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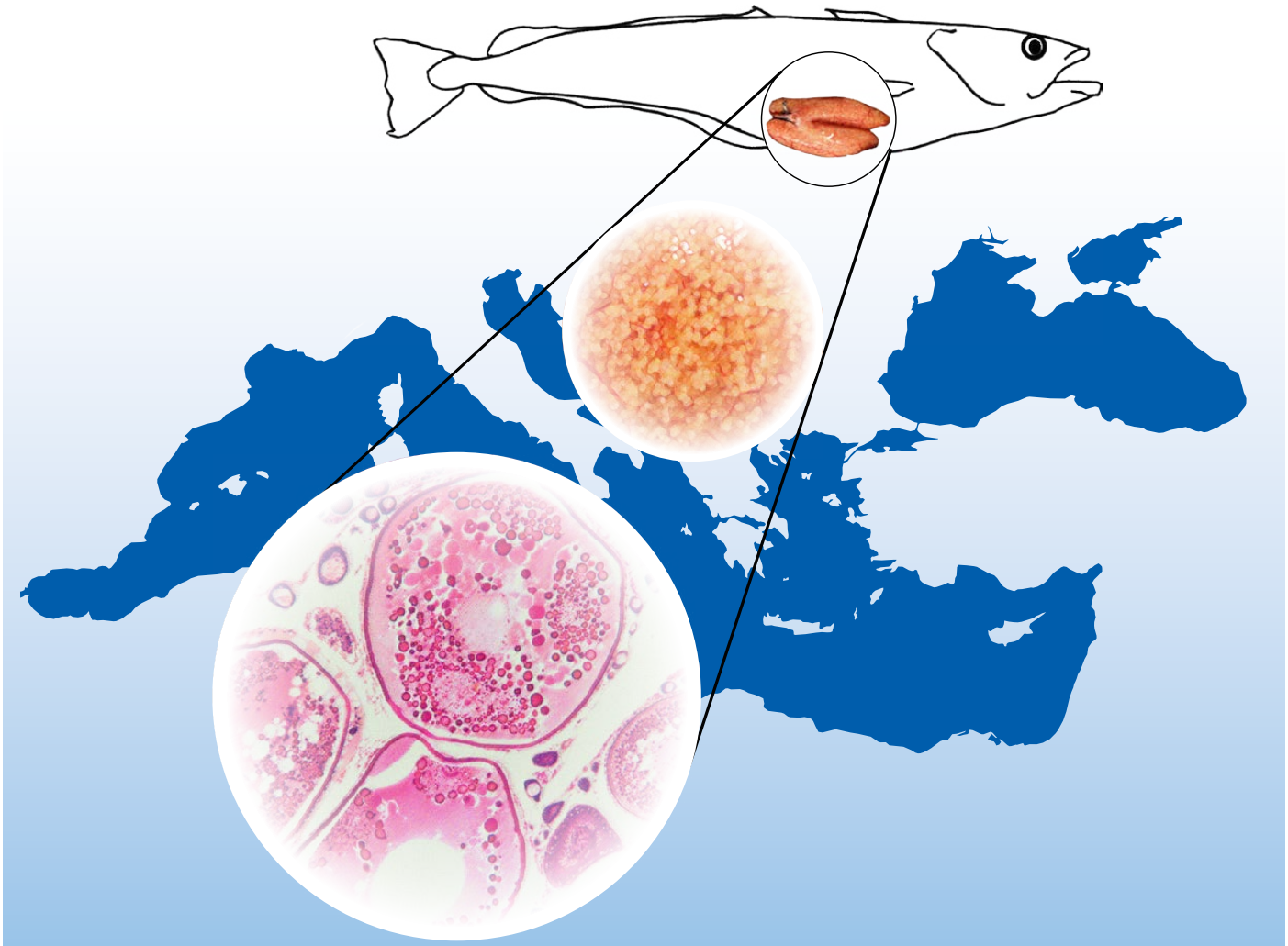

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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

STUDIES AND REVIEWS 99

ATLAS OF THE MATURITY STAGES OF MEDITERRANEAN FISHERY RESOURCES

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Preparation of this document

This publication is part of the Studies and Reviews series of the General Fisheries Commission for the Mediterranean (GFCM), which focuses on specific aspects of scientific interest for Mediterranean and Black Sea fisheries. This atlas is the fruit of the coordinated work of 22 researchers from different scientific institutes and stems from an experience on fish maturity staging carried out at the Mediterranean level. It falls within one of the main targets of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries implemented by the GFCM, which aims, among other things, to enhance knowledge and expertise on fisheries namely by strengthening data collection and information.

