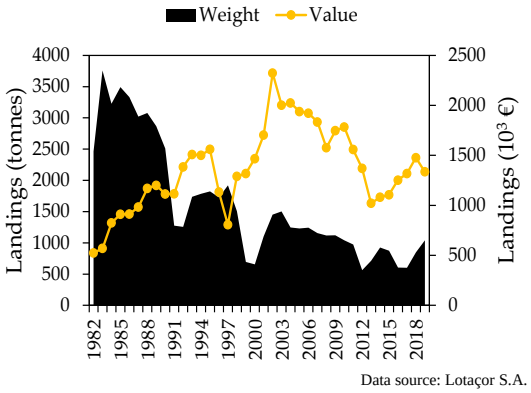
Year of implementation	Legislation	Measure
1999	Regulation (EC) No. 308/1999 of 8 February 1999	Minimum landing size (MLS) = 15 cm TL
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Purse-seine Fishing Regulation
2001	Regulation (EC) No. 724/2001 of 4 April 2001	Revocation of the MLS for Azorean waters
2001	Ordinance No. 57/2001 of 13 September 2001	Minimum mesh size = 16 mm for purse-seine (except for live bait: 8 mm). Fishing area restrictions: allowed to operate outside the 0.25 NM area and deeper than 30 m (except for live bait)
2003	Regulation (EC) No. 2341/2002 of 20 December 2002	Total allowable catch (TAC/quota)
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size = 12 mm for bottom longline and handlines. Fishing area restriction for longline (allowed to operate outside the 3NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Ordinance No. 65/2014 of 6 October 2014	Lift nets of any kind can be used at any distance from the coast or bathymetric
2014	Ordinance No. 65/2014 of 8 October 2014	Conditions for purse-seine fishing and lift nets in São Miguel and Terceira islands.
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

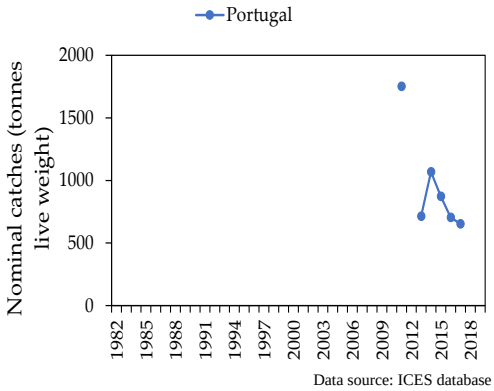
Note: NM: Nautical Miles; TL: Total Length.

Table 8. Time-series of total allowable catches (in tonnes) for the blue jack mackerel *Trachurus* spp. fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2003	3200
2004	3200
2005	3200
2006	3200
2007	3200
2008	3200
2009	3200
2010	3072
2011	3072
2012	3072
2013	3072
2014	3072
2015	3072
2016	3072
2017	3072
2018	3072
2019	3072
2020	3072

Note: *TAC/quota allocated to Portugal, ICES Subarea X and CECAF 34.1.1 (see Appendix I)





[Discard rate]
NA

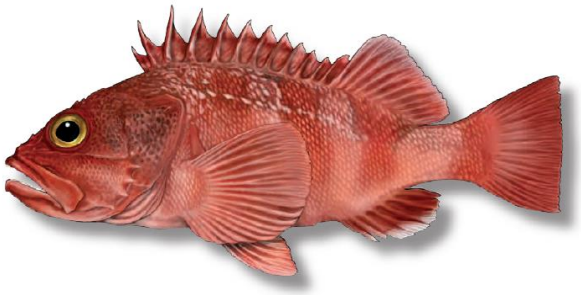
[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 3. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for blue jack mackerel *Trachurus picturatus* in the Azores region. NA: Not Available.

Blackbelly rosefish



Scientific name: *Helicolenus dactylopterus* (Delaroche, 1809)

Common name: Pt – Boca-negra; En – Blackbelly rosefish

FAO code: BRF

Distribution and habitat: The blackbelly rosefish *Helicolenus dactylopterus* is a scorpionfish widely distributed in the Atlantic Ocean, from west (Nova Scotia to Venezuela) to east (Iceland and Norway to South Africa, including the Macaronesian archipelagos), and in the Mediterranean Sea (Froese & Pauly 2019). The species occurs on soft bottoms at depths between 50 and 1100 m but usually found between 350 and 800 m (Santos et al. 2020b). Juveniles are found mainly in shallow zones (nursery and growth areas) and adults in deeper ones (Santos et al. 2020b).

Movements and stock structure: Body morphometric, otolith, genetic and tagging studies seem to support the current assumption of three stock units in Portuguese waters: a) Azores (ICES Subarea X); b) Madeira, and c) mainland Portugal (Subarea IX; Aboim 2005; Sequeira et al. 2011; Higgins et al. 2013; Santos et al. 2020b). In the Azores, the population have a strongly sedentary behaviour with an intraregional separation among subpopulations within the archipelago (Santos et al. 2020b).

Age and growth: Maximum size reported is 56 cm total length (TL) in the Azores (ICES Subarea X; Santos et al. 2020b). Maximum age, 43 years in French waters (Allain & Lorance, 2000) and 32 years in the Azores (Abecasis et al. 2006; Santos et al. 2020b). Males grow faster than females (Abecasis et al. 2006).

Reproduction: The blackbelly rosefish is a zygoparous species with asynchronous ovarian development and batch spawner pattern (Muñoz et al. 2010). It becomes mature between 3 and 5 years of age (Estácio et al. 2001). Females are internally inseminated. The sperm are reairned inside the ovaries for a period that may reach 6 to 7 months before spawning (Mendonça et al. 2006), which takes place where adults occur, from December to April depending on the area (Froese & Pauly 2019). Eggs with embryos are released enclosed in a gelatinous matrix and larvae develop in surface-water layer (Santos et al. 2020b). In the Azores, size-at-maturity of males is 28 cm TL and of females 22 cm TL (Estácio et al. 2001). Spawning occurs between January and March (Mendonça et al. 2006). Males outnumber females in larger length classes (Santos et al. 2020b).

Feeding habits: Feeds on benthic and pelagic crustaceans, fishes, cephalopods, and echinoderms (Hureau & Litvinenko 1986).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines and caught as bycatch in blackspot seabream fishery. Ranks fourth in terms of total landed value considering non-straddling stocks (1,3 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 5,07 €.

Table 9. Summary of biological parameters for blackbelly rosefish *Helicolenus dactylopterus* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0099 TL^{3.180}$ (n = 543; r^2 = 0.99)	$W = 0.0108 TL^{3.140}$ (n = 560; r^2 = 0.99)	$W = 0.0107 TL^{3.150}$ (n = 1324; r^2 = 0.99)	Linear regression	Isidro (1989)
	NA	NA	$W = 0.0214 TL^{2.943}$ (n = 519; r^2 = NA)	Linear regression	Silva & Menezes (1996)
	NA	NA	$W = 0.0124 TL^{3.104}$ (n = 1630; r^2 = 0.98)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0140 TL^{3.058}$ (n = 3753; r^2 = 0.98)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	41.0 TL	38.0 TL	41.0 TL	Length composition	Isidro (1987)
	39.5 TL	41.5 TL	41.5 TL	Length composition	Isidro (1989)
	NA	NA	52.5 TL	Length composition	Isidro (1996)
	NA	NA	40.0 TL	Length composition	Silva & Menezes (1996)
	47.0 TL	47.0 TL	47.0 TL	Length composition	Esteves et al. (1997)
	NA	NA	47.0 TL	Length composition	Krug et al. (1998)
	NA	NA	51.0 TL	Length composition	Barão (1999)
	NA	NA	48.0 TL	Length composition	ICES (2000)
	NA	NA	48.0 TL	Length composition	Krug et al. (2000)
	48.0 TL	46.0 TL	48.0 TL	Length composition	Menezes et al. (2001)
	46.0 TL	48.0 TL	48.0 TL	Length composition	Silva (2002)
	42.0 TL	47.0 TL	47.0 TL	Length composition	Abecasis et al. (2006)
	NA	NA	49.0 TL	Length composition	Rosa et al. (2006)
	NA	NA	56.0 TL	Length composition	Santos et al. (2020b)
Maximum age (y)	12	16	NA	Whole otoliths	Isidro (1987)
	15	15	15	Whole otoliths	Isidro (1989)
	12	14	NA	Whole otoliths	Esteves et al. (1997)
	NA	NA	16	Whole otoliths	Krug et al. (1998)
	NA	NA	16	Whole otoliths	Barão (1999)
	NA	NA	13	Whole otoliths	Menezes et al. (2001)
	NA	NA	16	Whole otoliths	ICES (2000)
	NA	NA	16	Whole otoliths	Krug et al. (2000)
	13	15	15	Whole otoliths	Silva (2002)
	28	32	NA	Sliced otoliths	Abecasis et al. (2006)
	NA	NA	32	Whole otoliths	Tanner et al. (2020)
Length (cm) at 50% maturity	20.1 TL	21.1 TL	NA	MSF	Isidro (1989)
	21.8 TL	28.1 TL	NA	MSF	Mendonça et al. (1998)

Parameter	Value			Method	Source
	Female	Male	Combined		
	20.9 TL	26.0 TL	NA	MSF	ICES (2000)
	21.8 TL	28.1 TL	NA	MSF	Krug et al. (2000)
	21.8 TL	28.1 TL	NA	MSF	Estácio et al. (2001)
	18.6 TL	17.2 TL	NA	MSF	Sequeira et al. (2012)
Age (y) at 50% maturity	3.6	4.4	NA	ALK	Isidro (1989)
	3	5	NA	ALK	Mendonça et al. (1998)
	2	4	NA	ALK	ICES (2000)
	3	5	NA	ALK	Krug et al. (2000)
	3	5	NA	ALK	Estácio et al. (2001)
Spawning season	Jan-Apr/May	Jul-Sep/Oct	NA	GSI, MSF	Isidro (1989)
	Jan-Apr/May	Jun-Oct	NA	GSI	Mendonça et al. (1998)
	Jan-May (Peak: Jun-Jul)	Jan-May (Peak: Jun-Jul)	Jan-May (Peak: Jun-Jul)	GSI	ICES (2000)
	Jan-May (Peak: Jun-Jul)	Jan-May (Peak: Jun-Jul)	Jan-May (Peak: Jun-Jul)	GSI	Krug et al. (2000)
	Jan-May (Peak: Jan)	NA	NA	MSF, GSI	Estácio et al. (2001)
	Nov-May	Apr-Dec	NA	MSF	Menezes et al. (2001)
	(Peak: Jan-Mar)	(Peak: May-Oct)	NA	GSI	Menezes et al. (2001)
	Jan-Mar	Jul-Nov	NA	MSF, GSI	Mendonça et al. (2006)
	Dec-Mar (Peak: Dec-Feb)	Jun-Dec (Peak: Jun-Oct)	NA	MSF, GSI	Sequeira et al. (2012)
Fecundity (thousands of oocytes)	NA				
L_{inf}	38.89 TL	44.88 TL	NA	Direct readings – Whole otoliths	Isidro (1987)
	42.00 TL	41.00 TL	42.00 TL	Direct readings – Whole otoliths	Isidro (1989)
	54.70 TL	50.20 TL	NA	Direct readings – Whole otoliths	Esteves et al. (1997)
	52.60 TL	57.40 TL	NA	Back calculation – Fraser-Lee equation	Esteves et al. (1997)
	56.00 TL	65.30 TL	NA	Length-frequency analysis	Esteves et al. (1997)
	NA	NA	50.50 TL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	50.50 TL	Length-frequency analysis	Krug et al. (1998)
	NA	NA	56.90 TL	Direct readings – Whole otoliths	Barão (1999)
	NA	NA	48.30 TL	Direct readings – Whole otoliths	ICES (2000)
	NA	NA	48.30 TL	Direct readings – Whole otoliths	Krug et al. (2000)
	50.62 TL	52.09 TL	50.90 TL	Direct readings – Whole otoliths	Menezes et al. (2001)
	48.30 TL	54.10 TL	51.60 TL	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	53.00 TL	Length-frequency analysis	Silva (2002)
	56.53 TL	59.06 TL	NA	Direct readings – Whole otoliths	Abecasis et al. (2006)

Parameter	Value			Method	Source
	Female	Male	Combined		
	57.08 TL	54.81 TL	NA	Direct readings – Sliced otoliths	Abecasis et al. (2006)
k	0.18	0.11	NA	Direct readings – Whole otoliths	Isidro (1987)
	0.10	0.11	0.10	Direct readings – Whole otoliths	Isidro (1989)
	0.10	0.16	NA	Direct readings – Whole otoliths	Esteves et al. (1997)
	0.11	0.11	NA	Back calculation – Fraser-Lee equation	Esteves et al. (1997)
	0.15	0.13	NA	Length-frequency analysis	Esteves et al. (1997)
	NA	NA	0.14	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.16	Length-frequency analysis	Krug et al. (1998)
	NA	NA	0.10	Direct readings – Whole otoliths	Barão (1999)
	NA	NA	0.16	Direct readings – Whole otoliths	ICES (2000)
	NA	NA	0.16	Direct readings – Whole otoliths	Krug et al. (2000)
	0.15	0.16	0.16	Direct readings – Whole otoliths	Menezes et al. (2001)
	0.16	0.13	0.14	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	0.08	Length-frequency analysis	Silva (2002)
	0.07	0.07	NA	Direct readings – Whole otoliths	Abecasis et al. (2006)
	0.05	0.06	NA	Direct readings – Sliced otoliths	Abecasis et al. (2006)
t_0	-0.42	-1.83	NA	Direct readings – Whole otoliths	Isidro (1987)
	-2.87	-2.05	-2.26	Direct readings – Whole otoliths	Isidro (1989)
	-1.16	0.05	NA	Direct readings – Whole otoliths	Esteves et al. (1997)
	-0.24	-0.32	NA	Back calculation – Fraser-Lee equation	Esteves et al. (1997)
	1.08	0.71	NA	Length-frequency analysis	Esteves et al. (1997)
	NA	NA	-1.23	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-0.46	Length-frequency analysis	Krug et al. (1998)
	NA	NA	-2.23	Direct readings – Whole otoliths	Barão (1999)
	NA	NA	-1.13	Direct readings – Whole otoliths	ICES (2000)
	NA	NA	-1.13	Direct readings – Whole otoliths	Krug et al. (2000)
	-1.59	-1.10	-1.10	Direct readings – Whole otoliths	Menezes et al. (2001)
	-1.22	-1.74	-1.60	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	-1.00	Length-frequency analysis	Silva (2002)
	-1.13	-0.21	NA	Direct readings – Whole otoliths	Abecasis et al. (2006)
	-2.28	-2.29	NA	Direct readings – Sliced otoliths	Abecasis et al. (2006)
Mortality rate	NA	NA	M = 0.30	Rikhter & Efanov (1976)	Isidro (1996)
	NA	NA	M = 0.25	Pauly (1980)	Isidro (1996)
	NA	NA	M = 0.20	Pauly (1980) – 0.8 multiplying factor	Isidro (1996)

Parameter	Value			Method	Source
	Female	Male	Combined		
	NA	NA	M = 0.13	Alagaraja (1984)	Isidro (1996)
	NA	NA	Z = 0.15 (F = 0.05; M = 0.10)	Z: Catch curve; F: Beverton & Holt (1959); M: combined methods	Isidro (1996)
	NA	NA	M = 0.19	Tanaka (1960)	Barão (1999)
	NA	NA	M = 0.49	Rikhter & Efanov (1976)	Barão (1999)
	NA	NA	M = 0.27	Pauly (1980)	Barão (1999)
	NA	NA	Z = 0.39 (F = 0.17; M = 0.22)	Z: F + M; F: VPA; M: combined methods	Barão (1999)
Trophic level (mean ± s.e.)	NA	NA	3.80 ± 0.58	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; VPA: Virtual Population Analysis; NA: Not Available.

Table 10. Summary of management regulations affecting the blackbelly rosefish *Helicolenus dactylopterus* in the Azores region.

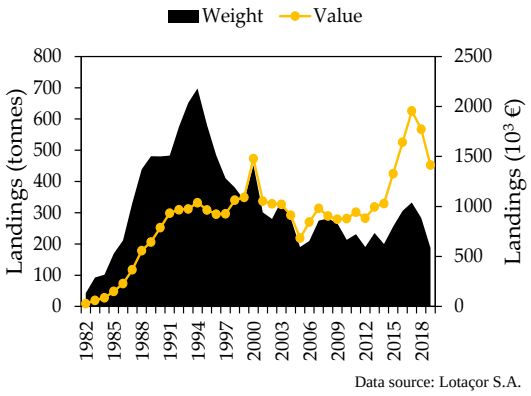
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket.
2010	Ordinance No. 1/2010 of 18 January 2010	Minimum landing size (MLS) = 25 cm TL or 250 g
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2017	Ordinance No. 13/2017 of 31 January 2017	MLS = 27 cm TL
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2019	Ordinance No. 63/2019 of 12 September 2019	MLS = 30 cm TL
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

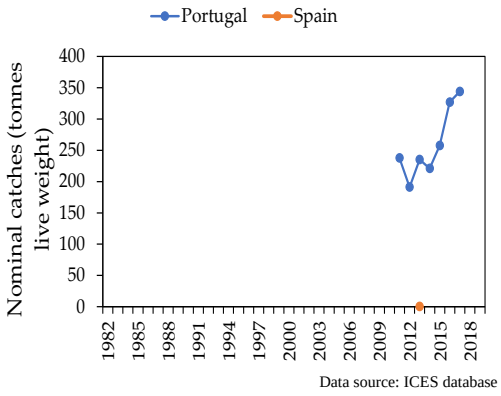
Note: NM: Nautical Miles; TL: Total Length.

Table 11. Time-series of total allowable catches (in tonnes) for the blackbelly rosefish *Helicolenus dactylopterus* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	250

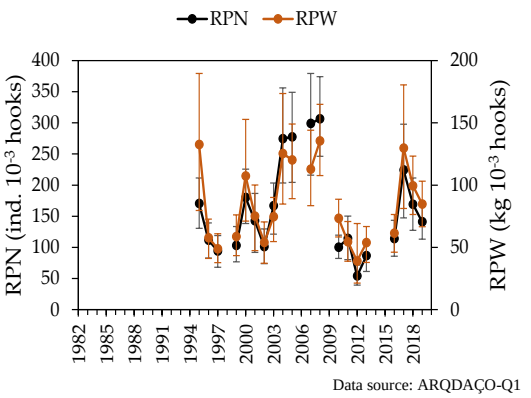
Note: *TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

[Fishing effort]
NA



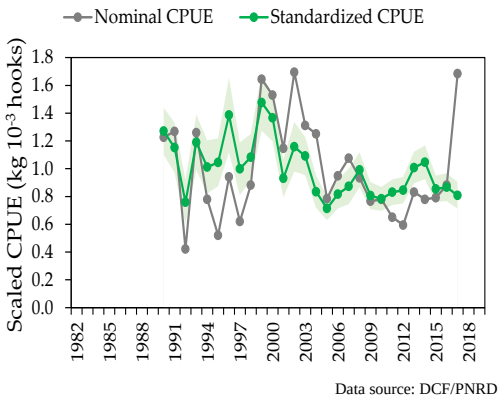
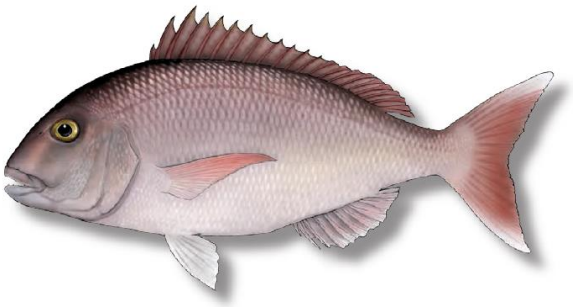


Fig. 4. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for blackbelly rosefish *Helicolenus dactylopterus* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Red Porgy



Scientific name: *Pagrus pagrus* (Linnaeus, 1758)

Common name: Pt – Pargo, Parguete; En – Red porgy

FAO code: RPG

Distribution and habitat: The red porgy *Pagrus pagrus* is a sparid fish widely distributed in the Eastern Atlantic (English Channel to Western Sahara, including Macaronesian archipelagos), Western Atlantic (United States to Argentina, including the Gulf of Mexico but not the eastern Caribbean Sea) and Mediterranean Sea (Robins & Ray 1986). The species shows a considerable site fidelity, living on rock, rubble, or sand bottoms down to 250 m depth (Bauchot & Hureau 1990; Pinho et al. 2020), usually between 10 m and 80 m (Cervigón 1993; Pinho et al. 2020).

Movements and stock structure: Genetic studies support the existence of an Azorean population unit within the eastern North Atlantic (Ball et al. 2007).

Age and growth: Maximum size reported is 91 cm total length (TL; Lieske & Myers 1994). Maximum age, 18 years in the North Carolina, USA (Pots & Manooch 2002). In the Azores (ICES Subarea X), maximum size reported is 71 cm fork length (FL) and maximum age 17 years (Krug et al. 1998). Since it is a protogynous hermaphrodite and undergo a size- and behaviour-related transition from females to males, no comparison of growth rates between sexes is usually carried out.

Reproduction: The red porgy is an oviparous species with protogynous hermaphroditism (Kokokiris et al. 1999). It has asynchronous ovarian development, indeterminate fecundity and sequential spawner pattern (Daniel 2003; Mylonas et al. 2004). Size-at-maturity occurs at 3 years of age (about 24 cm TL; Froese & Pauly 2019). Spawning tends to be in spring, depending on the seawater temperature (Manooch 1976; Manooch & Hassler 1978; Pajuelo & Lorenzo 1996; Mylonas et al. 2004). Eggs and larvae are pelagic, and juveniles are distributed more inshore than adult populations (Manooch & Hassler 1978). In the Azores, size-at-maturity of males is 33 cm FL and of females 30 cm. Spawning occurs between March and July (Mendonça et al. 1998). For most size categories, proportion of males to females is close to 1:1 (Mendonça et al. 1998).

Feeding habits: Carnivore, feeds on crustaceans, small fishes and molluscs (Bauchot & Hureau 1990).

Fishing importance: Targeted by the Azorean demersal coastal fishery using hook and lines. Ranks fifth in terms of total landed value considering non-straddling stocks (0,9 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 10,07 €.