Since 1984, several institutes in Italy have been involved in national and international scientific fisheries programmes, focused on the study of the biology, ecology, population dynamics and the assessment of the most important fishery resources, including *Merluccius merluccius*, *Mullus barbatus* and *Sardina pilchardus*. Since the beginning of 2000, biological, environmental, technical, and socio-economic data on fish catch have been regularly collected (including within the GFCM Data Collection Reference Framework [DCRF] and, at the European level, the Data Collection Framework [DCF]). Since the beginning of data collection, there has been a need for strong regional coordination on the methodology and maturity criteria and for a general agreement among maturity stagers and laboratories. In this context, a working group on fish maturity staging was created in 2014 under the supervision of the Società Italiana di Biologia Marina (SIBM). This atlas includes the main achievements of this working group.

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Abstract

Maturity is one of the most relevant biological parameters used in stock assessment programmes. Indeed, the macroscopic stage of gonadal development is an essential feature in estimating the maturity ogive and spawning stock biomass (SSB). It is also useful for determining the spawning season of a species and for monitoring long-term changes in the spawning cycle, as well as for many other research needs related to the biology of fish.

In current data collection programmes carried out in the Mediterranean which cover extensive samplings of maturity stages, some specific technical aspects have not always been taken into consideration, and collected data cannot reach the required precision levels. Also, the coding schemes in use and the uncertainty in the interpretation of particular stages can give rise to misinterpretations of the actual maturity stage leading to inaccurate spawning stock biomass estimations. Several stock assessments are therefore based on time-invariant maturity ogives and only partially cover the spatial distribution of the stocks. Hence, on several occasions, the need has been expressed to improve the identification of the macroscopic maturity stages through a standardization of operational procedures and terminology.

One of the solutions for overcoming these problems was to formalize an atlas of the macroscopic and histological maturity stages of the main species of commercial interest in the Mediterranean. In this context, this atlas aims to develop sound approaches to maturity sampling for a wide range of species, based on an accurate and precise determination of the different maturity stages. It includes macroscopic photos of gonads belonging to the main species, and for some of them, a validation-based histological analysis is also presented.

The systematic categories investigated in the atlas are bony fish, cartilaginous fish, both oviparous and viviparous, crustaceans and cephalopods.

Contents

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Acronyms and abbreviations

ac	cortival alveoli
AG	accessory glands
AL	anal length
AO	atretic oocyte
AVO	advanced vitellogenic oocyte
BM	brown material
C	combined sexes
CA	cortical alveolar oocyte
cf	follicular cell
CL	carapace length
CT	connective tissue
DCF	Data Collection Framework
DCR	Data Collection Regulation
DL	disc length
DW	disc width
e	erythrocytes
E	embryo
EC	egg case
EO	epigonal organ
EPO	early primary oocyte
EU	European Union
EVO	early vitellogenic oocyte
f	flagella
F	females
FC	follicular cell
FE	follicular epithelium
FL	fork length
FO	fold
Fpo	post-ovulatory follicle
gl	lipidic droplet
GSA	geographical subarea
GVBD	germinal vesicle breakdown stage
GVM	germinal vesicle migration stage
GZ	germinal zone
H and E	haematoxylin and eosin
IE	ICES ecoregion
IR	inner region
L	lumen
LI	lipidic inclusion
LM	lamellae
LPO	late primary oocyte
LVO	late vitellogenic oocyte
L_{50}	Length at maturity
M	males
MEDITS	Mediterranean International Trawl Survey
ML	mantle length
MST	mucous secretory tubule
MT	masson trichrome
N	nucleus
NG	nidamental glands
NS	Needham's sac
OG	oviducal gland
OO	oogonium
OR	outer region
OV	ovary
OVD	oviduct
PAS/AB	periodic acid Schiff and Alcian blue
PG	primary growth oocyte
PO	primary oocyte
POF	post-ovulatory follicle
PVO	previtellogenic oocyte
SPF	spermatophores
S	spermiduct
SC	sertoli cell
SCO	spermatophoric complex
SG	secretory granule
SGA	spermatangia
SIBM	Società Italiana di Biologia Marina
SM	secretory material
SP	spermathecae
SPC	spermatocyte
SPC I	spermatocyte I
SPC II	spermatocyte II
SPD	spermatidium
SPF	spermatophores
SPG	spermatogonium
SPZ	spermatozoa
SPZ imm	immature spermatozoa
SQC	squamous cell
ST	sampling time
STE	sternite
STU	secretory tubule
T	testis
TB and E	toluidin blue and eosin
TL	total length
TW	total weight
UT	uterus
VO	vitellogenic oocyte
Vtg1	primary vitellogenic oocyte
Vtg2	secondary vitellogenic oocyte
Vtg3	tertiary vitellogenic oocyte
W_{50}	Weight at maturity
Y	yolk
YS	yolk sac
ZP	zona pellucida
Zr	zona radiata