Table 12. Summary of biological parameters for red porgy *Pagrus pagrus* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0402\ FL^{2.849}$ ($n = 393$; $r^2 = 0.99$)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0388\ FL^{2.856}$ ($n = 884$; $r^2 = 0.99$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	71.0 FL	Length composition	Serafim (1995)
	NA	NA	71.0 FL	Length composition	Serafim & Krug (1995)
	NA	NA	71.0 FL	Length composition	Krug et al. (1998)
	66.0 FL	64.0 FL	66.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	66.0 FL	Length composition	Rosa et al. (2006)
Maximum age (y)	NA	NA	13	Whole otoliths	Serafim (1995)
	NA	NA	13	Whole otoliths	Serafim & Krug (1995)
	NA	NA	17	Whole otoliths	Krug et al. (1998)
Length (cm) at 50% maturity	29.9 FL	33.3 FL	NA	MSF	Mendonça et al. (1998)
Age (y) at 50% maturity	4	5	NA	ALK	Mendonça et al. (1998)
Spawning season	NA	NA	Mar-Jul (Peak: Mar-May)	GSI	Mendonça et al. (1998)
	(Peak: May)	(Peak: May)	NA	MSF, GSI	Menezes et al. (2001)
Fecundity (thousands of oocytes)	NA				
L_{inf}	92.60 FL	101.10 FL	103.00 FL	Direct readings – Whole otoliths	Serafim (1995)
	NA	NA	103.00 FL	Direct readings – Whole otoliths	Serafim (1995)
	NA	NA	104.60 FL	Back calculation – Fraser-Lee equation	Serafim (1995)
	NA	NA	103.00 FL	Direct readings – Whole otoliths	Serafim & Krug (1995)
	NA	NA	104.60 FL	Back calculation – Fraser-Lee equation	Serafim & Krug (1995)
	NA	NA	102.70 FL	Length-frequency analysis	Serafim & Krug (1995)
	NA	NA	101.00 FL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	132.20 FL	Length-frequency analysis	Krug et al. (1998)
k	0.07	0.06	0.06	Direct readings – Whole otoliths	Serafim (1995)
	NA	NA	0.07	Back calculation – Fraser-Lee equation	Serafim (1995)
	NA	NA	0.07	Length-frequency analysis	Serafim (1995)
	NA	NA	0.06	Direct readings – Whole otoliths	Serafim & Krug (1995)
	NA	NA	0.07	Back calculation – Fraser-Lee equation	Serafim & Krug (1995)
	NA	NA	0.07	Length-frequency analysis	Serafim & Krug (1995)
	NA	NA	0.05	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.04	Length-frequency analysis	Krug et al. (1998)

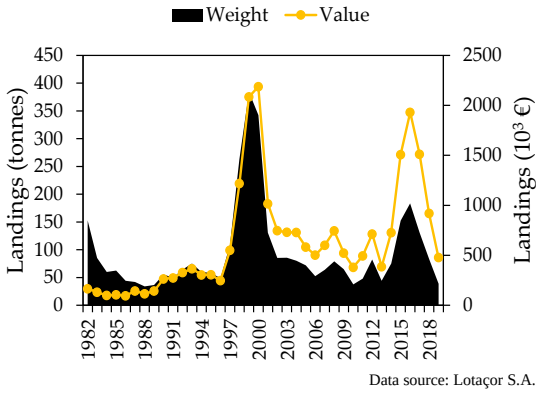
Parameter	Value			Method	Source
	Female	Male	Combined		
t_0	-1.40	-1.90	-1.72	Direct readings – Whole otoliths	Serafim (1995)
	NA	NA	-0.80	Back calculation – Fraser-Lee equation	Serafim (1995)
	NA	NA	-0.96	Length-frequency analysis	Serafim (1995)
	NA	NA	-1.72	Direct readings – Whole otoliths	Serafim & Krug (1995)
	NA	NA	-0.80	Back calculation – Fraser-Lee equation	Serafim & Krug (1995)
	NA	NA	-0.96	Length-frequency analysis	Serafim & Krug (1995)
	NA	NA	-3.29	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-3.05	Length-frequency analysis	Krug et al. (1998)
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.55 ± 0.51	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

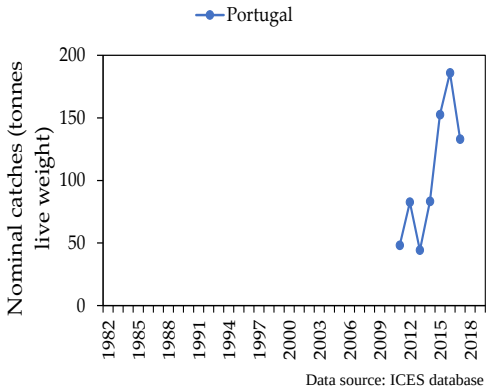
Note: FL: Fork Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 13. Summary of management regulations affecting the red porgy *Pagrus pagrus* fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2001	Ordinance No. 27/2001 of 15 January 2001	Minimum landing size (MLS) = 20 cm TL
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM). Ban on red porgy catch using bottom longline.
2017	Ordinance No. 13/2017 of 31 January 2017	MLS = 30 cm TL
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

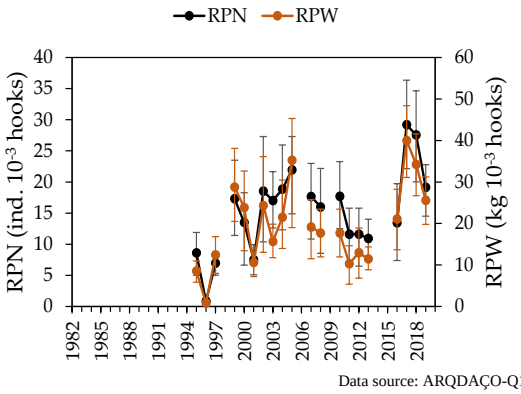
Note: NM: Nautical Miles; TL: Total Length.





[Discard rate]
NA

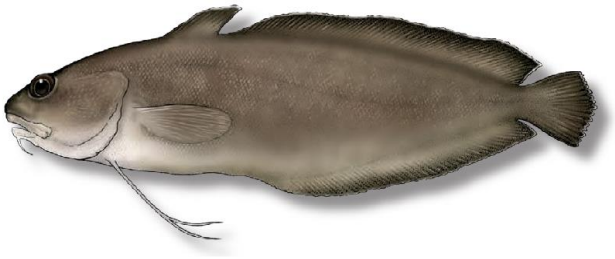
[Fishing effort]
NA



[Nominal and standardized CPUE]
NA

Fig. 5. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for red porgy *Pagrus pagrus* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Forkbeard



Scientific name: *Phycis phycis* (Linnaeus, 1766)

Common name: Pt – Abrótea; En – Forkbeard

FAO code: FOR

Distribution and habitat: The forkbeard *Phycis phycis* is a phycid fish widely distributed in the Northeast Atlantic (Bay of Biscay to Morocco, south to Cape Verde and Macaronesian archipelagos) and Mediterranean Sea (Cohen et al. 1990). The species occurs on hard and sandy-muddy bottoms near rocks at depths between 100 and 650 m (Cohen et al. 1990) usually found in shallow waters down to 200 m (Santos et al. 2019a). It is active at night and hides among rocks during the day. Juveniles appear to inhabit shallower and coastal areas, migrating to deeper areas as they grow (Santos et al. 2019a).

Movements and stock structure: Both body morphometric and otolith shape studies seem to support the existence of three stock units in Portuguese waters: a) Azores (ICES Subarea X); b) Madeira, and c) mainland Portugal (Subarea IX; Vieira et al. 2014; 2016a).

Age and growth: Maximum size reported is 75 cm total length (TL) for males and and 79 cm TL for females in the Azores (Monteiro 2014). Maximum age, 18 years for both sexes (Abecasis et al. 2009). There are no practical differences in growth between sexes (Abecasis et al. 2009).

Reproduction: The forkbeard is an oviparous species with group-synchronous ovarian development and batch spawner pattern (Vieira et al. 2016b). Size-at-maturity is 36 cm TL for females and 28 cm TL for males in the mainland Portugal (Vieira et al. 2016b). Spawning occurs from September to February depending in the area (Silva 1986b, c; Vieira et al. 2016b). In the Azores, size-at-maturity is 42 cm TL for males and 38 cm TL for females (Mendonça et al. 1998). Spawning occurs between January and August (Mendonça et al. 1998). Females outnumber males in larger length classes (Silva 1986b, c).

Feeding habits: Feeds mainly on fishes (e.g. *Macroramphosus scolopax*, *Capros aper*) and decapods (e.g. *Homola barbata*, *Liocarcinus corrugatus*; Morato et al. 1999).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks sixth in terms of total landed value considering non-straddling stocks (0,8 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 4,12 €.

Table 14. Summary of biological parameters for forkbeard *Phycis phycis* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0054\ TL^{3.205}$ ($n = 350$; $r^2 = 0.98$)	Linear regression	Silva (1985)
	NA	NA	$W = 0.0054\ TL^{3.205}$ ($n = 350$; $r^2 = 0.98$)	Linear regression	Silva (1986c)
	NA	NA	$W = 0.0054\ TL^{3.205}$ ($n = 350$; $r^2 = 0.98$)	Linear regression	Silva & Krug (1992)
	NA	NA	$W = 0.0117\ TL^{2.977}$ ($n = 233$; $r^2 = 0.96$)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0069\ TL^{3.135}$ ($n = 42$; $r^2 = 0.99$)	Linear regression	Morato et al. (2001b)
	NA	NA	$W = 0.0085\ TL^{3.069}$ ($n = 1150$; $r^2 = 0.96$)	Linear regression	Rosa et al. (2006)
	NA	NA	$W = 0.0056\ TL^{3.192}$ ($n = 1968$; $r^2 = 0.99$)	Linear regression	Monteiro (2014)
Maximum length (cm)	NA	NA	70.0 TL	Length composition	Silva (1986c)
	NA	NA	71.0 TL	Length composition	Krug et al. (1998)
	NA	NA	75.0 TL	Length composition	Marcelo (1999)
	62.0 TL	62.0 TL	62.0 TL	Length composition	Menezes et al. (2001)
	NA	NA	59.5 TL	Length composition	Morato et al. (2001b)
	NA	NA	74.0 TL	Length composition	Pinho (2003)
	NA	NA	69.0 TL	Length composition	Rosa et al. (2006)
	68.0 TL	71.0 TL	NA	Length composition	Abecasis et al. (2009)
	79.0 TL	75.0 TL	83.0 TL	Length composition	Monteiro (2014)
Maximum age (y)	15	12	15	Sliced otoliths	Silva (1985)
	15	12	15	Sliced otoliths	Silva (1986a)
	15	12	15	Sliced otoliths	Silva (1986c)
	NA	NA	15	NA	Silva & Krug (1992)
	NA	NA	17	Whole otoliths	Krug et al. (1998)
	NA	NA	17	Whole otoliths	Marcelo (1999)
	18	18	NA	Sliced and burned otoliths	Abecasis et al. (2009)
	NA	NA	16	NA	Monteiro (2014)
Length (cm) at 50% maturity	41.0 TL	36.0 TL	NA	MSF	Silva (1986b)
	41.0 TL	36.0 TL	NA	MSF	Silva (1986c)
	38.5 TL	41.7 TL	NA	MSF	Mendonça et al. (1998)
	38.2 TL	37.2 TL	NA	MSF	Monteiro (2014)
Age (y) at 50% maturity	5	4	NA	ALK	Silva (1986b)
	5	4	NA	ALK	Silva (1986c)
	4	5	NA	ALK	Mendonça et al. (1998)

Parameter	Value			Method	Source
	Female	Male	Combined		
	3-4	3-4	NA	ALK	Monteiro (2014)
Spawning season	NA	NA	Dec-Feb (Peak: Jan)	MSF, GSI	Silva (1986b)
	NA	NA	Dec-Mar (Peak: Nov-Dec)	MSF, GSI	Silva (1986a)
	Dec-Feb (Peak: Jan)	Dec-Feb (Peak: Jan)	Dec-Feb (Peak: Jan)	MSF, GSI	Silva (1986c)
	(Peak: Jan, Jun and Aug)	(Peak: Jan and Aug)	NA	GSI	Mendonça et al. (1998)
	Jun-Dec (Peak: Nov)	Jun-Dec (Peak: Nov)	NA	MSF, GSI	Menezes et al. (2001)
	Aug-Mar (Peak: Nov-Dec)	Aug-Mar (Peak: Nov-Dec)	Aug-Mar (Peak: Nov-Dec)	MSF, GSI	Monteiro (2014)
Fecundity (thousands of oocytes)	321-14993			Ovary analysis	Silva (1986b)
	321-14993			Ovary analysis	Silva (1986c)
L_{inf}	NA	NA	65.30 TL	Direct readings – Sliced otoliths	Silva (1985)
	NA	NA	65.30 TL	Direct readings – Sliced otoliths	Silva (1986a)
	NA	NA	65.30 TL	Direct readings – Sliced otoliths	Silva (1986c)
	NA	NA	72.40 TL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	74.00 TL	Length-frequency analysis	Krug et al. (1998)
	NA	NA	73.00 TL	Direct readings – Whole otoliths	Marcelo (1999)
	80.50 TL	85.30 TL	79.60 TL	Direct readings – Sliced and burned otoliths	Abecasis et al. (2009)
	73.60 TL	71.00 TL	72.20 TL	Direct readings - NA	Monteiro (2014)
k	NA	NA	0.19	Direct readings – Sliced otoliths	Silva (1985)
	NA	NA	0.19	Direct readings – Sliced otoliths	Silva (1986a)
	NA	NA	0.19	Direct readings – Sliced otoliths	Silva (1986c)
	NA	NA	0.09	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.10	Length-frequency analysis	Krug et al. (1998)
	NA	NA	0.14	Direct readings – Whole otoliths	Marcelo (1999)
	0.09	0.08	0.09	Direct readings – Sliced and burned otoliths	Abecasis et al. (2009)
	0.10	0.11	0.11	Direct readings - NA	Monteiro (2014)
t_0	NA	NA	-0.28	Direct readings – Sliced otoliths	Silva (1985)
	NA	NA	-0.28	Direct readings – Sliced otoliths	Silva (1986c)
	NA	NA	-4.56	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-3.56	Length-frequency analysis	Krug et al. (1998)
	NA	NA	-1.03	Direct readings – Whole otoliths	Marcelo (1999)
	-1.53	-2.31	-1.88	Direct readings – Sliced and burned otoliths	Abecasis et al. (2009)
	-3.98	-3.53	-3.72	Direct readings - NA	Monteiro (2014)

Parameter	Value			Method	Source
	Female	Male	Combined		
Mortality rate	NA	NA	Z = 0.41 (F = 0.04; M = 0.37)	Z: F + M; F: Beverton & Holt (1959); M: combined methods	Silva (1988)
	NA	NA	Z = 0.27 (F = 0.07; M = 0.20)	Z, F: VPA; M: Tanaka (1960)	Silva & Krug (1992)
	NA	NA	M = 0.30	Pauly (1980)	Marcelo (1999)
	NA	NA	M = 0.18	Alagaraja (1984)	Marcelo (1999)
	NA	NA	Z = 0.36 (F = 0.16; M = 0.20)	Z: Catch curve; F: Z-M; M: combined methods	Marcelo (1999)
	NA	NA	F = 0.10	LCA	Marcelo (1999)
	NA	NA	Z = 0.24 (F = 0.01-0.06; M = 0.20)	Z: Catch curve; F: Z-M; M: combined methods	Monteiro (2014)
Trophic level (mean ± s.e.)	NA	NA	3.91 ± 0.85	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; VPA: Virtual Population Analysis; LCA: Length Cohort Analysis; NA: Not Available.

Table 15. Summary of management regulations affecting the forkbeard *Phycis phycis* fishery in the Azores region.

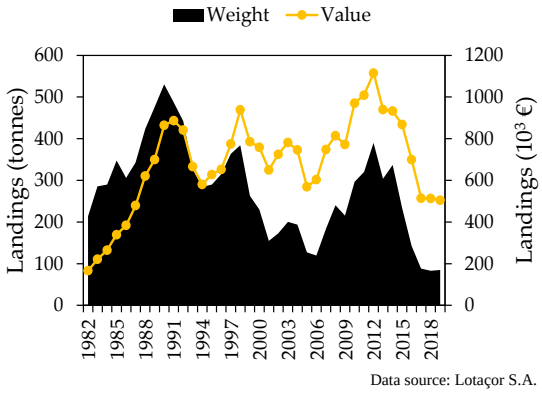
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

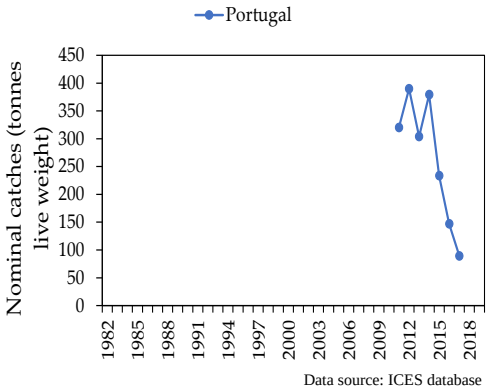
Note: NM: Nautical Miles.

Table 16. Time-series of total allowable catches (in tonnes) for the forkbeard *Phycis phycis* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	200

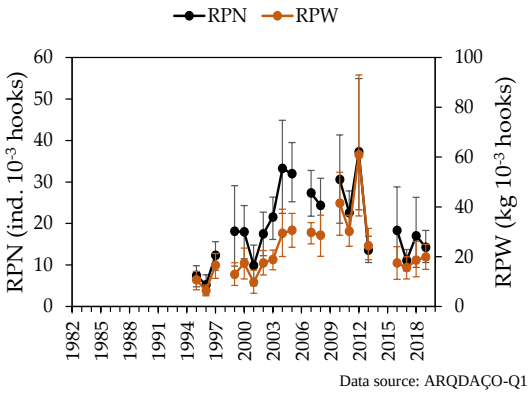
Note: * TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

[Fishing effort]
NA



[Nominal and standardized CPUE]
NA

Fig. 6. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for forkbeard *Phycis phycis* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

European conger

Scientific name: *Conger conger* (Linnaeus, 1758)

Common name: Pt – Congro, Safio; En – European conger

FAO code: COE

Distribution and habitat: The European conger *Conger conger* is a congrid fish distributed in the Eastern Atlantic (Norway and Iceland to Senegal, including the Macaronesian archipelagos) and the Mediterranean and Black Seas (Froese & Pauly 2019). The species occurs on rocky and sandy bottoms at depths down to 4000 m but typically found to 600 m (Santos et al. 2019a). Juveniles are found to occupy neritic zones and move towards deeper waters when they reach maturity (Maigret & Ly 1986).

Movements and stock structure: Both otolith chemistry analyses and genetic studies support the hypothesis of a broad-scale dispersal of larvae with limited connectivity between juvenile fish populations. However, the existence of one or multiple spawning areas for the species remains uncertain (Correia et al. 2012). Additional studies with focus on connectivity between young and mature individuals are needed to determine whether the Azorean population can be considered a local management unit (Medeiros-Leal et al. 2019).

Age and growth: Maximum size reported is 300 cm total length (TL; Smith 1990). Maximum age, 20 years in Irish waters (O'Sullivan et al. 2003). In the Azores (ICES Subarea X), maximum size reported is 260 cm TL (Santos et al. 2019a) but no age information is available. No comparison of growth rates between the sexes have been carried out.

Reproduction: The European conger is an oviparous species with synchronous ovarian development. Sexual maturation seems to occur during their migration towards deep-sea spawning areas (Cau & Manconi 1983; 1984; Sbaihi et al. 2001; O'Sullivan et al. 2003). Size-at-maturity is around 200 cm TL (Froese & Pauly 2019). Spawning occur only once in its lifetime (semelparous species), from December to June, depending on the area (O'Sullivan et al. 2003; Correia et al. 2002; 2009). Eggs are deposited at depths between 2000 and 3000 m (Göthel 1992). Larvae are pelagic and have a leptocephali phase. Size-at-maturity is not available for the Azores. Spawning seems to occur between January and July (Correia et al. 2002). Females outnumber males in larger length classes (Casadevall et al. 2017).

Feeding habits: Feeds mainly on fishes (e.g. *Capros aper*, *Macroramphosus scolopax*), decapods and cephalopods (Morato et al. 1999).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks seventh in terms of total landed value considering non-straddling stocks (0,7 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 1,93 €.

Table 17. Summary of biological parameters for European conger *Conger conger* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0006\ TL^{3.252}$ ($n = 158$; $r^2 = 0.97$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	193.0 TL	Length composition	Rosa et al. (2006)
	NA	NA	260.0 TL	Length composition	Santos et al. (2019a)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	Jan-Jul (Peak: Jun-Jul)	FDI	Correia et al. (2002)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.26 ± 0.76	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; FDI: First Daily (otolith) Increment; NA: Not Available.

Table 18. Summary of management regulations affecting the European conger *Conger conger* in the Azores region.

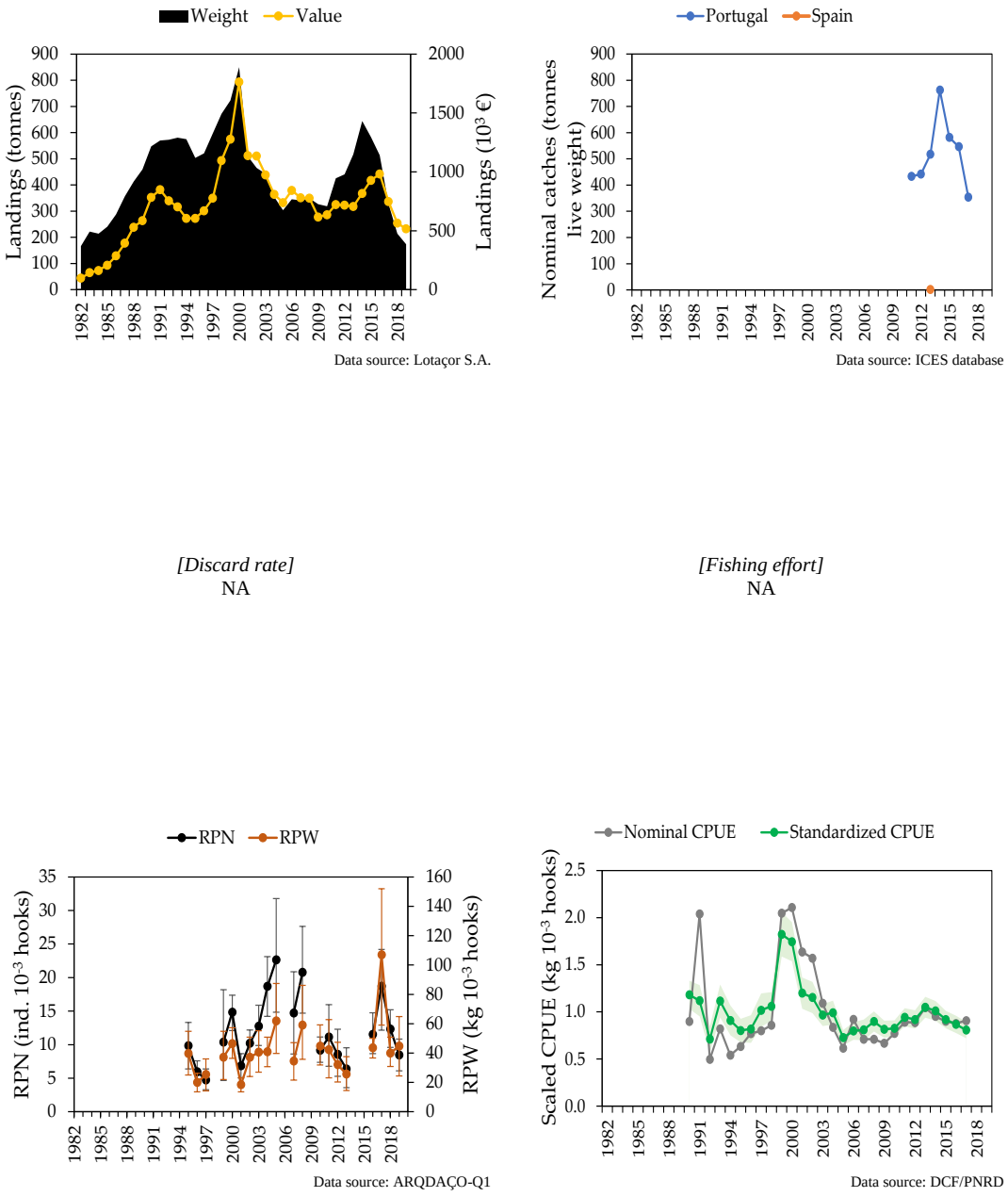
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2001	Ordinance No. 27/2001 of 15 January 2001	Minimum landing size (MLS) = 58 cm TL
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Ordinance No. 1/2010 of 18 January 2010	MLS = 113 cm TL or 3000 g
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2015	Ordinance No. 74/2015 of 15 June 2015	MLS = 133 cm TL or 5000 g
2017	Ordinance No. 13/2017 of 31 January 2017	MLS = 140 cm TL
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2019	Ordinance No. 21/2019 of 19 March 2019	MLS = 140 cm TL or 5500 g
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

Note: NM: Nautical Miles; TL: Total Length.