1. Introduction

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The study of fish biology started with Aristotle (384–322 BC), who was the first to describe aspects of fish life history in the Mediterranean Sea with his observations on habitat, diet and spawning (Ganias, Mezarli and Voultsiadou, 2017). And yet, today the Mediterranean Sea is one of the areas where key biological information is lacking for many fish species, especially in the southern part (Stergiou and Tsikliras, 2006). In particular, knowledge is still lacking on the field of research related to reproduction, in terms of the standardization of methods and terminology describing the reproductive development of fish. Several classifications and associated terminologies have been introduced in the literature to describe reproductive development. Many of these classifications, based on the identification of various features of gonads and different numbered staging systems, have caused confusion and have hindered communication among researchers in fish-related disciplines, particularly when the same number is used to identify different developmental stages by different scientists. Dodd (1986) stated that "methods to estimate the ovarian stages and their terminology are confused and confusing", and this is still true today regarding the terminology used to describe reproductive development in both sexes.

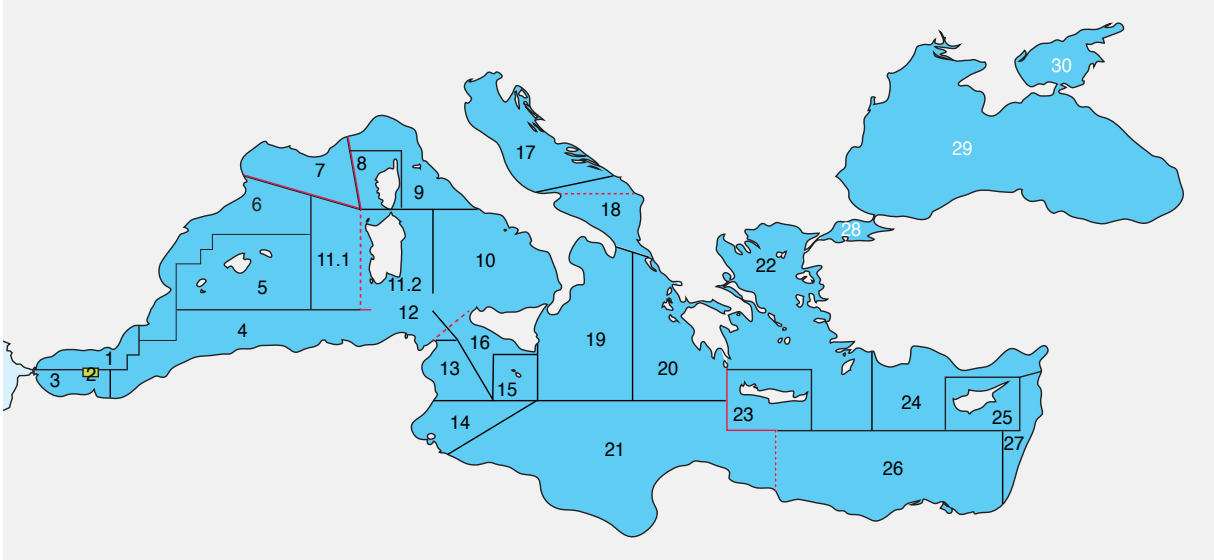
Under the Data Collection Regulation (DCR), maturity samples are collected for a wide range of species but the strategy of sampling programmes and the utilization of aggregated data, collected from different areas at potentially different times of the year, have not yet been addressed. In particular, the DCF programme covers extensive samplings of maturity stages for stocks within European Union (EU) waters, but often, specific technical aspects have not been taken into consideration, and consequently, collected data cannot reach the aimed highest precision level (i.e. level 3: 5 percent precision). In some cases, in fact, the stocks spawning season do not coincide with the time when the samplings are carried out. Furthermore, the coding schemes in use (varying from a 4grade to a 10grade scale) and the interpretation of particular stages (in particular, immature versus post spawning or skipped spawning) give rise