Table 19. Time-series of total allowable catches (in tonnes) for the European conger *Conger conger* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	400

Note: * TAC/quota for vessels operating in the ICES Subarea X.

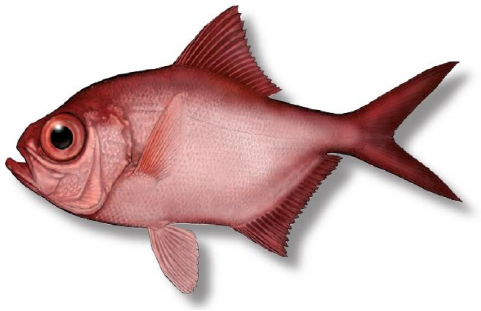


[Discard rate]
NA

[Fishing effort]
NA

Fig. 7. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for European conger *Conger conger* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Alfonsino



Scientific name: *Beryx decadactylus* Cuvier, 1829

Common name: Pt – Imperador; En – Alfonsino

FAO code: BXD

Distribution and habitat: The alfonsino *Beryx decadactylus* is a berycid fish widely distributed in the temperate and tropical latitudes, except the eastern Pacific (Froese & Pauly 2019). The species occurs on mud or sandy-muddy bottoms at depths between 200 and 950 m but usually found between 400 and 600 m (Maul 1981; 1986; Santos et al. 2019b). Juveniles seem to grow in demersal and shallower zones than those typically inhabited by adults, but further studies are needed to confirm this behaviour (Santos et al. 2019a, b).

Movements and stock structure: Genetic studies seem to support the existence of a panmictic population within the North Atlantic Ocean (González et al. 1998; Aboim 2005; Friess & Sedberry 2011a, b), with a strong differentiation between Cape Verde islands and the rest of the NE Atlantic populations (Aboim 2005).

Age and growth: Maximum size reported is 100 cm total length (TL; Claro 1994). Maximum age, 69 years in Southeastern USA (Friess & Sedberry 2011b), 11 years in Madeira and 9 years in Canary Islands (Krug et al. 2010). In the Azores (ICES Subarea X), maximum size reported is 67 fork length (FL; Santos et al. 2019b) and maximum age 15 years (Isidro 1996). There are no practical differences in growth between sexes (Krug et al. 2010).

Reproduction: Aspects related to reproductive strategy are not fully known as studies considering an entire population have not been developed until now (FAO 2016). In the Azores, sizes-at-maturity and spawning period are uncertain, i.e., studies show a high variability in the estimations. Females outnumber males in larger length classes (Pereira & Pinho 2012).

Feeding habits: Feeds on small fishes and several invertebrates (Shimizu 1984; Dürr & González 2002).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks eighth in terms of total landed value considering non-straddling stocks (0,6 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 15,98 €.

Table 20. Summary of biological parameters for alfonsino *Beryx decadactylus* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0225 FL^{3.030}$ (n = 404; r^2 = 0.99)	$W = 0.0250 FL^{3.000}$ (n = 408; r^2 = 0.99)	$W = 0.0236 FL^{3.017}$ (n = 828; r^2 = 0.99)	Linear regression	Isidro (1996)
	NA	NA	$W = 0.0356 FL^{2.897}$ (n = 40; r^2 = NA)	Linear regression	Silva & Menezes (1996)
	NA	NA	$W = 0.0273 FL^{2.940}$ (n = 5; r^2 = 0.89)	Linear regression	González et al. (1998)
	NA	NA	$W = 0.0270 FL^{2.974}$ (n = 266; r^2 = 0.99)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0304 FL^{2.941}$ (n = 484; r^2 = 0.98)	Linear regression	Rosa et al. (2006)
	$W = 0.0217 FL^{3.039}$ (n = 1045; r^2 = 0.99)	$W = 0.0219 FL^{3.036}$ (n = 1054; r^2 = 0.99)	$W = 0.0217 FL^{3.038}$ (n = 2215; r^2 = 0.99)	Linear regression	Pereira & Pinho (2012)
Maximum length (cm)	48.5 FL	49.5 FL	58.5 FL	Length composition	Isidro (1996)
	NA	NA	47.0 FL	Length composition	Silva & Menezes (1996)
	NA	NA	51.0 FL	Length composition	González et al. (1998)
	NA	NA	51.0 FL	Length composition	Krug et al. (2000)
	48.0 FL	46.0 FL	49.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	55.0 FL	Length composition	Rosa et al. (2006)
	NA	NA	51.0 FL	Length composition	Krug et al. (2010)
	60.0 FL	55.0 FL	60.0 FL	Length composition	Pereira & Pinho (2012)
	NA	NA	67.0 FL	Length composition	Santos et al. (2019b)
Maximum age (y)	14	15	15	Whole otoliths	Isidro (1996)
	NA	NA	10	Whole otoliths	González et al. (1998)
	NA	NA	13	Whole otoliths	Krug et al. (1998)
	NA	NA	13	Whole otoliths	Krug et al. (2000)
	NA	NA	9	Whole otoliths	Menezes et al. (2001)
	NA	NA	10	Whole otoliths	Krug et al. (2010)
Length (cm) at 50% maturity	27.6 FL	29.1 FL	NA	MSF	Isidro (1996)
	33.0 FL	30.0 FL	32.0 FL	MSF	González et al. (1998)
	32.5 FL	30.3 FL	NA	MSF	Mendonça et al. (1998)
	32.5 FL	30.3 FL	NA	MSF	Krug et al. (2000)
	32.5 FL	30.3 FL	NA	MSF	Estácio et al. (2001)
Age (y) at 50% maturity	3-4	3.9	NA	ALK	Isidro (1996)
	4	4	4	ALK	González et al. (1998)
	4	4	NA	ALK	Mendonça et al. (1998)

Parameter	Value			Method	Source
	Female	Male	Combined		
	4	4	NA	ALK	Krug et al. (2000)
	4	4	NA	ALK	Estácio et al. (2001)
Spawning season	Aug-Jan	Aug-Jan	NA	MSF, GSI	Isidro (1996)
	NA	NA	Aug-Mar	MSF, GSI	González et al. (1998)
	NA	May-Dec (Peak: May-Jul)	NA	GSI	Mendonça et al. (1998)
	NA	May-Dec (Peak: May-Jul)	NA	GSI	Estácio et al. (2001)
	NA	(Peak: Aug)	NA	GSI	Menezes et al. (2001)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	56.30 FL	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	54.30 FL	Back calculation – Regression equation	Isidro (1996)
	NA	NA	68.40 FL	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	53.70 FL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	59.40 FL	Length-frequency analysis	Krug et al. (1998)
	NA	NA	53.70 FL	Direct readings – Whole otoliths	Krug et al. (2000)
	56.87 FL	63.12 FL	59.15 FL	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	68.40 FL	Direct readings – Whole otoliths	Krug et al. (2010)
k	NA	NA	0.11	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	0.11	Back calculation – Regression equation	Isidro (1996)
	NA	NA	0.11	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	0.16	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.12	Length-frequency analysis	Krug et al. (1998)
	NA	NA	0.16	Direct readings – Whole otoliths	Krug et al. (2000)
	0.17	0.11	0.14	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	0.11	Direct readings – Whole otoliths	Krug et al. (2010)
t_0	NA	NA	-2.83	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	-3.26	Back calculation – Regression equation	Isidro (1996)
	NA	NA	-1.90	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	-1.52	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-2.22	Length-frequency analysis	Krug et al. (1998)
	NA	NA	-1.52	Direct readings – Whole otoliths	Krug et al. (2000)
	-1.69	-2.96	-2.08	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	-1.90	Direct readings – Whole otoliths	Krug et al. (2010)
Mortality rate	NA	NA	M = 0.13	Rikhter & Efanov (1976)	Isidro (1996)

Parameter	Value			Method	Source
	Female	Male	Combined		
	NA	NA	M = 0.24	Pauly (1980)	Isidro (1996)
	NA	NA	M = 0.19	Pauly (1980) – 0.8 multiplying factor	Isidro (1996)
	NA	NA	M = 0.31	Alagaraja (1984)	Isidro (1996)
	NA	NA	Z = 0.32 (F = 0.12; M = 0.20)	Z: Catch curve; F: Beverton & Holt (1959); M: combined methods	Isidro (1996)
Trophic level (mean ± s.e.)	NA	NA	4.13 ± 0.76	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: FL: Fork Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; NA: Not Available.

Table 21. Summary of management regulations affecting the alfonsino *Beryx decadactylus* fishery in the Azores region.

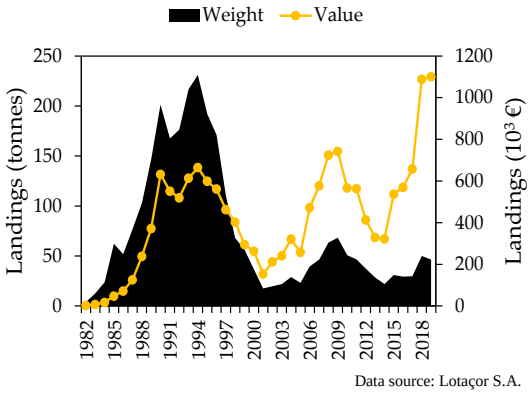
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 2270/2004 of 22 December 2004	Total allowable catch (TAC/quota)
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2015	Ordinance No. 74/2015 of 15 June 2015	Minimum landing size (MLS) for *Beryx* spp. = 250 g
2017	Ordinance No. 13/2017 of 31 January 2017	MLS for *B. decadactylus* = 35 cm TL
2017	Ordinance No. 161/2017 of 15 May 2017	Quota allocation of *Beryx* spp. for the Azores (85% of total quota for NE Atlantic area)
2017	Ordinance No. 93/2017 of 14 December 2017	Regional quota allocation of *Beryx* spp. by vessel per year (15% of total quota for the Azores) and tide (1.5%).
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

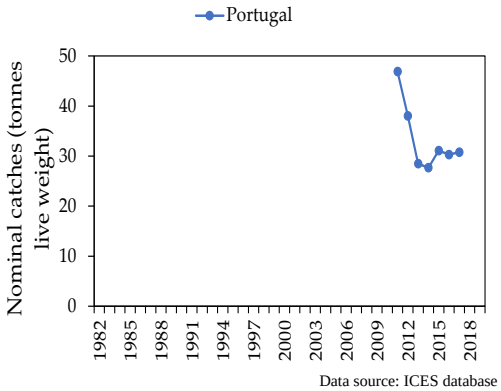
Note: NM: Nautical Miles; TL: Total Length.

Table 22. Time-series of total allowable catches (in tonnes) for the alfonsinos *Beryx* spp. fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2005	328
2006	328
2007	328
2008	328
2009	328
2010	328
2011	328
2012	328
2013	312
2014	296
2015	296
2016	296
2017	280
2018	280
2019	252
2020	252

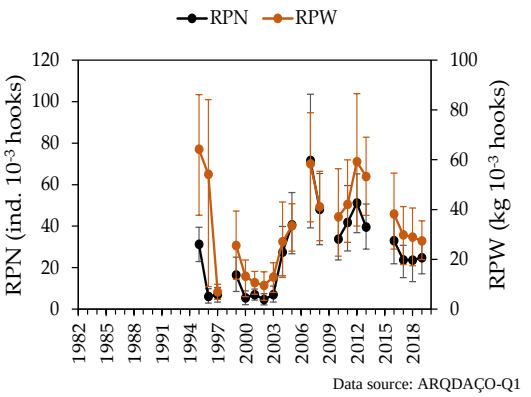
Note: * TAC/quota for European Commission's vessels operating in the ICES Subareas III-XII.





[Discard rate]
NA

[Fishing effort]
NA



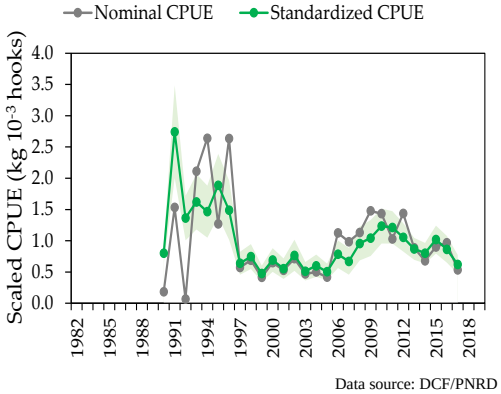
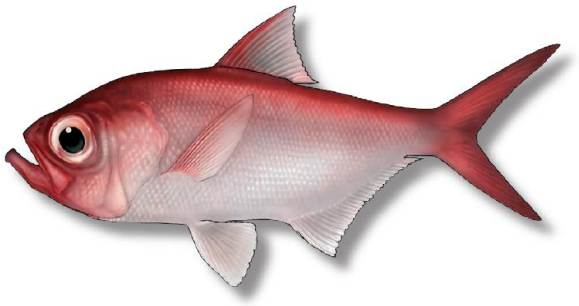


Fig. 8. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for alfonsino *Beryx decadactylus* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Splendid alfonsino



Scientific name: *Beryx splendens* Lowe, 1834

Common name: Pt – Alfonsim; En – Splendid alfonsino

FAO code: BYS

Distribution and habitat: The splendid alfonsino *Beryx splendens* is a berycid fish with circumglobal distribution, but does not occur in the Northeast Pacific (Paxton 1999; Golani et al. 2002). The species lives closed to rocky bottoms or deep-water reefs at depths between 100 and 1240 m but typically found between 100 and 600 m (Maul 1981; Santos et al. 2019b). Juveniles grow in demersal and shallower zones than those typically inhabited by adults (Santos et al. 2019a, b).

Movements and stock structure: Genetic, body morphometric and life history studies seem to support the existence of an Azorean stock in the NE Atlantic Ocean (Schönhuth et al. 2005; Santos et al. 2019b).

Age and growth: Maximum size reported is 70 cm total length (TL; Sommer et al. 1996). Maximum age, 16.8 years in New Zealand (Massey & Horn 1990), 12 years in Madeira and 9 years in Canary Islands (Rico et al. 2001). In the Azores (ICES Subarea X), maximum size reported is 53 cm fork length (FL; Santos et al. 2019b) and maximum age 13 years (Isidro 1996). Females grow faster than males (Lehodey & Grandperrin 1996).

Reproduction: The splendid alfonsino is an oviparous species with synchronous ovarian development, determinate fecundity and batch spawner pattern (Lehodey et al. 1997). Size-at-maturity is around 33 cm FL (FAO 2016; Froese & Pauly 2019). Spawning occurs about 10 to 12 times at intervals of about 4 days during the breeding season in areas inhabited by adults (Alekseev et al. 1986; Santos et al. 2019b). Some studies (e.g. Galaktionov 1984; Lehodey & Grandperrin 1996; Lehodey et al. 1997) indicate that the species migrates vertically at night to upper water layers. Consequently, water with higher temperature may be the main factor that induces maturation and spawning. Eggs and larvae are pelagic. In the Azores, sizes-at-maturity and spawning period are uncertain, i.e., studies show a high variability in the estimations. Females outnumber males in larger length classes (Pereira & Pinho 2012).

Feeding habits: Feeds on fishes, crustaceans and cephalopods (Dürr & González 2002).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks ninth in terms of total landed value considering non-straddling stocks (0,5 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 3,74 €.

Table 23. Summary of biological parameters for splendid alfonsino *Beryx splendens* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0173\ FL^{3.085}$ (n = 498; r^2 = 0.98)	$W = 0.0170\ FL^{3.091}$ (n = 401; r^2 = 0.98)	$W = 0.0168\ FL^{3.094}$ (n = 930; r^2 = 0.98)	Linear regression	Isidro (1996)
	NA	NA	$W = 0.0239\ FL^{2.987}$ (n = 871; r^2 = NA)	Linear regression	Silva & Menezes (1996)
	NA	NA	$W = 0.0229\ FL^{2.999}$ (n = 857; r^2 = 0.96)	Linear regression	González et al. (1998)
	NA	NA	$W = 0.0203\ FL^{3.032}$ (n = 631; r^2 = 0.98)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0198\ FL^{3.043}$ (n = 868; r^2 = 0.97)	Linear regression	Rosa et al. (2006)
	$W = 0.0179\ FL^{3.074}$ (n = 1210; r^2 = 0.99)	$W = 0.0173\ FL^{3.086}$ (n = 809; r^2 = 0.98)	$W = 0.0178\ FL^{3.076}$ (n = 2087; r^2 = 0.98)	Linear regression	Pereira & Pinho (2012)
Maximum length (cm)	40.5 FL	38.5 FL	50.5 FL	Length composition	Isidro (1996)
	NA	NA	39.0 FL	Length composition	Silva & Menezes (1996)
	39.5 FL	35.0 FL	43.0 FL	Length composition	González et al. (1998)
	NA	NA	45.0 FL	Length composition	Krug et al. (1998)
	NA	NA	40.0 FL	Length composition	Krug et al. (2000)
	36.0 FL	38.0 FL	38.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	43.0 FL	Length composition	Rico et al. (2001)
	NA	NA	38.0 FL	Length composition	Rosa et al. (2006)
	45.0 FL	47.5 FL	47.5 FL	Length composition	Pereira & Pinho (2012)
	NA	NA	53.0 FL	Length composition	Santos et al. (2019b)
Maximum age (y)	13	13	13	Whole otoliths	Isidro (1996)
	NA	NA	11	Whole otoliths	González et al. (1998)
	NA	NA	11	Whole otoliths	Krug et al. (1998)
	NA	NA	11	Whole otoliths	Krug et al. (2000)
	NA	NA	7	Whole otoliths	Menezes et al. (2001)
	NA	NA	11	Whole otoliths	Rico et al. (2001)
Length (cm) at 50% maturity	24.7 FL	24.7 FL	NA	MSF	Isidro (1996)
	23.0 FL	23.0 FL	23.0 FL	MSF	González et al. (1998)
	23.0 FL	22.9 FL	NA	MSF	Mendonça et al. (1998)

Parameter	Value			Method	Source
	Female	Male	Combined		
	23.0 FL	22.9 FL	NA	MSF	Krug et al. (2000)
	23.0 FL	22.9 FL	NA	MSF	Estácio et al. (2001)
	23.0 FL	23.0 FL	NA	MSF	González et al. (2003)
	35.5 FL	NA	NA	MSF	Pereira & Pinho (2012)
Age (y) at 50% maturity	4.3	3.4	NA	ALK	Isidro (1996)
	2	2	2	ALK	González et al. (1998)
	2	2	NA	ALK	Mendonça et al. (1998)
	2	2	NA	ALK	Krug et al. (2000)
	2	2	NA	ALK	Estácio et al. (2001)
Spawning season	Aug-Jan/Feb	Aug-Jan/Feb	NA	MSF, GSI	Isidro (1996)
	Sep-Jan/Feb	Sep-Mar/Apr	NA	MSF, GSI	González et al. (1998)
	Sep-Jan/Feb	Sep-Mar/Apr	NA	GSI	Mendonça et al. (1998)
	Sep-Jan/Feb	Sep-Mar/Apr	NA	GSI	Estácio et al. (2001)
	(Peak: May)	(Peak: Jun)	NA	GSI	Menezes et al. (2001)
	NA	NA	Aug-Mar (Peak: Dec)	MSF	González et al. (2003)
	NA	NA	Sep-Mar (Peak: Jan)	GSI	González et al. (2003)
	Feb-Jul Oct-Dec (Peak: Mar-Apr)	Feb-Jul Oct-Dec (Peak: Mar-Apr)	NA	MSF	Pereira & Pinho (2012)
	Feb-Jun (Peak: Jun)	NA	NA	GSI	Pereira & Pinho (2012)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	56.70 FL	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	50.00 FL	Back calculation – Regression equation	Isidro (1996)
	NA	NA	43.10 FL	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	50.80 FL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	45.30 FL	Length-frequency analysis	Krug et al. (1998)
	NA	NA	50.80 FL	Direct readings – Whole otoliths	Krug et al. (2000)
	45.33 FL	45.07 FL	44.99 FL	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	43.10 FL	Direct readings – Whole otoliths	Rico et al. (2001)

Parameter	Value			Method	Source
	Female	Male	Combined		
k	NA	NA	0.08	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	0.11	Back calculation – Regression equation	Isidro (1996)
	NA	NA	0.17	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	0.11	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.15	Length-frequency analysis	Krug et al. (1998)
	NA	NA	0.11	Direct readings – Whole otoliths	Krug et al. (2000)
	0.14	0.13	0.14	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	0.17	Direct readings – Whole otoliths	Rico et al. (2001)
t_0	NA	NA	-3.51	Direct readings – Whole otoliths	Isidro (1996)
	NA	NA	-2.81	Back calculation – Regression equation	Isidro (1996)
	NA	NA	-2.80	Direct readings – Whole otoliths	González et al. (1998)
	NA	NA	-3.58	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-3.61	Length-frequency analysis	Krug et al. (1998)
	NA	NA	-3.58	Direct readings – Whole otoliths	Krug et al. (2000)
	-3.09	-3.33	-3.13	Direct readings – Whole otoliths	Menezes et al. (2001)
	NA	NA	-2.80	Direct readings – Whole otoliths	Rico et al. (2001)
Mortality rate	NA	NA	M = 0.13	Rikhter & Efanov (1976)	Isidro (1996)
	NA	NA	M = 0.25	Pauly (1980)	Isidro (1996)
	NA	NA	M = 0.20	Pauly (1980) – 0.8 multiplying factor	Isidro (1996)
	NA	NA	M = 0.35	Alagaraja (1984)	Isidro (1996)
	NA	NA	Z = 0.39 (F = 0.19; M = 0.20)	Z: Catch curve; F: Beverton & Holt (1959); M: combined methods	Isidro (1996)
Trophic level (mean ± s.e.)	NA	NA	3.81 ± 0.74	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: FL: Fork Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; NA: Not Available.

Table 24. Summary of management regulations affecting the splendid alfonsino *Beryx splendens* fishery in the Azores region.

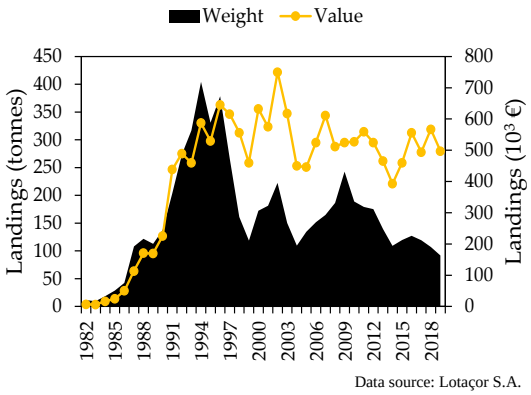
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 2270/2004 of 22 December 2004	Total allowable catch (TAC/quota)
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2015	Ordinance No. 74/2015 of 15 June 2015	Minimum landing size (MLS) for *Beryx* spp. = 250 g
2017	Ordinance No. 13/2017 of 31 January 2017	MLS for *B. splendens* = 30 cm TL
2017	Ordinance No. 161/2017 of 15 May 2017	Quota allocation of *Beryx* spp. for the Azores (85% of total quota for NE Atlantic area)
2017	Ordinance No. 93/2017 of 14 December 2017	Regional quota allocation of *Beryx* spp. by vessel per year (15% of total quota for the Azores) and tide (1.5%).
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2019	Ordinance No. 21/2019 of 19 March 2019	MLS for *B. splendens* = 33 cm TL
2019	Ordinance No. 63/2019 of 12 September 2019	MLS for *B. splendens* = 35 cm TL

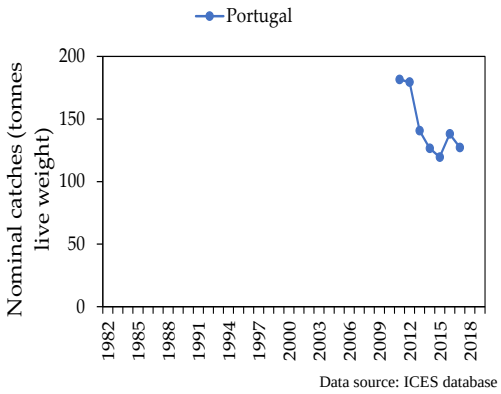
Note: NM: Nautical Miles; TL: Total Length.

Table 25. Time-series of total allowable catches (in tonnes) for the alfonsinos *Beryx* spp. fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2005	328
2006	328
2007	328
2008	328
2009	328
2010	328
2011	328
2012	328
2013	312
2014	296
2015	296
2016	296
2017	280
2018	280
2019	252
2020	252

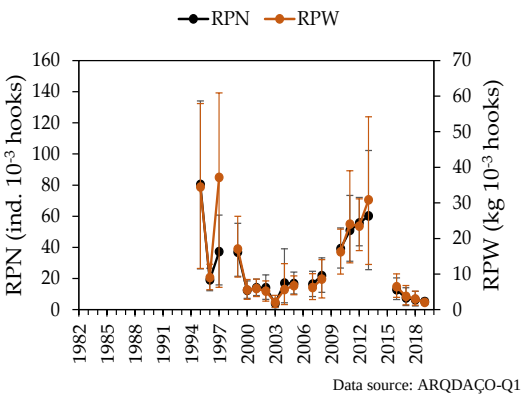
Note: * TAC/quota for European Commission's vessels operating in the ICES Subareas III-XII.





[Discard rate]
NA

[Fishing effort]
NA



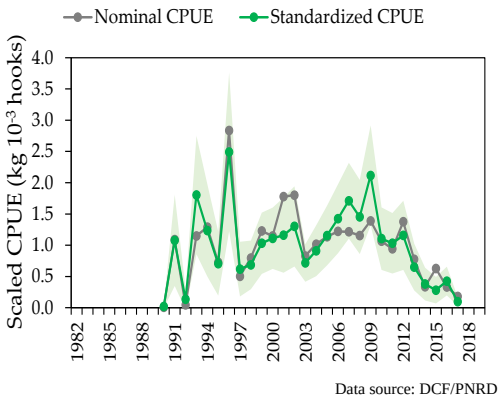
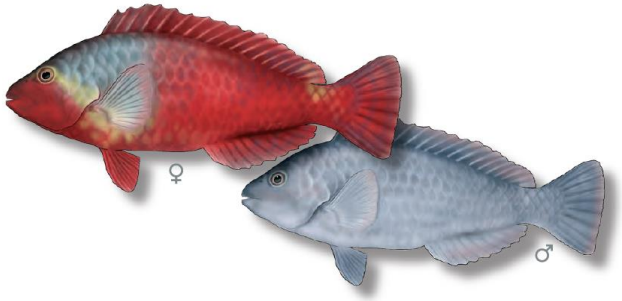


Fig. 9. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for splendid alfonsino *Beryx splendens* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Parrotfish



Scientific name: *Sparisoma cretense* (Linnaeus, 1758)

Common name: Pt – Veja; En – Parrotfish

FAO code: PRR

Distribution and habitat: The parrotfish *Sparisoma cretense* is a scarid fish distributed in the Northeast Atlantic, from mainland Portugal to Senegal, including Azores, Madeira and Canary archipelagos, and in the eastern and southern coasts of the Mediterranean Sea (Froese & Pauly 2019). The species occurs on rocky bottoms, seagrass interiors and seagrass adjacent to reefs at depths down to 50 m (Guidetti & Boero 2002). Juveniles are found mainly on seagrass beds and adults on rocky reefs (Espino et al. 2015).

Movements and stock structure: Little information is available about the stock structure of this species in the NE Atlantic and Mediterranean Sea. Tagging and acoustic tracking studies performed in the Azores have shown a very high site fidelity and minimal dispersion of adult parrotfish (Afonso et al. 2008a).

Age and growth: Maximum size reported is 50 cm TL (Randall 1990). Maximum age, 8 years in Greek waters (Petrakis & Papaconstantinou 1990). In the Azores (ICES Subarea X), maximum size reported is 52 cm TL (Afonso et al. 2008b) but no age information is available. No comparison of growth rates between sexes have been carried out.

Reproduction: The parrotfish is a secondary gonochorist species (i.e., males show secondary testes, indicating that their gonads develop ovaries as juveniles, which are later rediferentiated into functional testes) with asynchronous ovarian development and batch spawner pattern (De Girolamo et al. 1999). Size-at-maturity is around 15 cm TL (Froese & Pauly 2019). Spawning occurs from June to October (González 1991; 1993). It exhibits a dual mating system where males hold female harems within year-round territories or live in multi-male groups (Afonso et al. 2008b). In the Azores, size-at-maturity of males is 22 cm TL and of females 25 cm TL (Afonso et al. 2008b). Spawning occurs between July and October (Afonso et al. 2008b). Males outnumber females in larger length classes (Afonso et al. 2008b).

Feeding habits: A daytime feeder, scraping algae, seagrasses and small invertebrates from the substrate with its fused, beak-like jaws (Espino et al. 2015).

Fishing importance: Targeted by the Azorean demersal coastal fishery using gillnets. Ranks tenth in terms of total landed value considering non-straddling stocks (0,5 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 2,21 €.

Table 26. Summary of biological parameters for parrotfish *Sparisoma cretense* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0095\ TL^{3.162}$ (n = 340; $r^2 = 0.99$)	$W = 0.0127\ TL^{3.079}$ (n = 273; $r^2 = 0.99$)	$W = 0.0107\ TL^{3.129}$ (n = 647; $r^2 = 0.99$)	Linear regression	Morato et al. (2001b)
Maximum length (cm)	49.5 TL	52.2 TL	52.2 TL	Length composition	Morato et al. (2001b)
	50.0 TL	50.0 TL	50.0 TL	Length composition	São João (2006)
	49.6 TL	52.2 TL	52.2 TL	Length composition	Afonso et al. (2008b)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	25.0 TL	21.9 TL	24.16 TL	MSF	Afonso et al. (2008b)
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	Jul-Sep/Oct	Jul-Sep/Oct	NA	MSF, GSI	Afonso et al. (2008b)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	2.86 ± 0.27	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 27. Summary of management regulations affecting the parrotfish *Sparisoma cretense* in the Azores region.

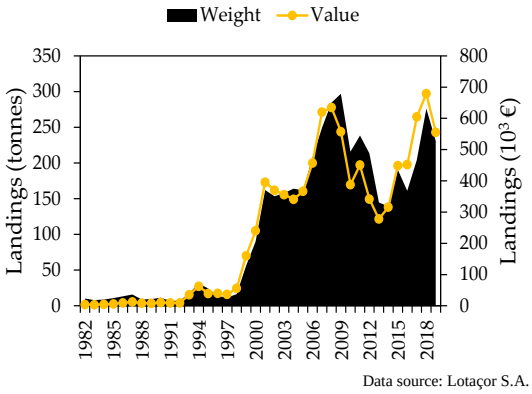
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-H/2000 of 22 November 2000	Gillnet Fishing Regulation
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species. Parrotfish is an exception
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2019	Ordinance No. 21/2019 of 19 March 2019	MLS = 25 cm TL
2019	Ordinance No. 63/2019 of 12 September 2019	MLS = 30 cm TL
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

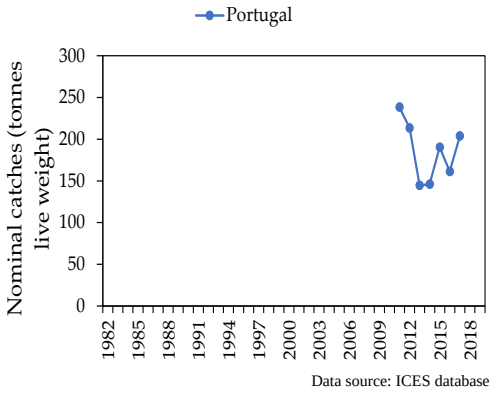
Note: TL: Total Length.

Table 28. Time-series of total allowable catches (in tonnes) for the parrotfish *Sparisoma cretense* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	200

Note: *TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 10. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for parrotfish *Sparisoma cretense* in the Azores region. NA: Not Available.

Silver scabbardfish

Scientific name: *Lepidopus caudatus* (Euphrasen, 1788)

Common name: Pt – Peixe-espada-branco; En – Silver scabbardfish

FAO code: SFS

Distribution and habitat: The Silver scabbardfish *Lepidopus caudatus* is a trichiurid fish widely distributed in the Atlantic Ocean, from France to Senegal, including Norway, England, Scotland, Iceland and Macaronesian archipelagos, in the Mediterranean Sea, in the Pacific Ocean, from New South Wales to Southern West Australia and New Zealand, and in the Indian Ocean (Froese & Pauly 2019). The species occurs on sandy and muddy bottoms at depths between 42 and 620 m (Mytilineou et al. 2005), typically between 100 m and 300 m (Nakamura & Parin 1993). It migrates from deeper to shallower waters at night and forms schools, occasionally found inshore in upwelling of deep water when it appears at surface (Froese & Pauly 2019).

Movements and stock structure: Available information is not sufficient to define stock units along the Atlantic Ocean.

Age and growth: Maximum size reported is 196 cm total length (TL) in the Mediterranean (Demestre et al. 1993) and 160 cm TL in the NE Atlantic (Mikahilin 1976). Maximum age, 8 years in the Mediterranean (Demestre et al. 1993) and 13 years in the NE Atlantic (Mikahilin 1976). In the Azores (ICES Subarea X), maximum size reported is 194 cm fork length (FL; González et al. 1998) and maximum age 10 years (González et al. 1998; Krug et al. 1998, 2000). Males grow faster than females (Demestre et al. 1993).

Reproduction: The Silver scabbardfish is an oviparous species with a group-synchronous ovarian development, indeterminate fecundity and batch spawner pattern (Demestre et al. 1993; Tuset et al. 2006). However, the most important period for reproduction is from late summer through autumn (Estácio et al. 2001). Size-at-maturity of females ranges from 114.9 cm to 196.0 cm and of males from 85.0 cm to 96.0 cm TL (Demestre et al. 1993; Estácio et al. 2001). The maturity age is around 1-3 years (Estácio et al. 2001). In the Azores, size-at-maturity of males is 85 cm TL and of females 115 cm TL (Estácio et al. 2001). Spawning occurs between August and January (Estácio et al. 2001). Females outnumber males in larger length classes (Mendonça et al. 1998; Estácio et al. 2001).

Feeding habits: Feeds on crustaceans, fishes and cephalopods (Parin 1986; Demestre et al. 1993).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks eleventh in terms of total landed value considering non-straddling stocks (0,5 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 2,37 €.

Table 29. Summary of biological parameters for silver scabbardfish *Lepidopus caudatus* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	W = 0.0006 $FL^{3.066}$ (n = 566; r^2 = NA)	Linear regression	Silva & Menezes (1996)
	W = 0.00301 $FL^{2.743}$ (n = 806; r^2 = 0.93)	W = 0.0004 $FL^{3.181}$ (n = 148; r^2 = 0.96)	W = 0.0022 $FL^{2.802}$ (n = 969; r^2 = 0.95)	Linear regression	González et al. (1998)
	NA	NA	W = 0.0013 $FL^{2.848}$ (n = 193; r^2 = 0.92)	Linear regression	Menezes et al. (2001)
	NA	NA	W = 0.0025 $FL^{2.710}$ (n = 364; r^2 = 0.92)	Linear regression	Rosa et al. (2006)
	W = 0.0002 $FL^{3.280}$ (n = 813; r^2 = 0.96)	W = 0.0003 $FL^{3.182}$ (n = 137; r^2 = 0.96)	W = 0.0002 $FL^{3.280}$ (n = 986; r^2 = 0.96)	Linear regression	Figueiredo (2012)
Maximum length (cm)	NA	NA	185.0 FL	Length composition	Silva & Menezes (1996)
	194.0 FL	138.0 FL	194.0 FL	Length composition	González et al. (1998)
	NA	NA	181.0 FL	Length composition	Krug et al. (1998)
	NA	NA	186.0 FL	Length composition	Krug et al. (2000)
	184.0 FL	138.0 FL	184.0 FL	Length composition	Lobão (2000)
	NA	NA	155.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	162.0 FL	Length composition	Rosa et al. (2006)
	189.0 FL	143.0 FL	189.0 FL	Length composition	Figueiredo (2012)
	160.0 FL	125.0 FL	163.0 FL	Length composition	Figueiredo et al. (2015)
Maximum age (y)	NA	NA	10	Whole otoliths	González et al. (1998)
	NA	NA	10	Whole otoliths	Krug et al. (1998)
	NA	NA	10	Whole otoliths	Krug et al. (2000)
	8	7	8	Sliced and burned otoliths	Lobão (2000)
	8	5	8	Whole otoliths	Figueiredo (2012)
	NA	NA	7	Whole otoliths	Figueiredo et al. (2015)
Length (cm) at 50% maturity	113.0 FL	87.0 FL	101.0 FL	MSF	González et al. (1998)
	114.9 TL	85.0 TL	NA	MSF	Mendonça et al. (1998)
	114.9 TL	85.0 TL	NA	MSF	Krug et al. (2000)
	114.9 TL	85.0 TL	NA	MSF	Estácio et al. (2001)
	85.0 FL	NA	NA	MSF	Figueiredo (2012)
Age (y) at 50% maturity	3	2	2	ALK	González et al. (1998)
	3	1	NA	ALK	Mendonça et al. (1998)
	3	1	NA	ALK	Krug et al. (2000)

Parameter	Value			Method	Source
	Female	Male	Combined		
	3	1	NA	ALK	Estácio et al. (2001)
	2	NA	NA	ALK	Figueiredo (2012)
Spawning season	Aug-Dec (Peak: Nov)	Aug-Dec (Peak: Sep)	NA	MSF, GSI	González et al. (1998)
	Aug-Dec (Peak: Nov-Dec)	Aug-Dec (Peak: Sep-Nov)	NA	GSI	Mendonça et al. (1998)
	Sep-Dec	Aug-Oct/Jan	NA	GSI	Krug et al. (2000)
	Sep-Dec	Aug-Oct/Jan	NA	GSI	Estácio et al. (2001)
	Oct-Mar	Oct-Mar	Oct-Mar	MSF	Figueiredo (2012)
	Oct-Mar (Peak: Nov-Dec)	Oct-Feb (Peak: Oct)	NA	GSI	Figueiredo (2012)
Fecundity (thousands of oocytes)	NA				
L_{inf}	203.60 FL	148.90 FL	238.90 FL	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	184.00 FL	Length-frequency analysis	Krug et al. (1998)
	203.60 FL	148.90 FL	238.90 FL	Direct readings – Whole otoliths	Krug et al. (2000)
	204.20 FL	145.00 FL	NA	Direct readings – Sliced and burned otoliths	Lobão (2000)
	204.20 FL	NA	NA	Back calculation – Dahl-Lea equation	Lobão (2000)
	204.20 FL	NA	NA	Back calculation – Fraser-Lee equation	Lobão (2000)
	NA	NA	207.80 FL	Length-frequency analysis	Lobão (2000)
	203.60 FL	148.80 FL	238.90 FL	Direct readings – Whole otoliths	González et al. (1998)
	157.40 FL	119.70 FL	156.80 FL	Direct readings – Whole otoliths	Figueiredo (2012)
	157.30 FL	126.50 FL	156.90 FL	Back calculation – Dahl-Lea equation	Figueiredo (2012)
	200.00 FL	147.10 FL	199.40 FL	Back calculation – Fraser-Lee equation	Figueiredo (2012)
	182.30 FL	152.10 FL	183.20 FL	Direct readings – Whole otoliths	Figueiredo et al. (2015)
k	0.13	0.18	0.09	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.13	Length-frequency analysis	Krug et al. (1998)
	0.13	0.18	0.09	Direct readings – Whole otoliths	Krug et al. (2000)
	0.12	0.27	NA	Direct readings – Sliced and burned otoliths	Lobão (2000)
	0.13	NA	NA	Back calculation – Dahl-Lea equation	Lobão (2000)
	0.12	NA	NA	Back calculation – Fraser-Lee equation	Lobão (2000)
	NA	NA	NA	Length-frequency analysis	Lobão (2000)
	0.13	0.17	0.09	Direct readings – Whole otoliths	González et al. (1998)
	0.20	0.30	1.97	Direct readings – Whole otoliths	Figueiredo (2012)
	0.19	0.24	0.19	Back calculation – Dahl-Lea equation	Figueiredo (2012)

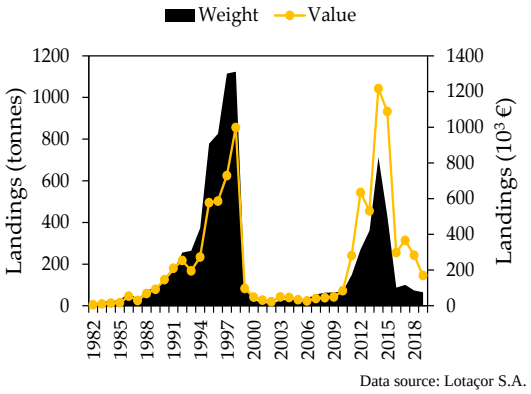
Parameter	Value			Method	Source
	Female	Male	Combined		
	0.12	0.176	0.12	Back calculation – Fraser-Lee equation	Figueiredo (2012)
	0.14	0.18	0.14	Direct readings – Whole otoliths	Figueiredo et al. (2015)
t_0	-3.04	-3.66	-4.12	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-3.47	Length-frequency analysis	Krug et al. (1998)
	-3.04	-3.66	-4.12	Direct readings – Whole otoliths	Krug et al. (2000)
	-3.33	-1.33	NA	Direct readings – Sliced and burned otoliths	Lobão (2000)
	-2.20	NA	NA	Back calculation – Dahl-Lea equation	Lobão (2000)
	-2.99	NA	NA	Back calculation – Fraser-Lee equation	Lobão (2000)
	NA	NA	-3.98	Length-frequency analysis	Lobão (2000)
	-3.00	-3.70	-4.12	Direct readings – Whole otoliths	González et al. (1998)
	-2.00	-2.00	-2.00	Direct readings – Whole otoliths	Figueiredo (2012)
	-2.00	-2.00	-2.00	Back calculation – Dahl-Lea equation	Figueiredo (2012)
	-2.00	-2.00	-2.00	Back calculation – Fraser-Lee equation	Figueiredo (2012)
	-2.36	-2.08	-2.17	Direct readings – Whole otoliths	Figueiredo et al. (2015)
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.12 ± 0.79	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

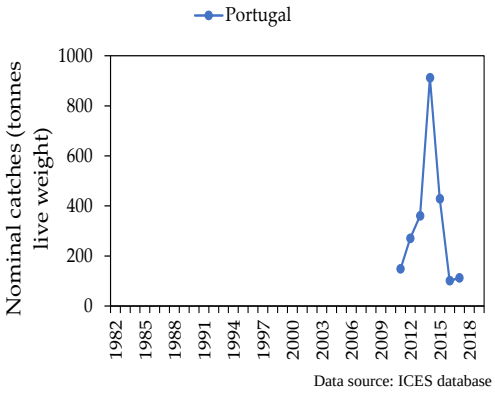
Note: FL: Fork Length; TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 30. Summary of management regulations affecting the silver scabbardfish *Lepidopus caudatus* in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

Note: NM: Nautical Miles.





[Discard rate]
NA

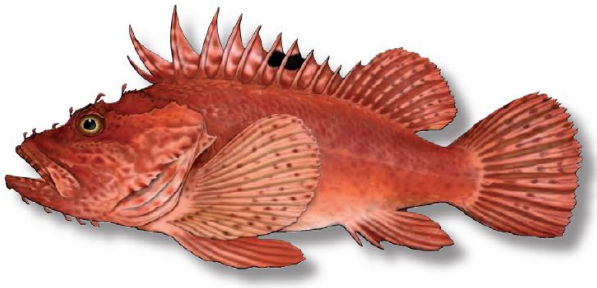
[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 11. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for silver scabbardfish *Lepidopus caudatus* in the Azores region. NA: Not Available.

Red scorpionfish



Scientific name: *Scorpaena scrofa* Linnaeus, 1758

Common name: Pt – Rocaz; En – Red scorpionfish

FAO code: SER

Distribution and habitat: The red scorpionfish *Scorpaena scrofa* is a scorpaenid fish distributed in the Eastern Atlantic, from the British Isles to Senegal including the Macaronesian region (Azores, Madeira, Canary and Cape Verde archipelagos) and in the Mediterranean Sea (Froese & Pauly 2019). The species occurs on rocky, sandy or muddy bottoms at depths between 20 and 150 m, usually 150 m (Froese & Pauly 2019).

Movements and stock structure: Acoustic tracking studies indicate that this species is a sedentary, solitary and non-migratory fish (Özgül et al. 2019). However, little is known about the population structure in Atlantic waters and stock units are unclear.

Age and growth: Maximum size reported is 53 cm total length (TL) and maximum age 25 years in the Adriatic Sea (Matic-Skoko et al. 2015). In the Azores (ICES Subarea X), maximum size reported is 59 cm TL (Rosa et al. 2006) but no age information is available. There are no practical differences in growth between sexes (Froese & Pauly, 2019).

Reproduction: The red scorpionfish is an oviparous species with asynchronous ovarian development and batch spawner pattern (Bradai & Bouain 1991). Size-at-maturity is estimated at 29 cm TL for females and 24.9 cm TL for males in the Adriatic Sea (Matic-Skoko et al. 2015). Spawning takes place during the summer (Matic-Skoko et al. 2015). Aspects related to the reproductive strategy of this species in Azorean waters are not available. The proportion of males to females is close to 1:1 (Bradai & Bouain 1991).

Feeding habits: Feeds on fishes, crustaceans, molluscs and benthic invertebrates (Fisher 1987).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks twelfth in terms of total landed value considering non-straddling stocks (0,4 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 13,94 €.

Table 31. Summary of biological parameters for red scorpionfish *Scorpaena scrofa* from the Azores region.

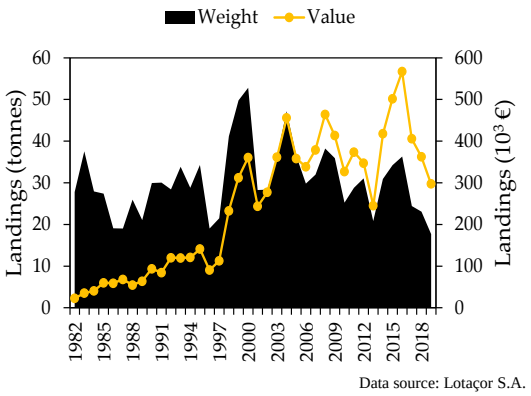
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0177\ TL^{3.015}$ ($n = 38$; $r^2 = 0.96$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	59.0 TL	Length composition	Rosa et al. (2006)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	NA		
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.95 ± 0.61	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; NA: Not Available.

Table 32. Summary of management regulations affecting the red scorpionfish *Scorpaena scrofa* fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM). Ban on red scorpionfish catch using bottom longline
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

Note: NM: Nautical Miles.



[Nominal catches]
NA

[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

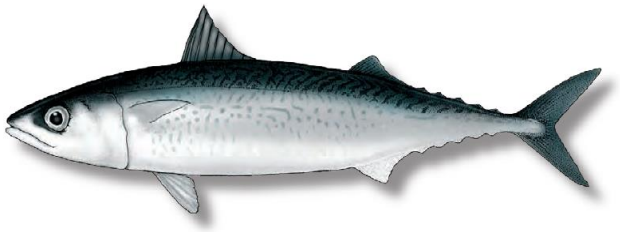
Fig. 12. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for red scorpionfish *Scorpaena scrofa* in the Azores region. NA: Not Available.

Atlantic chub mackerel

Scientific name: *Scomber colias* Gmelin, 1789

Common name: Pt – Cavala; En – Atlantic chub mackerel

FAO code: MAZ



Distribution and habitat: The Atlantic chub mackerel *Scomber colias* is a scombrid fish distributed in the Atlantic Ocean, from the Bay of Biscay to South Africa, including Azores, Madeira and Canary archipelagos, and in the Mediterranean Sea (Castro & Santana 2000). This middle-sized pelagic species occurs at depths ranging from near the surface to 300 m (Collete & Nauen 1983; Collete 1986). Previously misclassified as *Scomber japonicus*, *S. colias* is now considered a separate species from the Indo-Pacific congener *S. japonicus*, based on morphologic and genetic analyses (Scoles et al. 1998; Infante et al. 2007).

Movements and stock structure: Available information is not sufficient to define stock units along the Atlantic Ocean (ICES 2020c). Movements patterns across latitude and between coastal and offshore areas seems to be related to seasonal cycles of spawning and feeding (Castro & Santana 2000).

Age and growth: Maximum size reported is 65 cm total length (TL) and maximum age 20 years in ICES Subarea IX (Navarro et al. 2012). In the Azores (ICES Subarea X), maximum size reported is 53 cm FL and maximum age 13 years (Carvalho et al. 2002). There are no practical differences in growth between sexes (Vasconcelos et al. 2011).

Reproduction: The Atlantic club mackerel is an oviparous species with asynchronous ovarian development, indeterminate fecundity and batch spawner pattern (Techetach et al. 2018). However, deficiency of information on its oocyte development, fecundity strategy, spawning behaviour and frequency, prevents correct evaluation of the populations' reproductive output (ICES 2020c). Size-at-maturity is estimated at 22 cm TL for both sexes in the Madeira (Vasconcelos et al. 2012). Period and duration of spawning activity depend on the latitude, particularly on the oceanographic conditions (water temperature and upwelling) and food availability (ICES 2020c). In the Azores, size-at-maturity is 25 cm FL for both sexes (Carvalho et al. 2002). Spawning takes place between March and August (Carvalho et al. 2002). The proportion of males to females is close to 1:1 (Westhaus-Ekau & Ekau 1982; Vasconcelos et al. 2012).

Feeding habits: Juveniles consume copepods, appendicularians and small fishes, immature fishes feed on mysids and copepods, and adults eat a greater proportion of fish (Castro 1993).

Fishing importance: Targeted by the Azorean fleet that operates with several types of surface nets, the most important a boat-operated lift net, which mainly targets juvenile fish. Bottom longline and handline fisheries also catch Atlantic chub mackerel, but not as a target species. Ranks thirteenth in terms of total landed value considering non-straddling stocks (0,4 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 1,22 €.

Table 33. Summary of biological parameters for Atlantic chub mackerel *Scomber colias* from the Azores region.

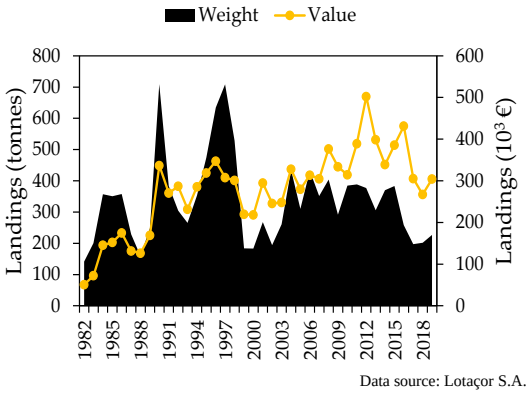
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0024\ FL^{3.474}$ ($n = 215$; $r^2 = NA$)	Linear regression	Westhaus-Ekau & Ekau (1982)
	NA	NA	$W = 0.0049\ FL^{3.261}$ ($n = 187$; $r^2 = 0.97$)	Linear regression	Carvalho et al. (2002)
	NA	NA	$W = 0.0046\ FL^{3.284}$ ($n = 167$; $r^2 = 0.97$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	42.5 FL	Length composition	Westhaus-Ekau & Ekau (1982)
	NA	NA	53.0 FL	Length composition	Carvalho et al. (2002)
	NA	NA	53.0 FL	Length composition	Rosa et al. (2006)
Maximum age (y)	NA	NA	8	Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	13	Whole otoliths	Carvalho et al. (2002)
Length (cm) at 50% maturity	NA	NA	25.46 FL	MSF	Carvalho et al. (2002)
Age (y) at 50% maturity	NA	NA	2.23	ALK	Carvalho et al. (2002)
Spawning season	NA	NA	Mar-Jul (Peak: Apr-May)	MSF	Westhaus-Ekau & Ekau (1982)
	NA	NA	Mar-Aug	MSF	Carvalho et al. (2002)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	44.74 FL	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	57.52 TL	Direct readings – Whole otoliths	Carvalho et al. (2002)
k	NA	NA	0.25	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	0.20	Direct readings – Whole otoliths	Carvalho et al. (2002)
t_0	NA	NA	-1.01	Direct readings – Whole otoliths	Westhaus-Ekau & Ekau (1982)
	NA	NA	-1.09	Direct readings – Whole otoliths	Carvalho et al. (2002)
Mortality rate	NA	NA	M = 0.19	Taylor (1959)	Carvalho et al. (2002)
Trophic level (mean ± s.e.)	NA	NA	3.91 ± 0.63	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

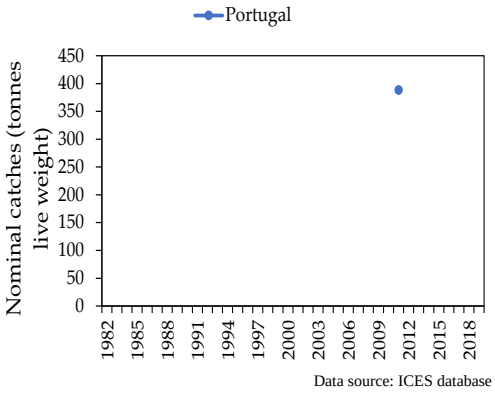
Note: FL: Fork Length; TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; M: Natural Mortality; NA: Not Available.

Table 34. Summary of management regulations affecting the Atlantic chub mackerel *Scomber colias* fishery in the Azores region.

Year of implementation	Legislation	Measure
1999	Regulation (EC) No. 308/1999 of 8 February 1999	Minimum landing size (MLS) = 20 cm TL
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Purse-seine Fishing Regulation
2001	Regulation (EC) No. 724/2001 of 4 April 2001	Revocation of the MLS for Azorean waters
2001	Ordinance No. 57/2001 of 13 September 2001	Minimum mesh size = 16 mm for purse-seine (except for live bait: 8 mm). Fishing area restrictions: allowed to operate outside the 0.25 NM area and deeper than 30 m (except for live bait).
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size = 12 mm for bottom longline and handlines. Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Ordinance No. 65/2014 of 6 October 2014	Lift nets of any kind can be used at any distance from the coast or bathymetric
2014	Ordinance No. 65/2014 of 8 October 2014	Conditions for purse-seine fishing and lift nets in São Miguel and Terceira islands
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

Note: NM: Nautical Miles; TL: Total Length.





[Discard rate]
NA

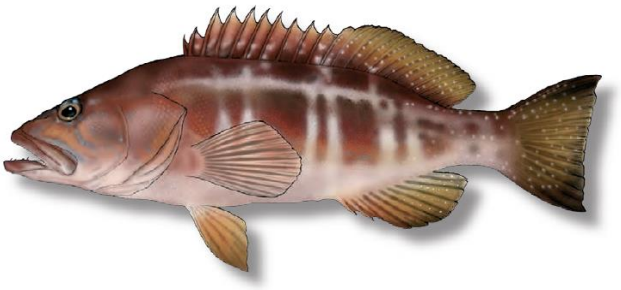
[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 13. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for Atlantic chub mackerel *Scomber colias* in the Azores region. NA: Not Available.

Blacktail comber



Scientific name: *Serranus atricauda* Günther, 1874

Common name: Pt – Garoupa; En – Blacktail comber

FAO code: WSA

Distribution and habitat: The blacktail comber *Serranus atricauda* is a serranid fish distributed in the Eastern Atlantic along the coasts of Europe and Africa, from Bay of Biscay to Mauritania, the Azores, Madeira and Canary archipelagos and in the western Mediterranean Sea (Froese & Pauly 2019). The species occurs on rocky bottoms at depths down to 150 m (Sanches 1991; García-Díaz et al. 2006).

Movements and stock structure: Acoustic tracking studies indicate that the species shows a high site fidelity (Afonso et al. 2016). However, little is known about the population structure in Atlantic waters and stock units are not clearly defined.

Age and growth: Maximum size reported is 43.2 cm total length (TL) and maximum age 16 years in the Canary Islands (Tuset et al. 2004). In the Azores (ICES Subarea X), maximum size reported is 46 cm TL (Rosa et al. 2006) and maximum age 11 years (Costa, 1997). As it is synchronous hermaphrodite, no comparison of growth rates between sexes has been carried out.

Reproduction: The blacktail comber is a synchronously hermaphroditic species (male and female tissues are simultaneous functional in the gonads) with an asynchronous oocyte growth (García-Díaz et al. 2002). Size-at-maturity and timing of peak spawning activity vary across areas. In the Azores, size-at-maturity is 25.6 cm TL (Lourinho 1998). Spawning occurs between July and September (Lourinho 1998).

Feeding habits: Feeds mainly on fishes and crustaceans; type and quantity of prey ingested vary between seasons (Morato et al. 2000).

Fishing importance: Targeted by the Azorean demersal coastal fishery using gillnets and hook and lines. Ranks fourteenth in terms of total landed value considering non-straddling stocks (0,3 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 5,27 €.

Table 35. Summary of biological parameters for blacktail comber *Serranus atricauda* from the Azores region.

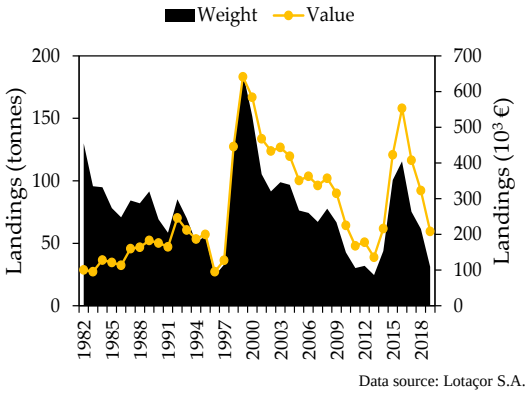
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0120\ TL^{3.010}$ (n = 767; $r^2 = 0.98$)	$W = 0.0120\ TL^{3.010}$ (n = 767; $r^2 = 0.98$)	$W = 0.0120\ TL^{3.010}$ (n = 767; $r^2 = 0.98$)	Linear regression	Costa (1997)
	$W = 0.0076\ TL^{3.175}$ (n = 385; $r^2 = 0.98$)	$W = 0.0076\ TL^{3.175}$ (n = 385; $r^2 = 0.98$)	$W = 0.0076\ TL^{3.175}$ (n = 385; $r^2 = 0.98$)	Linear regression	Morato et al. (2001b)
	$W = 0.0121\ TL^{3.007}$ (n = 366; $r^2 = 0.97$)	$W = 0.0121\ TL^{3.007}$ (n = 366; $r^2 = 0.97$)	$W = 0.0121\ TL^{3.007}$ (n = 366; $r^2 = 0.97$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	46.0 TL	46.0 TL	46.0 TL	Length composition	Costa (1997)
	46.0 TL	46.0 TL	46.0 TL	Length composition	Lourinho (1998)
	46.0 TL	46.0 TL	46.0 TL	Length composition	Morato et al. (2000)
	41.2 TL	41.2 TL	41.2 TL	Length composition	Morato et al. (2001b)
	46.0 TL	46.0 TL	46.0 TL	Length composition	Rosa et al. (2006)
Maximum age (y)	11	11	11	Whole otoliths	Costa (1997)
Length (cm) at 50% maturity	25.6 TL for hermaphrodites	25.6 TL for hermaphrodites	25.6 TL for hermaphrodites	MSF	Lourinho (1998)
Age (y) at 50% maturity	3	3	3	ALK	Lourinho (1998)
Spawning season	Mai-Oct (Peak: Jul)	Mai-Oct (Peak: Jul)	Mai-Oct (Peak: Jul)	GSI	Lourinho (1998)
Fecundity (thousands of oocytes)	NA				
L_{inf}	51.82 TL	51.82 TL	51.82 TL	Direct readings – Whole otoliths	Costa (1997)
	44.97 TL	44.97 TL	44.97 TL	Back calculation – Dahl-Lea equation	Costa (1997)
	44.85 TL	44.85 TL	44.85 TL	Back calculation – Fraser-Lee equation	Costa (1997)
	63.60 TL	63.60 TL	63.60 TL	Length-frequency analysis	Costa (1997)
k	0.12	0.12	0.12	Direct readings – Whole otoliths	Costa (1997)
	0.18	0.18	0.18	Back calculation – Dahl-Lea equation	Costa (1997)
	0.18	0.18	0.18	Back calculation – Fraser-Lee equation	Costa (1997)
	0.08	0.08	0.08	Length-frequency analysis	Costa (1997)
t_0	-1.98	-1.98	-1.98	Direct readings – Whole otoliths	Costa (1997)
	-0.72	-0.72	-0.72	Back calculation – Dahl-Lea equation	Costa (1997)
	-0.67	-0.67	-0.67	Back calculation – Fraser-Lee equation	Costa (1997)
	-2.56	-2.56	-2.56	Length-frequency analysis	Costa (1997)
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.82 ± 0.62	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

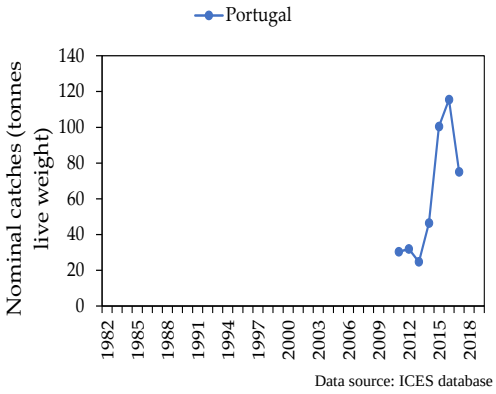
Note: TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 36. Summary of management regulations affecting the blacktail comber *Serranus atricauda* fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2000	Ordinance No. 1102-H/2000 of 22 November 2000	Gillnet Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species. Blacktail comber is an exception.
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2019	Ordinance No. 21/2019 of 19 March 2019	MLS = 25 cm TL
2019	Ordinance No. 63/2019 of 12 September 2019	MLS = 30 cm TL

Note: NM: Nautical Miles; TL: Total Length.





[Discard rate]
NA

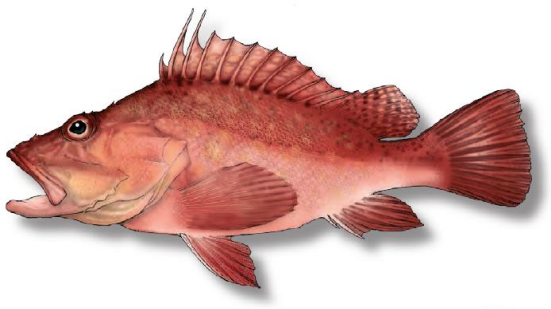
[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 14. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for blacktail comber *Serranus atricauda* in the Azores region. NA: Not Available.

Offshore rockfish



Scientific name: *Pontinus kuhlii* (Bowdich, 1825)

Common name: Pt – Cântaro, Bagre; En – Offshore rockfish

FAO code: POI

Distribution and habitat: The offshore rockfish *Pontinus kuhlii* is a scorpaenid fish distributed in the Eastern Atlantic (Macaronesian archipelagos and Portugal to São Tomé and Princípe), and in the Mediterranean Sea (Sicily and the coast of Spain; Eschmeyer & Dempster 1990; Wirtz et al. 2007). The species occurs on rocky bottoms at depths between 50 and 650 m but usually found down to 400 m (Santos et al. 2019a). There seems to be no difference in depth distribution between juveniles and adults (Santos et al. 2019a). However, juveniles seem to be more abundant on seamounts while larger individuals tend to occur on island slopes (Catarino et al. 2013).

Movements and stock structure: The offshore rockfish is a sedentary species and genetic studies seem to support the current assumption of a local stock in the Azores region (ICES Subarea X; Catarino et al. 2013). In this area, preliminary studies on otolith elemental signatures show the stock seems to have a meta-population structure (Higgins et al. 2013) but little is known about its dynamics.

Age and growth: Maximum size reported is 44.5 cm total length (TL) and maximum age 30 years in the ICES Subarea IX (Paiva et al. 2013). In the Azores (ICES Subarea X), maximum size reported is 56 cm TL (Krug et al. 1998) and maximum age 32 years (Isidro 1996). Males grow faster and attain larger sizes than females (López-Abellán et al. 2001).

Reproduction: The offshore rockfish is an oviparous species with asynchronous ovarian development, indeterminate fecundity and batch spawner pattern (Isidro 1996). Aspects related to the reproductive strategy is only available for the Azores. Size-at-maturity of males is 30 cm TL and of females 23 cm TL (Estácio et al. 2001). Spawning occurs between June and November (Mendonça et al. 1998). Males outnumber females in larger length classes (Estácio et al. 2001).

Feeding habits: Feeds mainly on small fishes and shrimps (Maigret & Ly 1986).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks fifteenth in terms of total landed value considering non-straddling stocks (0,3 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 5,22 €.

Table 37. Summary of biological parameters for offshore rockfish *Pontinus kuhlii* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0087 TL^{3.182}$ (n = 446; $r^2 = 0.98$)	$W = 0.0067 TL^{3.248}$ (n = 603; $r^2 = 0.99$)	$W = 0.0085 TL^{3.184}$ (n = 1079; $r^2 = 0.99$)	Linear regression	Isidro (1996)
	NA	NA	$W = 0.0210 TL^{2.929}$ (n = 25; $r^2 = 0.97$)	Linear regression	González et al. (1998)
	NA	NA	$W = 0.0113 TL^{3.088}$ (n = 377; $r^2 = 0.98$)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0115 TL^{3.075}$ (n = 1178; $r^2 = 0.97$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	40.5 TL	49.5 TL	52.5 TL	Length composition	Isidro (1996)
	37.0 TL	41.3 TL	41.3 TL	Length composition	González et al. (1998)
	NA	NA	56.0 TL	Length composition	Krug et al. (1998)
	NA	NA	47.0 TL	Length composition	Krug et al. (2000)
	38.0 TL	46.0 TL	46.0 TL	Length composition	Menezes et al. (2001)
	44.0 TL	48.0 TL	48.0 TL	Length composition	Silva (2002)
	NA	NA	50.0 TL	Length composition	Santos et al. (2019a)
Maximum age (y)	29	32	32	Whole otoliths	Isidro (1996)
	NA	NA	15	Whole otoliths	González et al. (1998)
	NA	NA	15	Whole otoliths	Krug et al. (1998)
	NA	NA	15	Whole otoliths	Krug et al. (2000)
	19	19	19	Whole otoliths	Silva (2002)
	NA	NA	26	Whole otoliths	Tanner et al. (2020)
Length (cm) at 50% maturity	18.5 TL	29.0 TL	NA	MSF	Isidro (1996)
	23.0 TL	30.0 TL	24.0 TL	MSF	González et al. (1998)
	22.6 TL	29.9 TL	NA	MSF	Mendonça et al. (1998)
	22.6 TL	29.9 TL	NA	MSF	Krug et al. (2000)
	22.6 TL	29.9 TL	NA	MSF	Estácio et al. (2001)
Age (y) at 50% maturity	4	8	NA	ALK	Isidro (1996)
	6	8	6	ALK	González et al. (1998)
	5	9	NA	ALK	Mendonça et al. (1998)
	5	9	NA	ALK	Krug et al. (2000)
	5	9	NA	ALK	Estácio et al. (2001)

Parameter	Value			Method	Source
	Female	Male	Combined		
Spawning season	Jun-Nov (Peak: Jul-Sep)	Jun-Dec (Peak: Aug-Sep)	Jun-Nov/Dec (Peak: Jul-Sep)	MSF, GSI	Isidro (1996)
	Jun-Nov (Peak: Jul-Sep)	Jun-Nov (Peak: Jul-Oct)	Jun-Nov (Peak: Jul-Oct)	MSF, GSI	González et al. (1998)
	NA	NA	Jun-Nov (Peak: Jul-Oct)	GSI	Mendonça et al. (1998)
	(Peak: May)	(Peak: Jun)	NA	MSF, GSI	Menezes et al. (2001)
Fecundity (thousands of oocytes)	NA				
L_{inf}	38.20 TL	54.20 TL	51.70 TL	Direct readings – Whole otoliths	Isidro (1996)
	46.00 TL	55.80 TL	54.40 TL	Back calculation – Fraser-Lee equation	Isidro (1996)
	43.30 TL	80.20 TL	73.70 TL	Direct readings – Whole otoliths	González et al. (1998)
	43.30 TL	80.20 TL	NA	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	51.40 TL	Length-frequency analysis	Krug et al. (1998)
	43.30 TL	80.20 TL	73.60 TL	Direct readings – Whole otoliths	Krug et al. (2000)
	51.60 TL	56.50 TL	56.50 TL	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	56.00 TL	Length-frequency analysis	Silva (2002)
k	0.12	0.08	0.08	Direct readings – Whole otoliths	Isidro (1996)
	0.12	0.09	0.09	Back calculation – Fraser-Lee equation	Isidro (1996)
	0.10	0.04	0.04	Direct readings – Whole otoliths	González et al. (1998)
	0.10	0.04	NA	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	0.11	Length-frequency analysis	Krug et al. (1998)
	0.01	0.04	0.04	Direct readings – Whole otoliths	Krug et al. (2000)
	0.07	0.08	0.06	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	0.09	Length-frequency analysis	Silva (2002)
t_0	-1.73	-1.96	-2.10	Direct readings – Whole otoliths	Isidro (1996)
	-0.57	-0.56	-0.56	Back calculation – Fraser-Lee equation	Isidro (1996)
	-2.00	-3.82	-3.87	Direct readings – Whole otoliths	González et al. (1998)
	-1.98	-3.82	NA	Direct readings – Whole otoliths	Krug et al. (1998)
	NA	NA	-0.55	Length-frequency analysis	Krug et al. (1998)
	-1.98	-3.82	-3.87	Direct readings – Whole otoliths	Krug et al. (2000)
	-1.72	-1.19	-3.21	Direct readings – Whole otoliths	Silva (2002)
	NA	NA	-0.73	Length-frequency analysis	Silva (2002)

Parameter	Value			Method	Source
	Female	Male	Combined		
Mortality rate	NA	NA	M = 0.09	Rikhter & Efanov (1976)	Isidro (1996)
	NA	NA	M = 0.22	Pauly (1980)	Isidro (1996)
	NA	NA	M = 0.17	Pauly (1980) – 0.8 multiplying factor	Isidro (1996)
	NA	NA	M = 0.14	Alagaraja (1984)	Isidro (1996)
	NA	NA	Z = 0.25 (F = 0.14; M = 0.11)	Z: Catch curve; F: Beverton & Holt (1959); M: combined methods	Isidro (1996)
Trophic level (mean ± s.e.)	NA	NA	4.05 ± 0.70	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; ALK: Age-Length Key; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; Z: Total Mortality; M: Natural Mortality; F: Fishing Mortality; NA: Not Available.

Table 38. Summary of management regulations affecting the offshore rockfish *Pontinus kuhlii* in the Azores region.

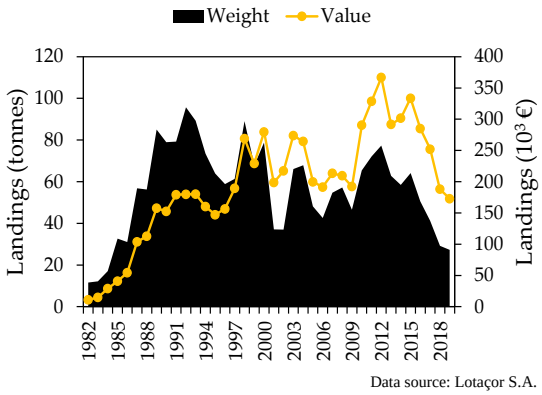
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

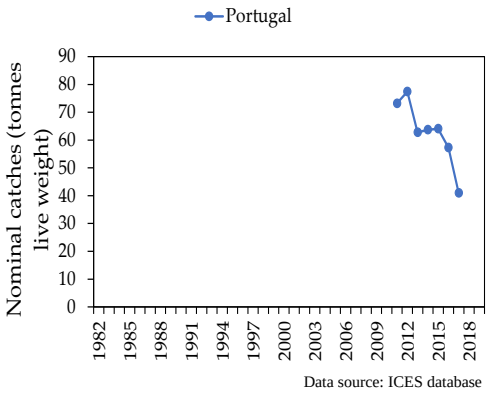
Note: NM: Nautical Miles.

Table 39. Time-series of total allowable catches (in tonnes) for the offshore rockfish *Pontinus kuhlii* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	50

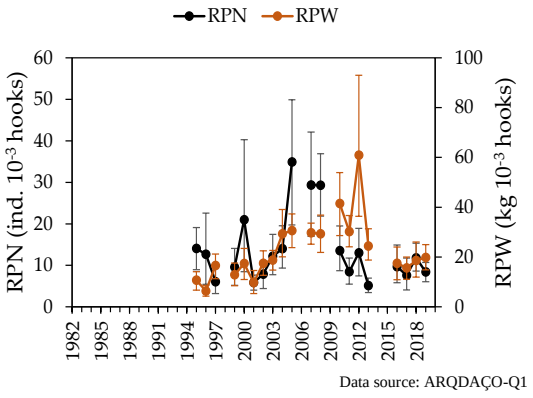
Note: * TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

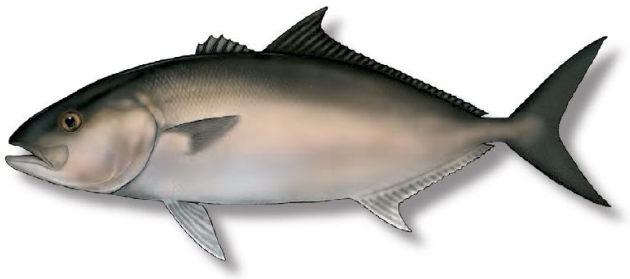
[Fishing effort]
NA



[Nominal and standardized CPUE]
NA

Fig. 15. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for offshore rockfish *Pontinus kuhlii* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Amberjacks nei



Scientific name: *Seriola* spp. Cuvier, 1816

Common name: Pt – Írio, Lírio; En – Amberjacks nei

FAO code: AMX

Distribution and habitat: The amberjacks nei *Seriola* spp. are carangid fishes with a circumglobal distribution (Froese & Pauly 2019). They usually inhabit outer reef slopes and offshore seamounts occurring in depths down to 360 m, occasionally entering coastal bays (Randall 1995; Allen & Erdmann 2012). Most *Seriola* species are found in small schools, with juveniles often seen around floating objects (Fischer et al. 1990; Smith-Vaniz 1995). In the Azores, the only representatives are *Seriola dumerili* and *S. rivoliana* (Santos et al. 2019a) and are landed as a single group *Seriola* spp. in ports of the region.

Movements and stock structure: Genetic studies seem to support the existence of different stocks of *Seriola dumerili* and *S. rivoliana* species inhabiting the Atlantic Ocean and the Mediterranean Sea (Šegvić-Bubić et al. 2016). In the Azores (ICES Subarea X), acoustic telemetric studies highlighted a resident behaviour in *S. rivoliana* (Fontes et al. 2014). Despite this, little is known about the population structure of this species group in NE Atlantic waters and stock units are not clearly defined.

Age and growth: Maximum size reported for *S. dumerili* is 183 cm fork length (FL) and maximum age 15 years in the Gulf of Mexico (Murie & Parkyn 2008). In the Azores, information is only available for *S. rivoliana.* Maximum size reported is 134 cm standard length (SL; Barreiros et al. 2003) but ages were not estimated. No comparison of growth rates between sexes has been reported.

Reproduction: Both species are oviparous with group-synchronous ovarian development, determinate fecundity and batch spawner pattern (Jerez et al. 2006; Roo et al. 2014). For *S. dumerili*, size-at-maturity is estimated to 109 cm standard length (SL) in males and 113 cm SL in females (Marino et al. 1995). Spawning tends to be in spring, depending on the seawater temperature (Lazzari & Barbera 1988, 1989; Grau 1992, Jerez et al. 2006). The proportion of males to females is close to 1:1 (Lazzari & Barbera 1989; Micale et al. 1993). For *S. rivoliana*, no information is available for populations living in wild habitats. In the Azores, aspects related to the reproductive strategy of both species are not available.

Feeding habits: Feeds mainly on fishes, but also on invertebrates (Barreiros et al. 2003; Froese & Pauly 2019).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks sixteenth in terms of total landed value considering non-straddling stocks (0,3 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 6,68 €.

Table 40. Summary of biological parameters for amberjacks nei *Seriola* spp. from the Azores region.

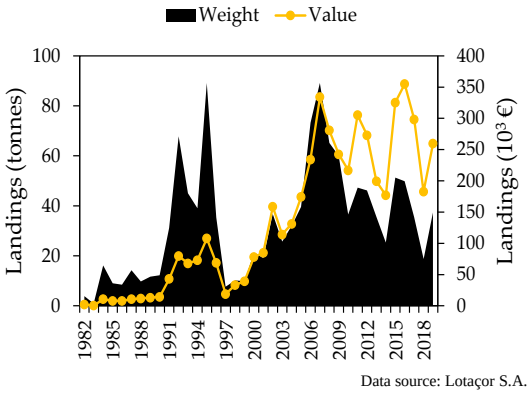
Parameter	Value			Method	Source
	Female	Male	Combined		
Seriola dumerili					
Length-weight relationship	NA	NA	NA		
Maximum length (cm)	NA	NA	NA		
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	NA		
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.06 ± 0.62	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)
Seriola rivoliana					
Length-weight relationship	W = 0.0096 $TL^{3.086}$ (n = 55; r^2 = 0.98)	W = 0.0160 $TL^{2.963}$ (n = 35; r^2 = 0.99)	W = 0.0108 $TL^{3.058}$ (n = 101; r^2 = 0.98)	Linear regression	Morato et al. (2001b)
Maximum length (cm)	122.8 TL	98.0 TL	122.8 TL	Length composition	Morato et al. (2001b)
	NA	NA	134.0 SL	Length composition	Barreiros et al. (2003)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	NA		
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.50 ± 0.78	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

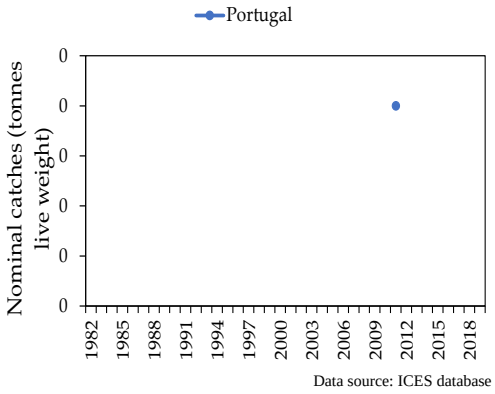
Note: TL: Total Length; SL: Standard Length; NA: Not Available.

Table 41. Summary of management regulations affecting the amberjacks nei *Seriola* spp. fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2000	Ordinance No. 1102-H/2000 of 22 November 2000	Gillnet Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species. Amberjacks are exception.
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

Note: NM: Nautical Miles.





[Discard rate]
NA

[Fishing effort]
NA

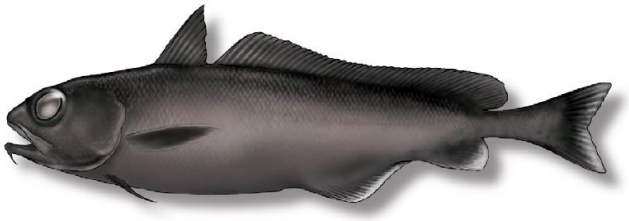
[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 16. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for amberjacks nei *Seriola* spp. in the Azores region. NA: Not Available.

Common mora

Scientific name: *Mora moro* (Risso, 1810)



Common name: Pt – Melga, Escamuda-branca; En – Common mora

FAO code: RIB

Distribution and habitat: The common mora *Mora moro* is a morid fish distributed in the Atlantic (Iceland and Faeroes to West Africa, including Azores and Madeira archipelagos and western Mediterranean), western Indian Ocean and Pacific Ocean (Australia, New Zealand and between Valparaiso, Chile and the Juan Fernandez Islands; Cohen 1986; Froese & Pauly 2019). The species is found in the outer continental shelf and slope at depths between 300 and 2500 m (Cohen 1986), typically below 600 m (Santos et al. 2019a). Juveniles are found mainly in shallow zones and adults in deeper waters (Rotllant et al. 2002; Santos et al. 2019a).

Movements and stock structure: The common mora has a sedentary behaviour (D'Onghia et al. 2011), supporting the possibility of the existence of local populations constituting different stock units. However, little is known about the population structure in the Atlantic waters and stock units are not clearly defined.

Age and growth: Maximum size reported is 80 cm fork length (FL; Santos et al. 2019b) and maximum age 59 years in the Azores (Vieira et al. 2013). Males grow faster than females (Vieira et al. 2013). In Australian waters, it reaches 55 cm total length (TL) and 56 years (Veale & Krusic-Golub 2008).

Reproduction: The common mora is an oviparous species whose period and duration of spawning activity depend on the area of occurrence (Gordon & Duncan 1985; McMillan & Hart 1998; Rotllant et al. 2002; Fernandez-Arcaya et al. 2013). Size-at-maturity is estimated to 32 cm TL for males and 34 cm TL for females in Mediterranean waters (Rotllant et al. 2002). In the Azores, size-at-maturity is not available. Spawning probably occurs from September to December (Vieira et al. 2013), same as in the Mediterranean (Rotllant et al. 2002; Fernandez-Arcaya et al. 2013). Females outnumber males in larger length classes (Rotllant et al. 2002; Vieira et al. 2013).

Feeding habits: Feeds on fishes, crustaceans, mollusks and other invertebrates (Froese & Pauly 2019).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines in deep waters. Ranks seventeenth in terms of total landed value considering non-straddling stocks (0,3 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 2,50 €.

Table 42. Summary of biological parameters for common mora *Mora moro* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0079 FL^{3.087}$ (n = 448; $r^2 = 0.97$)	Linear regression	Menezes et al. (2001)
	NA	NA	$W = 0.0095 FL^{3.038}$ (n = 1560; $r^2 = 0.96$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	76.0 FL	66.0 FL	76.0 FL	Length composition	Menezes et al. (2001)
	NA	NA	76.0 FL	Length composition	Rosa et al. (2006)
	76.0 FL	66.0 FL	NA	Length composition	Vieira et al. (2013)
	NA	NA	80.0 FL	Length composition	Santos et al. (2019a)
Maximum age (y)	59	45		Sliced otoliths	Vieira et al. (2013)
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	(Peak: Nov)	(Peak: Nov)	NA	MSF, GSI	Menezes et al. (2001)
	Sep-Dec (Peak: Nov-Dec)	Sep-Dec (Peak: Nov-Dec)	NA	MSF, GSI	Vieira et al. (2013)
Fecundity (thousands of oocytes)	NA				
L_{inf}	74.09 FL	57.85 FL	NA	Direct readings – Sliced otoliths	Vieira et al. (2013)
k	0.05	0.06	NA	Direct readings – Sliced otoliths	Vieira et al. (2013)
t_0	1.44	0.92	NA	Direct readings – Sliced otoliths	Vieira et al. (2013)
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.75 ± 0.55	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: FL: Fork Length; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 43. Summary of management regulations affecting the common mora *Mora moro* in the Azores region.

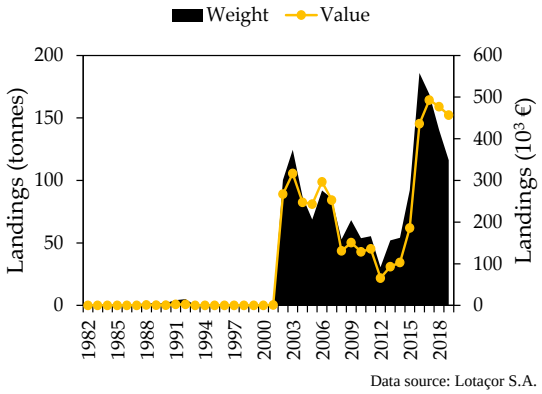
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

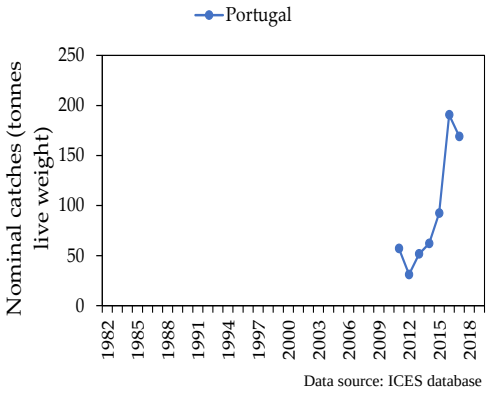
Note: NM: Nautical Miles.

Table 44. Time-series of total allowable catches (in tonnes) for the common mora *Mora moro* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	150

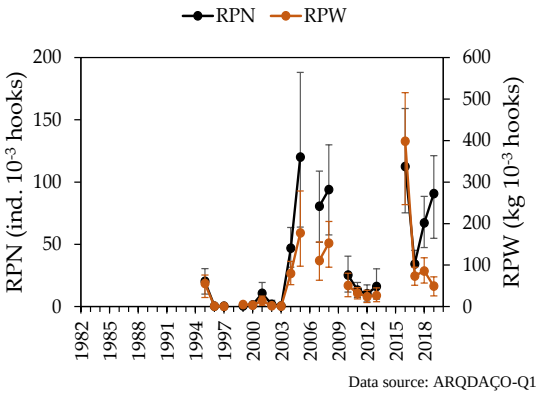
Note: * TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

[Fishing effort]
NA

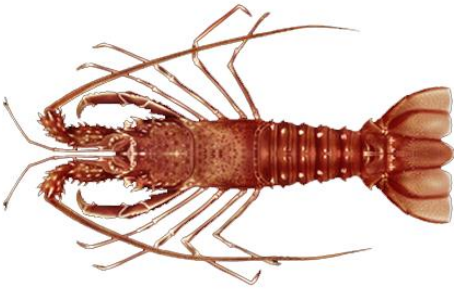


[Nominal and standardized CPUE]
NA

Fig. 17. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for common mora *Mora moro* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Common spiny lobster

Scientific name: *Palinurus elephas* (Fabricius, 1787)



Common name: Pt – Lagosta; En – Common spiny lobster

FAO code: SLO

Distribution and habitat: The common spiny lobster *Palinurus elephas* is a palinurid crustacean distributed in the Eastern Atlantic, from Norway to Morocco, including Azores, Madeira and Canary archipelagos, and in the Mediterranean Sea (Goñi & Latrouite 2005). The species occurs on rocky and coralligenous bottoms where there are numerous protective holes and micro-caves, at depths down to 200 m (Palomares & Pauly 2019), usually between 10 m and 70 m (Holthuis 1991). Little is known about the preferred habitat of juveniles (Goñi & Latrouite 2005). Adults are solitaries, in pairs or in small groups (Palomares & Pauly 2019).

Movements and stock structure: Genetic studies seem to support the existence of a panmictic population within the NE Atlantic Ocean (Froufe et al. 2010). On the other hand, tagging studies have shown a high site association and limited movements in tagged lobsters (Follesa et al. 2009). More studies are needed on the population structure and connectivity to clearly define stock units.

Age and growth: Maximum size reported is 195 mm carapace length (CL; Rjeibi 2012) and maximum age 20 years (Rjeibi et al. 2011) in Mediterranean waters. In the Azores (ICES Subarea X), maximum size reported is 195 mm CL (Sequeira 2001) but ages were not estimated. Males grow faster than females (Follesa et al. 2007; González-Vicente et al. 2012).

Reproduction: Ovigerous females are observed from September to October and February to March (Holthuis 1991). Breeds once a year between June and October in the Atlantic and from July to September in the Mediterranean. However, timing of peak spawning activity, as well as size-at-maturity, can vary across areas (Goñi et al. 2003; Goñi & Latrouite 2005). In the Azores, size-at-maturity is estimated to 73.2 mm CL for females (Sequeira 2001). Spawning probably occurs between October and March (Sequeira 2001).

Feeding habits: Omnivorous, but feeds mainly on hard-shelled bottom dwelling organisms, like molluscs, echinoderms and crustaceans (Goñi & Latrouite 2005).

Fishing importance: The spiny lobster is the main crustacean species targeted by the Azorean coastal fishery. It is mainly picked by hand but may also be caught using pots and traps for crustaceans. It ranks eighteenth in terms of total landed value considering non-straddling stocks (0,2 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 26,51 €.

Table 45. Summary of biological parameters for common spiny lobster *Palinurus elephas* from the Azores region.

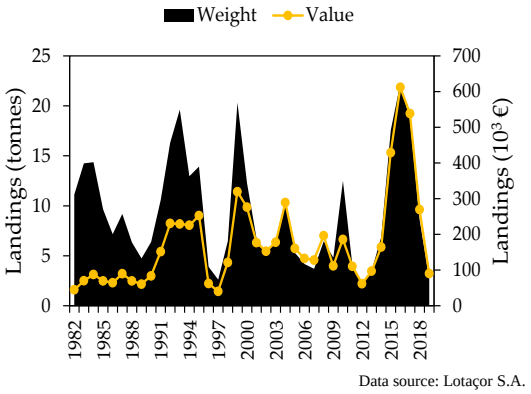
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0021 CL^{2.781}$ (n = 275; $r^2 = 0.98$)	$W = 0.0012 CL^{2.879}$ (n = 229; $r^2 = 0.99$)	NA	Linear regression	Sequeira (2001)
Maximum length (cm)	16.5 CL	19.5 CL	19.5 CL	Length composition	Sequeira (2001)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	7.32 CL	NA	NA	MSF	Sequeira (2001)
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	Oct-Mar (Peak: Nov-Feb)	NA	NA	MSF	Sequeira (2001)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.34 ± 0.66	Trophic level estimated from a number of food items using a randomized resampling routine.	Palomares & Pauly (2019)

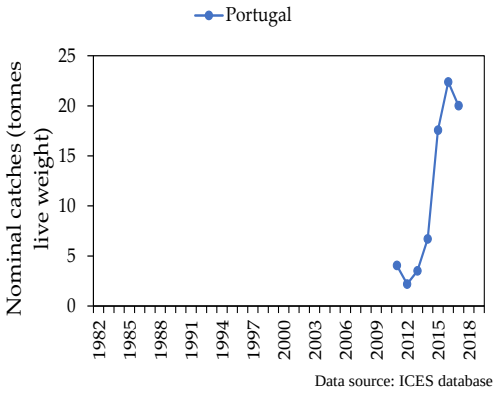
Note: CL: Carapace Length; MSF: Maturity Stage Frequency; NA: Not Available.

Table 46. Summary of management regulations affecting the common spiny lobster *Palinurus elephas* fishery in the Azores region.

Year of implementation	Legislation	Measure
1998	Regulation (EC) No. 850/1998 of 30 March 1998	Minimum landing size (MLS) = 11 cm CL
2000	Ordinance No. 1102-D/2000 of 22 November 2000	Trap Fishing Regulation
2001	Regulation (EC) No. 724/2001 of 4 April 2001	MLS = 9.5 cm CL
2004	Ordinance No. 30/2004 of 22 April 2004	Specificities of traps for crustaceans: mesh size > 30 mm with 4 escape vents (> 50 mm); maximum entrance size = 30 cm. Maximum number of traps = 200 traps for vessels < 9 m in length and 300 traps for vessels < 14 m
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Regional Decree No. 15/2012/A of 2 April 2012	Closed period (1 Oct – 31 Mar)
2014	Ordinance No. 1/2014 of 10 January 2014	Hand-picking Regulation
2017	Ordinance No. 79/2017 of 18 October 2017	Specificities of traps for crustaceans: mesh size > 50 mm; maximum entrance size = 30 cm. Maximum number of traps = 200 traps for vessels < 9 m in length, 300 traps for vessels < 14 m and 400 for vessels > 14m. Fishing area restriction by vessel size (< 14 m: allowed to operate outside the 0.5 NM area; ≥ 14 m: 3 NM; ≥ 24 m: 12 NM)

Note: CL: Carapace Length; NM: Nautical Miles.





[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 18. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for common spiny lobster *Palinurus elephas* in the Azores region. NA: Not Available.

Black scabbardfish

Scientific name: *Aphanopus carbo* Lowe, 1839

Common name: Pt – Peixe-espada-preto; En – Black scabbardfish

FAO code: BSF

Distribution and habitat: The black scabbardfish *Aphanopus carbo* is a trichiurid fish widely distributed in the North Atlantic, from Denmark to Western Sahara, with greatest abundance to the south of the Faroe Islands, west of mainland Portugal and around the Madeira and the Canary archipelagos, sporadic occurrence in the Scotland-Iceland-Greenland ridges and the Azores (Santos et al. 2019a; ICES 2020d). The species occurs at depths between 200 m and 2300 m (Pajuelo et al. 2008), typically found between 400 m and 1800 m (ICES 2020d). Juveniles are mesopelagic (Nakamura & Parin 1993) and adults bathypelagic (Coad & Reist 2004).

Movements and stock structure: Available information is not sufficient to clearly define stock units along the NE Atlantic Ocean (ICES 2020d). ICES considers that a single stock exists but has historically given separate advice for three management units which reflect the main fisheries to which the species is subjected: a) Northern (ICES Divisions Vb and XIIb and Subareas VI and VII; see Appendix I) exploits this resource by trawlers; b) Southern (Subareas VIII and IX) by deep-water longliners, and c) Other areas (Divisions IIIa and Va and Subareas I, II, IV, X and XIV) by both longliners and trawlers (ICES 2020d). This classification has recently been revised and now ICES considers a single assessment unit for this stock in Atlantic waters (ICES 2020d). Migrations driven by feeding and reproduction processes have been thought to connect these populations (Figueiredo et al. 2003).

Age and growth: Maximum size reported is 120 cm total length (TL) and maximum age 32 years in the British Isles (ICES Subarea VII; Kelly et al. 1998). However, maximum age between 12 and 15 years and maximum size 131 cm TL and 148 cm TL have usually been estimated in the Atlantic (ICES 2020d). In the Azores (ICES Subarea X), maximum size reported is 147 cm fork length (FL; Machete et al. 2011) and maximum age 12 years (Vieira et al. 2009). Females grow faster than males (Morales-Nin & Sena-Carvalho 1996).

Reproduction: The black scabbardfish spawns in one single event (total spawner) during the last quarter of the year (Figueiredo et al. 2003; Neves et al. 2009; Pajuelo et al. 2008; Perera 2008; Ribeiro Santos et al. 2013). Size-at-maturity is estimated between 103 cm and 116 cm TL around Madeira, Canary Islands and west of the British Isles (Figueiredo et al. 2003; Pajuelo et al. 2008; Ribeiro Santos et al. 2013). Reproductive aspects of the species in Azorean waters are not available. Overall, females outnumber males (Figueiredo et al. 2003).

Feeding habits: Feeds on crustaceans, cephalopods and fishes (mostly macrourids, morids and alepocephalids) (Froese & Pauly 2019).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines in deep waters. Ranks nineteenth in terms of total landed value considering non-straddling stocks (0,2 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 2,76 €.

Table 47. Summary of biological parameters for black scabbardfish *Aphanopus carbo* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	NA		
Maximum length (cm)	NA	NA	134.0 FL	Length composition	Dias (2006)
	NA	NA	147.0 FL	Length composition	Machete (2007)
	126.0 TL	122.0 TL	NA	Length composition	Vieira et al. (2009)
	NA	NA	147.0 FL	Length composition	Machete et al. (2011)
	NA	NA	147.0 FL	Length composition	Besugo (2013)
Maximum age (y)	12	12	NA	ALK	Vieira et al. (2009)
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	NA		
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	4.48 ± 0.77	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; FL: Fork Length; ALK: Age-Length Key; NA: Not Available.

Table 48. Summary of management regulations affecting the black scabbardfish *Aphanopus carbo* fishery in the Azores region.

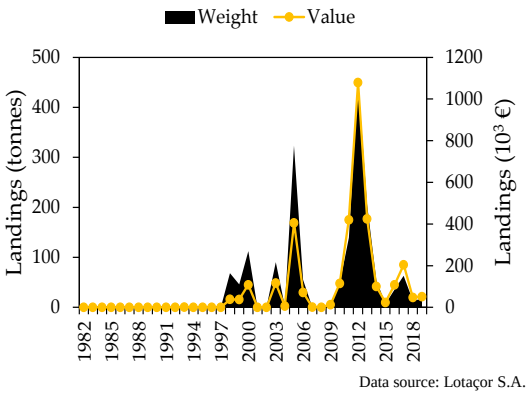
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2002	Regulation (EC) No. 2340/2002 of 16 December 2002	Total allowable catch (TAC/quota)
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size (12 mm for bottom longline and handlines). Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Maximum of 120 hooks per basket. Fishing area restriction by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM)
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)

Note: NM: Nautical Miles.

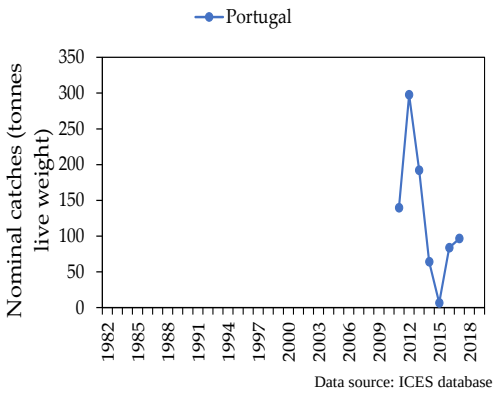
Table 49. Time-series of total allowable catches (in tonnes) for the black scabbardfish *Aphanopus carbo* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2003	4000
2004	4000
2005	4000
2006	4000
2007	4000
2008	4000
2009	3600
2010	3348
2011	3348
2012	3348
2013	3700
2014	3700
2015	3700
2016	3700
2017	3330
2018	2997
2019	2832
2020	2832

Note: *TAC/quota for European Commission's vessels operating in the ICES Subarea VIII, IX and X.



Data source: Lotaçor S.A.



Data source: ICES database

[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 19. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for black scabbardfish *Aphanopus carbo* in the Azores region. NA: Not Available.

Rough limpet

Scientific name: *Patella aspera* Röding, 1798

Common name: Pt – Lapa-brava; En – Rough limpet

FAO code: LQY

Distribution and habitat: The rough limpet *Patella aspera* is a patellid mollusc distributed from Southwest Norway to Mediterranean Sea, including the Azores, Madeira and Canary archipelagos (Lewis et al. 1982; Lavie et al. 1987; Hawkins et al. 2000). The species occurs on rocky bottoms in the middle and lower part of the littoral zone (Guerra & Gaudencio 1986) at depths down to 10 m (Hawkins et al. 1990). Previously classified as *Patella ulyssiponensis*, *P. aspera* from the Macaronesian archipelagos is now considered a separate species from the European Continental congener *P. ulyssiponensis*, based on genetic analyses (Weber & Hawkins 2005).

Movements and stock structure: Genetic studies indicate five population units: continental Atlantic, Mediterranean, Azores, Madeira and Canary (Weber et al. 1998; Hawkins et al. 2000; Carreira et al. 2010; 2017). Geometric morphometric analysis detected significant morphological differentiation that matched major phylogeographic groupings, i.e. continental Atlantic and Mediterranean populations (Carreira 2017).

Age and growth: Maximum size reported is 83 mm maximum shell- length (MSL) and maximum age 9 years in Madeira (Sousa et al. 2017). In the Azores, maximum size reported is 93.3 mm MSL (Ferraz 1998) but no age information is available. Females grow faster than males (Sousa et al. 2017).

Reproduction: Protandric hermaphrodite species (male during its first sexual maturity) with synchronous ovary development, determinate fecundity and batch spawner pattern (Thompson 1979; Sousa et al. 2017). Becomes mature in its second year at a MSL of 38 mm (males) at 42 mm (females; Guerra & Gaudencio 1986; Sousa et al. 2017). However, exploitation can cause sex change in smaller and presumably younger individuals (Martins et al. 2019). Spawning occur from October to December/January in Portuguese waters (Guerra & Gaudencio 1986) but timing of peak spawning activity can vary across regions and appears to involve falling water temperatures and wave action (Lewis et al. 1982). In the Azores, it reaches sexual maturity between 41 mm and 45 mm MSL, with peak of maximum gonad development in January and a gonad resting period in May to June (Martins et al. 1987). Males outnumber females and the proportion of males to females tended to decrease with increasing size/age (Guerra & Gaudencio 1986).

Feeding habits: Herbivores; feeds on algae living in littoral zone (Della Santina et al. 1993).

Fishing importance: The rough limpet is the main mollusc species targeted by the Azorean coastal fishery. It is picked by hand and ranks twenty-third in terms of total landed value considering non-straddling stocks (0,1 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 7,15 €.

Table 50. Summary of biological parameters for rough limpet *Patella aspera* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0002\ MSL^{2.807}$ ($n = 924$; $r^2 = 0.81$)	Linear regression	Ferraz (1998)
	NA	NA	$W = 0.00005\ MSL^{3.203}$ ($n = 389$; $r^2 = 0.86$)	Linear regression	Enes (2015)
Maximum length (mm)	NA	NA	74.0 MSL	Length composition	Martins et al. (1987)
	92.0	78.0	93.3 MSL	Length composition	Ferraz (1998)
	NA	NA	80.5 MSL	Length composition	Enes (2015)
Maximum age (y)	NA	NA	NA		
Length (mm) at 50% maturity	NA	NA	41-45 MSL		Martins et al. (1987)
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	Aug-Apr	MSF, GSI	Martins et al. (1987)
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	NA		

Note: MSL: Maximum Shell Length; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; NA: Not Available.

Table 51. Summary of management regulations affecting the rough limpet *Patella aspera* fishery in the Azores region.

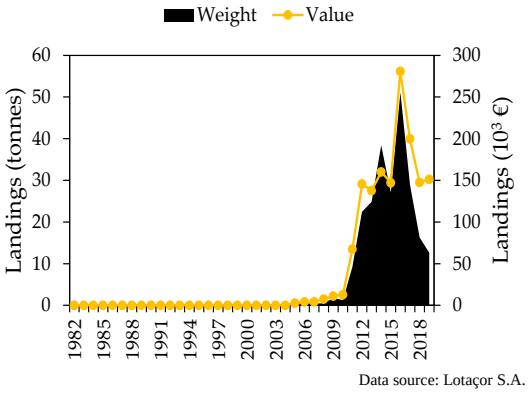
Year of implementation	Legislation	Measure
1993	Regional Decree No. 14/1993/A of 31 July 1993	Hand-picking Regulation for Limpets. Closed period (1 Oct – 31 May). Minimum landing size (MLS) = 55 mm MS
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Regional Decree No. 15/2012/A of 2 April 2012	Closed period (1 Oct – 30 Apr). MLS = 50 mm MS
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2014	Ordinance No. 1/2014 of 10 January 2014	Hand-picking Regulation
2015	Ordinance No. 73/2015 of 15 June 2015	Total allowable catch (TAC/quota)
2019	Ordinance No. 21/2019 of 19 March 2019	Closed period (1 Oct – 31 May)

Note: MS: Maximum Shell Size.

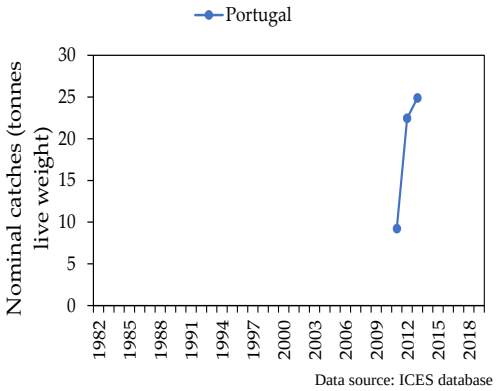
Table 52. Time-series of total allowable catches (in kg per day by hand picker) for the limpets *Patella* spp. fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2015	80
2016	80
2017	80
2018	50
2019	50
2020	50

Note: *TAC/quota for the ICES Subarea X.



Data source: Lotaçor S.A.



Data source: ICES database

[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

[Nominal and standardized CPUE]
NA

Fig. 20. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for rough limpet *Patella aspera* in the Azores region. NA: Not Available.

Thornback ray

Scientific name: *Raja clavata* Linnaeus, 1758

Common name: Pt – Raia; En – Thornback ray

FAO code: RJC

Distribution and habitat: The thornback ray *Raja clavata* is a rajid fish widely distributed in the Eastern Atlantic and Southwest Indian Ocean (Iceland to Madagascar), including the North Sea, the Macaronesian archipelagos, the Mediterranean Sea and the western Black Sea (Froese & Pauly 2019). The thornback ray is demersal, living on mud and sandy-muddy bottoms at depths between 5 and 1020 m (Last et al. 2016) but usually found in shallow waters down to 250 m (Santos et al. 2020c). Juveniles are found in shallower waters usually forming aggregations (Froese & Pauly 2019; Santos et al. 2020c).

Movements and stock structure: Genetic studies seem to support the existence of a stock unit in the Azores (ICES Subarea X; Chevolot et al. 2006; Marandel et al. 2018). However, little is known about the biology of the species in this ecoregion.

Age and growth: Maximum size reported is 104.7 cm total length (TL) and maximum age 12 years in the British Isles (ICES Subarea VII; Ryland & Ajayi 1984). In the Azores (ICES Subarea X), maximum size reported is 139 cm TL (Santos et al. 2020c) and maximum age 10 years (Rosa 2002). Males and females grow at a similar rate when young (1-4 year), but growth rates in males appear to be slowing down after four years of age (Whittamore & McCarthy 2005).

Reproduction: The thornback ray is ovoviviparous with asynchronous ovary development, determinate fecundity and batch spawner pattern (Serra-Pereira et al. 2011). Adults form same-sex aggregations during the breeding season and migrate independently to the spawning area (Ryland & Ajayi 1984). Size-at-maturity of females ranges from 61.2 cm to 78.4 cm and of males 58.8 cm to 67.9 cm TL (Walker 1999; Demirhan et al. 2005; Whittamore & McCarthy 2005; KrstulovićŠifner et al. 2009; Serra-Pereira et al. 2011). Age-at-maturity is around 5-8 years (Serra-Pereira et al. 2011; Last et al. 2016). Spawning occurs from May to January in Portuguese waters but the duration of the spawning season, size-at-maturity, and fecundity can vary across regions (Serra-Pereira et al. 2011). Paired eggs are laid and deposited on shallow bottoms. Embryos feed on yolk, egg cases hatch after 4 to 5 months and pups are c. 11 to 13 cm TL at birth (Pawson & Ellis 2005). The proportion of males to females is close to 1:1 (KrstulovićŠifner et al. 2009). Reproductive aspects in Azorean waters are not available.

Feeding habits: Feeds mainly on small bony fishes, crustaceans (crabs and shrimps) and cephalopods (Farias et al. 2006).

Fishing importance: Targeted by the Azorean demersal fishery using hook and lines. Ranks twenty-sixth in terms of total landed value considering non-straddling stocks (0,1 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 1,18 €

Table 53. Summary of biological parameters for thornback ray *Raja clavata* from the Azores region.

Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	NA	NA	$W = 0.0058\ TL^{3.022}$ (n = 404; $r^2 = 0.93$)	Linear regression	Rosa et al. (2006)
Maximum length (cm)	NA	NA	93.0 TL	Length composition	Rosa (2002)
	NA	NA	89.0 TL	Length composition	Rosa et al. (2006)
	NA	NA	139.0 TL	Length composition	Santos et al. (2020c)
Maximum age (y)	10	9	10	Whole vertebrae	Rosa (2002)
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	NA	NA	NA		
Fecundity (thousands of oocytes)	NA				
L_{inf}	NA	NA	161.90 TL	Direct readings – Whole vertebrae	Rosa (2002)
	NA	NA	174.80 TL	Back calculation – Dahl-Lea equation	Rosa (2002)
	NA	NA	143.70 TL	Back calculation – Fraser-Lee equation	Rosa (2002)
	NA	NA	130.60 TL	Length-frequency analysis	Rosa (2002)
k	NA	NA	0.06	Direct readings – Whole vertebrae	Rosa (2002)
	NA	NA	0.05	Back calculation – Dahl-Lea equation	Rosa (2002)
	NA	NA	0.06	Back calculation – Fraser-Lee equation	Rosa (2002)
	NA	NA	0.07	Length-frequency analysis	Rosa (2002)
t_0	NA	NA	-3.03	Direct readings – Whole vertebrae	Rosa (2002)
	NA	NA	-0.76	Back calculation – Dahl-Lea equation	Rosa (2002)
	NA	NA	-3.64	Back calculation – Fraser-Lee equation	Rosa (2002)
	NA	NA	-4.61	Length-frequency analysis	Rosa (2002)
Mortality rate	M = 0.33	M = 0.33	M = 0.50	Beverton & Holt (1959)	ICES (2015d)
	M = 0.20	M = 0.20	M = 0.30	Taylor (1960)	ICES (2015d)
	M = 0.20	M = 0.20	M = 0.30	Tanaka (1960)	ICES (2015d)
	M = 0.28	M = 0.28	M = 0.38-0.70	Alverson & Carney (1975)	ICES (2015d)
	M = 0.26-0.32	M = 0.31-0.42	M = 0.20-0.40	Rikhter & Efanov (1976)	ICES (2015d)
	NA	NA	M = 0.14-0.50	Pauly (1980)	ICES (2015d)
	M = 0.30	M = 0.30	M = 0.44	Hoening (1983)	ICES (2015d)
	M = 0.31	M = 0.31	M = 0.46	Alagaraja (1984)	ICES (2015d)
	M = 0.49-0.60	M = 0.58-0.77	M = 0.39-0.74	Roff (1984)	ICES (2015d)
	M = 0.22-0.50	M = 0.19-0.53	M = 0.14-0.84	Ralston (1987)	ICES (2015d)
	M = 0.17-0.29	M = 0.15-0.30	M = 0.13-0.44	Gunderson & Dygert (1988)	ICES (2015d)
	M = 0.33-0.40	M = 0.39-0.51	M = 0.26-0.49	Charnov & Berrigan (1990)	ICES (2015d)

Parameter	Value			Method	Source
	Female	Male	Combined		
	M = 0.17-0.28	M = 0.17-0.29	M = 0.14-0.36	Djabali *et al.* (1993) – equation 1	ICES (2015d)
	NA	NA	M = 0.14-0.38	Djabali *et al.* (1993) – equation 2	ICES (2015d)
	M = 0.27-0.33	M = 0.32-0.42	M = 0.22-0.41	Jensen (1996) – equation 1	ICES (2015d)
	M = 0.14-0.34	M = 0.13-0.35	M = 0.10-0.56	Jensen (1996) – equation 2	ICES (2015d)
	M = 0.14-0.32	M = 0.12-0.33	M = 0.09-0.53	Jensen (1996) – equation 3	ICES (2015d)
	M = 0.46-0.84	M = 0.43-0.87	M = 0.37-1.29	Pauly & Binohlan (1996)	ICES (2015d)
	M = 0.13-0.31	M = 0.11-0.33	M = 0.08-0.51	Cubilos *et al.* (1999)	ICES (2015d)
	M = 0.55-0.84	M = 0.71-0.98	M = 0.40-1.40	Groeneveld (2000)	ICES (2015d)
	M = 0.17-0.39	M = 0.15-0.40	M = 0.11-0.64	Cubilos (2003)	ICES (2015d)
	M = 0.28	M = 0.28	M = 0.42	Hewitt & Hoening (2005)	ICES (2015d)
	NA	NA	M = 0.25-0.35	Zhang & Megrey (2006)	ICES (2015d)
Trophic level (mean ± s.e.)	NA	NA	4.15 ± 0.95	Trophic level estimated from a number of food items using a randomized resampling routine.	Froese & Pauly (2019)

Note: TL: Total Length; MSF: Maturity Stage Frequency; GSI: Gonado Somatic Index; M: Natural Mortality; NA: Not Available.

Table 54. Summary of management regulations affecting the thornback ray *Raja clavata* fishery in the Azores region.

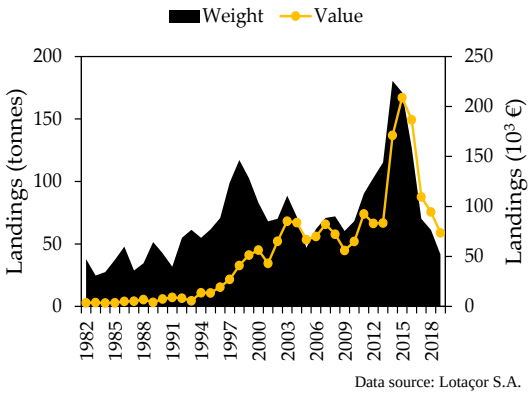
Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-C/2000 of 22 November 2000	Hook and line Fishing Regulation
2003	Ordinance No. 101/2002 of 24 October 2002	Minimum hook size = 12 mm for bottom longline and handlines. Fishing area restriction for longline (allowed to operate outside the 3 NM area) and by vessel type (closed decks ≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 6 NM; > 30 m: 12 NM)
2003	Regulation (EC) 1954/2003 of 4 November 2003	A box of 100 miles was created around the Azorean EEZ where only the Azorean fleets are permitted to line fish for deep-sea species
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Regulation (EC) 1568/2005 of 20 September 2005	Prohibition of gillnet, entangling net or trammel net at depths greater than 200 m
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2009	Ordinance No. 43/2009 of 27 May 2009	Fishing area restriction for longline by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 12 NM). Maximum of 120 hooks per basket
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Ordinance No. 50/2012 of 27 April 2012	Fishing area restriction for longline (allowed to operate outside the 6 NM area) and by vessel size (≤ 14 m in length: allowed to operate outside the 1 NM area; > 14 m: 3 NM; > 24 m: 30 NM)
2014	Regulation (EC) 1380/2013 of 11 December 2013	Landing obligation for quota species
2015	Ordinance No. 74/2015 of 15 June 2015	Minimum landing size (MLS) = 52 cm TL
2018	Ordinance No. 116/2018 of 25 October 2018	Minimum hook size (14 mm for bottom longline and handlines). Fishing area restriction by vessel size (< 14 m in length: allowed to operate outside the 3 NM area for handlines or 1 NM when near the registration port; ≥ 14 m: 6 NM for hook and line fishing; ≥ 24 m: 30 NM for hook and line fishing)
2020	Ordinance No. 92/2019 of 30 December 2019	Total allowable catch (TAC/quota)

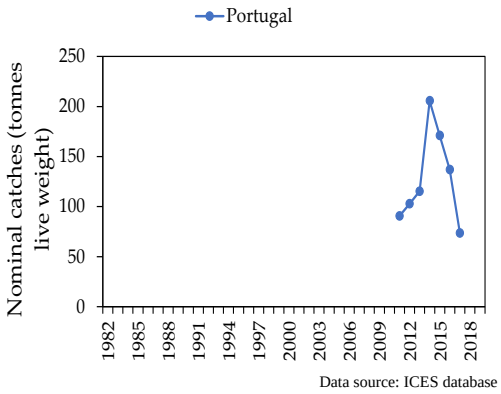
Note: NM: Nautical Miles; TL: Total Length.

Table 55. Time-series of total allowable catches (in tonnes) for the thornback ray *Raja clavata* fishery in the Azores region.

Year	Total allowable catch (TAC/quota)*
2020	100

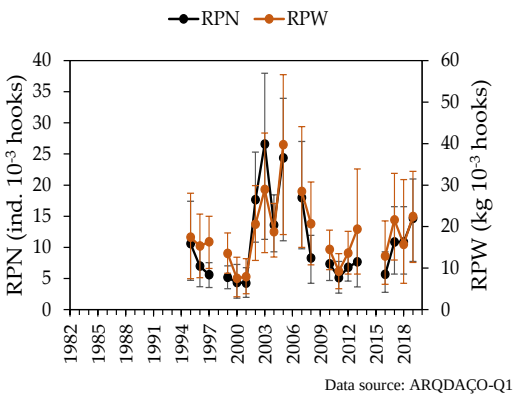
Note: *TAC/quota for vessels operating in the ICES Subarea X.





[Discard rate]
NA

[Fishing effort]
NA



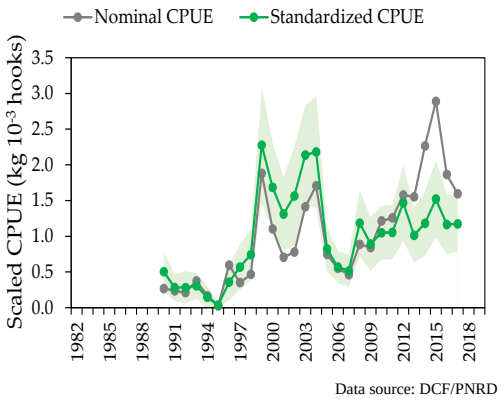


Fig. 21. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for thornback ray *Raja clavata* in the Azores region. RPN: Relative Population Number; RPW: Relative Population Weight; CPUE: Catch Per Unit Effort; NA: Not Available.

Mediterranean slipper lobster

Scientific name: *Scyllarides latus* (Latreille, 1803)

Common name: Pt – Cavaco; En – Mediterranean slipper lobster

FAO code: YLL

Distribution and habitat: The Mediterranean slipper lobster *Scyllarides latus* is a scyllarid crustacean distributed in the Eastern Atlantic Ocean, from mainland Portugal to Senegal, including Macaronesian archipelagos and in the Mediterranean Sea (Palomares & Pauly 2019). The species occurs on rocky and sandy bottoms at depths between 4 m and 100 m (Holthuis 1991). During daytime it hides in caves, tending to congregate on the ceilings, and forages during the night (Martins 1985a; Carpenter & De Angelis 2014).

Movements and stock structure: Genetic studies suggest this species forms a panmictic population along the Northeast Atlantic and the Mediterranean (Faria et al. 2013). High fecundity and long-lived pelagic larva have been thought to promote high levels of connectivity between these populations (Faria et al. 2013). However, mechanisms transporting the larvae are not fully understood. In the Azores, for example, is possible that larvae hatched there can perform a full turn and come back and settle in the islands after one year (Martins 1985b). More information about the population structure and connectivity is needed to clearly define stock units.

Age and growth: Maximum size recorded in the south-eastern Mediterrean is 144 mm carapace length (CL; Almog-Dhtayer 1988). In the Azores (ICES Subarea X), maximum size reported is 122 mm CL (Martins 1985a). However, animals from the Azores were heavier than those of the same size from the Mediterranean (Spanier & Lavalli 1998). Molting is believed to take place from December to February (Martins 1985a). Comparision of growth rates between sexes are not known. No age information is available for the Mediterranean slipper lobster.

Reproduction: The Mediterranean slipper lobster is an oviparous species with determinate fecundity and batch spawner pattern (Spanier & Lavalli 1998). It moves seasonally to deeper waters and return to shallow zones around early spring to mid-summer for reproduction (Martins 1985a). No information is available about size-at-maturity. Ovigerous females were observed from June to August (Martins 1985a; Holthuis 1991). In the Azores, spawning occurs in July and August (Martins 1985a). Fertilization is external and the egg-bearing period lasts for approximately 6-8 weeks (Martins 1985a). Fecundity varies according to the CL, with a mean of 227 424 eggs per female (Martins 1985a).

Feeding habits: Feeds on molluscs, especially limpets (*Patella* spp.) (Martins 1985a).

Fishing importance: The Mediterranean slipper lobster is picked by hand or caught using pots and traps for crustaceans by the Azorean coastal fleet. It is a highly esteemed sea food in the Azores and ranks thirty-sixth in terms of total landed value considering non-straddling stocks (0,04 M € on average per year; Santos et al. 2020a). Mean price per kg for 2009-2019 was 25,15 €.

Table 56. Summary of biological parameters for Mediterranean slipper lobster *Scyllarides latus* from the Azores region.

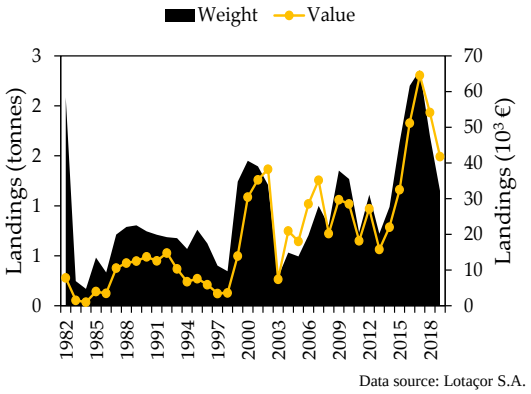
Parameter	Value			Method	Source
	Female	Male	Combined		
Length-weight relationship	$W = 0.0065\ CL^{2.580}$ ($n = 190$; $r^2 = 0.99$)	$W = 0.0020\ CL^{2.825}$ ($n = 308$; $r^2 = 0.99$)	NA	Linear regression	Martins (1985a)
Maximum length (cm)	122.0 CL	110.0 CL	122.0 CL	Length composition	Martins (1985a)
	121.0 CL	112.0 CL	121.0 CL	Length composition	Schmiing & Afonso (2009)
Maximum age (y)	NA	NA	NA		
Length (cm) at 50% maturity	NA	NA	NA		
Age (y) at 50% maturity	NA	NA	NA		
Spawning season	Jul-Aug	NA	NA	MSF	Martins (1985a)
Fecundity (thousands of eggs)	151.5-356.1			Broods of eggs analysis	Martins (1985a)
L_{inf}	NA	NA	NA		
k	NA	NA	NA		
t_0	NA	NA	NA		
Mortality rate	NA	NA	NA		
Trophic level (mean ± s.e.)	NA	NA	3.86 ± 0.10	Trophic level estimated from a number of food items using a randomized resampling routine.	Palomares & Pauly (2019)

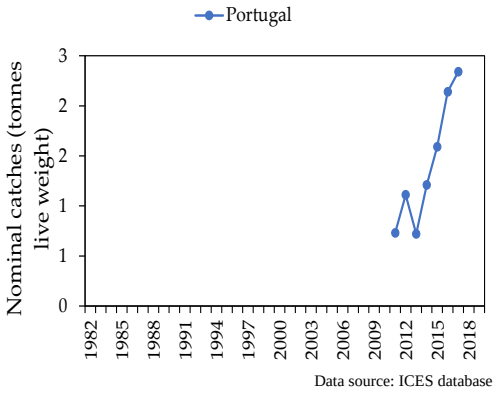
Note: CL: Carapace Length; MSF: Maturity Stage Frequency; NA: Not Available.

Table 57. Summary of management regulations affecting the Mediterranean slipper lobster *Scyllarides latus* fishery in the Azores region.

Year of implementation	Legislation	Measure
2000	Ordinance No. 1102-D/2000 of 22 November 2000	Trap Fishing Regulation
2004	Ordinance No. 30/2004 of 22 April 2004	Specificities of traps for crustaceans: mesh size > 30 mm with 4 escape vents (> 50 mm); maximum entrance size = 30 cm. Maximum number of traps = 200 traps for vessels < 9 m in length and 300 traps for vessels < 14 m.
2004	Regulation (EC) 1811/2004 of 11 October 2004	Prohibition of bottom trawls in Azorean waters
2005	Ordinance No. 91/2005 of 22 December 2005	Prohibition of gillnet, entangling net or trammel net for demersal and deep-water species
2010	Regional Decree No. 29/2010/A of 9 November 2010	Legal framework for Azorean Fisheries
2012	Regional Decree No. 15/2012/A of 2 April 2012	Closed period (1 May – 31 Aug). Minimum landing size (MLS) = 170 mm corresponding to the measurement between the eye and the tail base.
2014	Ordinance No. 1/2014 of 10 January 2014	Hand-picking Regulation
2017	Ordinance No. 13/2017 of 31 January of 2017	MLS = 77 mm CL
2017	Ordinance No. 79/2017 of 18 October 2017	Specificities of traps for crustaceans: mesh size > 50 mm; maximum entrance size = 30 cm. Maximum number of traps = 200 traps for vessels < 9 m in length, 300 traps for vessels < 14 m and 400 for vessels > 14m. Fishing area restriction by vessel size (< 14 m: allowed to operate outside the 0.5 NM area; ≥ 14 m: 3 NM; ≥ 24 m: 12 NM).

Note: CL: Carapace Length; NM: Nautical Miles.





[Discard rate]
NA

[Fishing effort]
NA

[Survey-derived abundance index]
NA

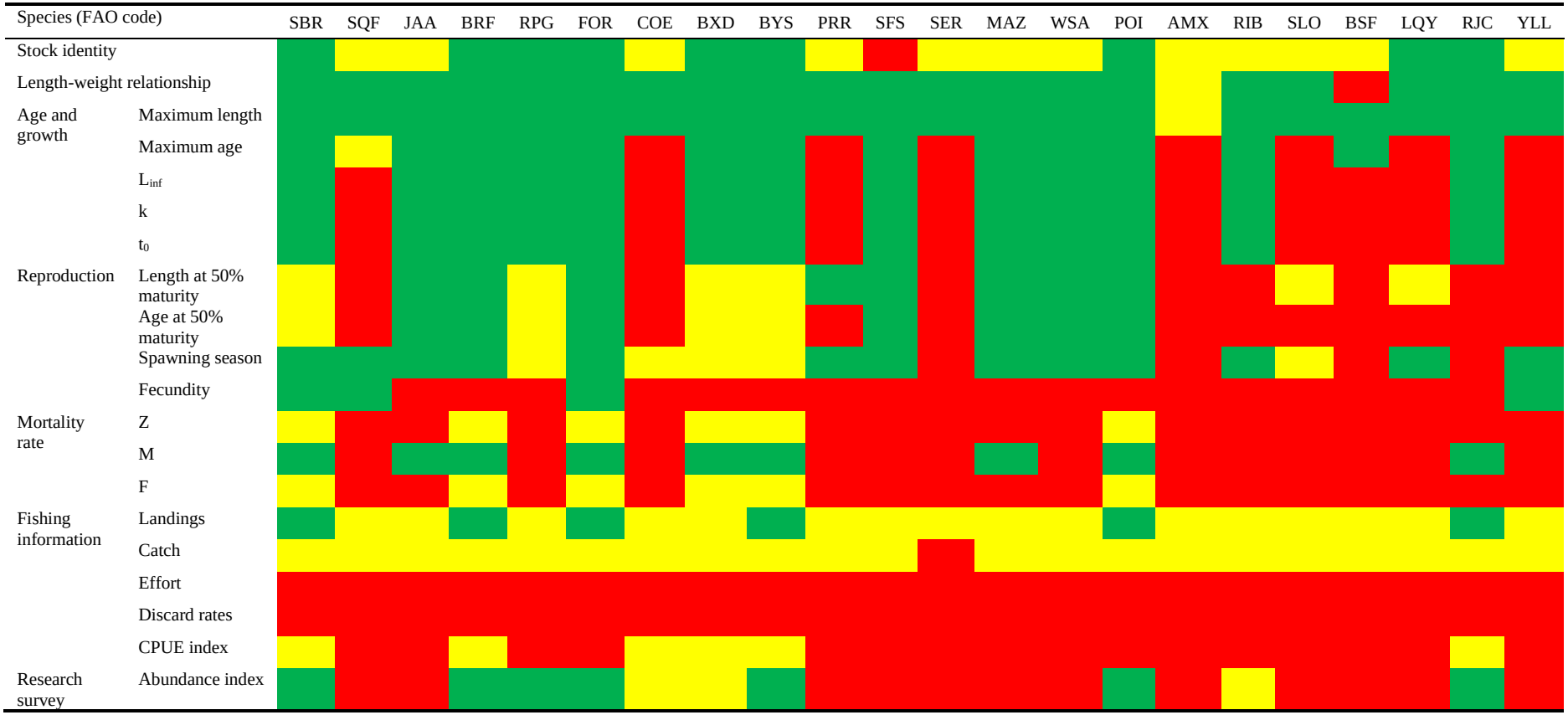
[Nominal and standardized CPUE]
NA

Fig. 22. Annual commercial landings, nominal catches, discard rates, fishing effort and abundance indices (mean ± 0.95 confidence interval) derived from surveys and commercial fishery (nominal and standardized CPUE) for Mediterranean slipper lobster *Scyllarides latus* in the Azores region. NA: Not Available.

FINAL CONSIDERATIONS

Stock delimitation, life-history parameters and survey-derived abundance data or other indicators of stock size such as fishery-dependent indices (landings or catches per unit effort) are not available (red colour in overview table below) or are insufficient for assessment purposes (yellow colour) in most of priority stocks. Available data whether sufficient (green colour) or not should be reviewed, revised and validated in future studies to facilitate use in stock assessment models. For some coastal resources (e.g. blue jack mackerel, amberjacks, rough limpets), catches are not fully reported because they are mainly caught for self-consumption or used as live-bait in tuna fishery, and therefore official commercial landings may be underestimated. A well-structured monitoring program to assist data collection of missing information on reproductive biology, growth parameters and estimates of mortality rates is of utmost importance. Alternatively, data-limited assessment methods should be explored to determine proxies for stock status and define management strategies.

OVERVIEW OF THE CURRENT DATA AVAILABLE



Available

Available but insufficient for assessment/management purpose or estimated values are uncertain or show high discrepancies

Not available

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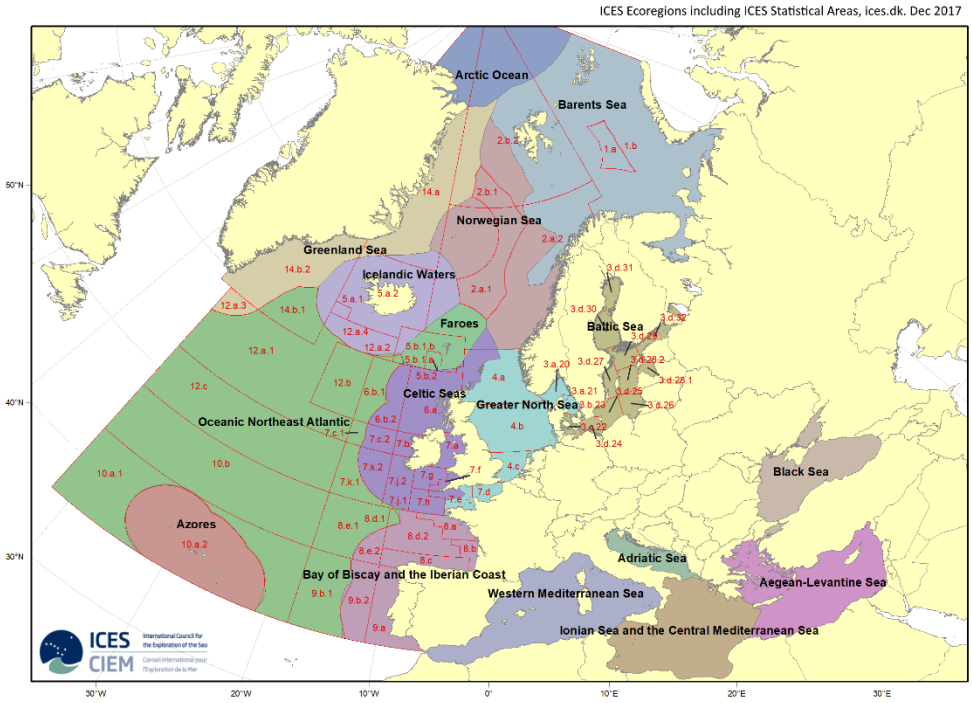
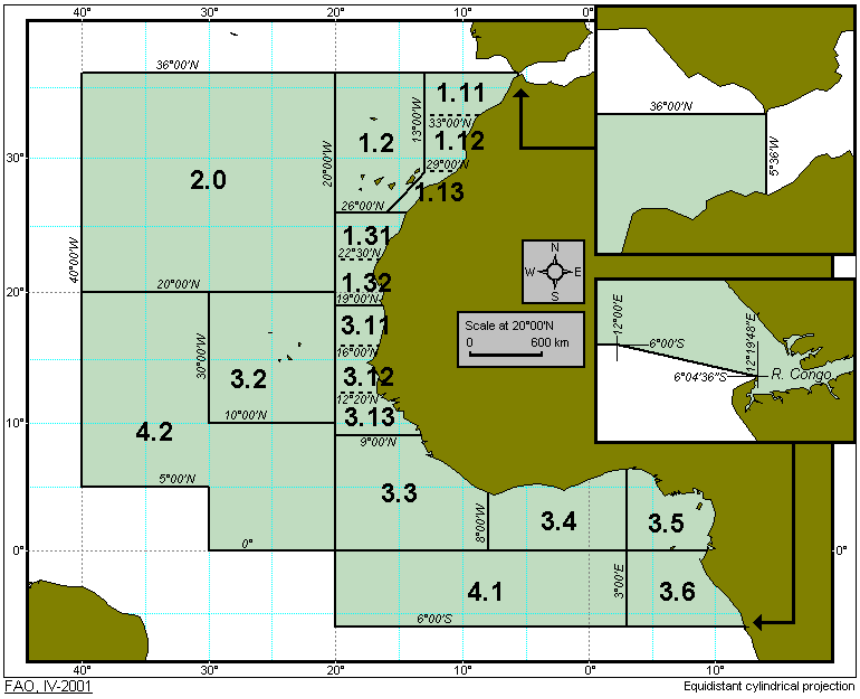
APPENDIX I

A. ICES ecoregions and advisory areas.



Source: https://www.ices.dk/advice/advisory-process/Pages/ICES-ecosystems-and-advisory-areas.aspx

B. CECAF major fishing area 34 and its statistical divisions.



Source: http://www.fao.org/fishery/area/Area34/en

GLOSSARY

Asynchronous oocyte maturation (or asynchronous ovarian development) - Oocytes of all stages are present in the ovary. Ovary appears to be a random mixture of oocytes, at every conceivable stage.

Batch spawner pattern - Multiple spawning of an individual in a spawning season; species which sheds eggs more than once through a spawning season rather than within a short period (a sequential spawner).

Determinate fecundity - Fecundity is determinate when the potential annual fecundity becomes fixed prior to the onset of spawning. In fishes with determinate fecundity, total fecundity decreases with each spawning because the standing stock of advanced yolked oocytes is not replaced during the spawning season.

Gonochorist species - Species with sexes separate, male and female reproductive organs being in different individuals, as opposed to hermaphroditism.

Group-synchronous ovarian development - During gonadal recrudescence, each ovary contains two or more clutches of oocytes in different stages of development that are successively ovulated.

Indeterminate fecundity - Fecundity is indeterminate when the potential annual fecundity of a female is not fixed prior to onset of spawning and unyolked oocytes continue to be matured and spawned during the spawning season.

Meta-population - Group of spatially separated populations of the same species which interact at some level.

Oviparous - Producing eggs that develop and hatch outside the body of the female.

Ovoviviparous - Animals that retain the eggs within the body of the female in a brood chamber in which the development of the embryo takes place, perhaps deriving some nourishment from the female, but without strong umbilical attachment to a placenta as in mammals; the typical condition of so-called "live-bearing" fishes.

Protandrous hermaphroditism - Individual functions first as a male and later as a female.

Protogynous hermaphroditism - Individual functions first as a female and later as a male.

Sequential spawner pattern - Release of eggs at intervals, usually over several days or weeks.

Stock unit - Population of a species for which it is assumed that abundance dynamics are determined by internal processes of recruitment and mortality, and insignificantly affected by immigration and emigration.

Straddling stocks - Stocks that migrate through or occur in more than one Exclusive Economic Zone.

Synchronous ovarian development - All oocytes, once formed, grow and ovulate from the ovary development in unison; further replacement of one stage by an earlier stage does not take place.