to misinterpretations of the actual biological maturity stage, leading to inaccurate estimation of the spawning stock biomass. Consequently, although the current DCR establishes a high level of accuracy for determining the maturity stages, the aimed precision has not been yet achieved; thus, several stock assessments, based on timeinvariant maturity ogives are incomplete in covering the spatial distribution of the stocks. For all these reasons, there was a general need for an atlas with standardized maturity scales, including macroscopic images of gonads for the analysed species, validated by histological analysis.

This atlas is based on samples collected as part of national and international scientific programmes in which Italian researchers have been involved since 1984 (Table 1, Figure 1). The main aim is to develop sound approaches to maturity sampling of a wide range of species, starting with an accurate determination of the different maturity stages. When possible, histological confirmation of the macro maturity stages is provided for different species.

In the atlas, the macroscopic stage determination follows the Mediterranean International Trawl Survey (MEDITS) macroscopic scales (MEDITS, A.A.V.V., 2016) for 53 species of all systematic categories investigated (bony fish, cartilaginous fish, both oviparous and viviparous, crustaceans and cephalopods). When the literature included studies on particular species (see *Solea solea* for bony fish and *Squilla mantis* and *Palinurus elephas* for crustaceans) highlighting the unsuitablesness of MEDITS scale, some conversion tables were added.

FIGURE 1
Map and list of the GFCM geographical subareas (GSAs) [*GSAs involved in fish staging for the atlas]



1	Northern Alboran Sea	16	Southern Sicily*
2	Alboran Island	17	Northern Adriatic Sea*
3	Southern Alboran Sea	18	Southern Adriatic Sea*
4	Algeria	19	Western Ionian Sea*
5	Balearic Islands	20	Eastern Ionian Sea
6	Northern Spain	21	Southern Ionian Sea
7	Gulf of Lion	22	Aegean Sea
8	Corsica	23	Crete
9	Ligurian Sea and northern Tyrrhenian Sea*	24	North Levant Sea
10	Southern and central Tyrrhenian Sea*	25	Cyprus
11.1 11.2	Sardinia (west)* Sardinia (east)*	26	South Levant Sea
12	Northern Tunisia	27	Eastern Levant Sea
13	Gulf of Hammamet	28	Marmara Sea
14	Gulf of Gabès	29	Black Sea
15	Malta	30	Azov Sea

Table 1 – Italian institutes involved in the fish staging for the Data Collection Framework

Institutes	Geographical subarea
Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci", Livorno	GSA 9
University of Cagliari – Department of Life and Environment Sciences, Cagliari	GSA 11
COISPA Tecnologia & Ricerca , Bari	GSA 10, GSA 18, GSA 19
National Research Council – Institute for Coastal Marine Environment (CNR-IAMC), Messina	GSA 10
National Research Council Institute for Coastal Marine Environment (CNR-IAMC), Mazara del Vallo	GSA 16
National Research Council Institute of Marine Sciences (CNR-ISMAR), Ancona	GSA 17
University of Bari – Department of Zoology, Bari	GSA 19

2. Materials and methods

2.1 Samplings

Biological samplings were carried out both at sea during the Italian scientific trawl surveys (MEDITS) on board commercial vessels, and at landing points (Council Regulation [EC No 199/2008] and Commission Regulation [EC No 665/2008]). In commercial fisheries, the samplings were performed throughout the year in order to also store gonads of species whose reproductive period did not coincide with the MEDITS survey season.

The macroscopic scales of the atlas were constructed according to the maturity scales for each systematic group (bony fish, cartilaginous fish oviparous and viviparous, crustaceans and cephalopods) in the MEDITS Handbook Version n. 8, 2016 (Tables 3, 4, 5, 6 and 7). Specific studies on particular species such as *S. solea* for bony fish, *S. mantis* and *P. elephas* for crustaceans highlighted the unsuitableness of the MEDITS scale, and some conversion tables were added.

In general, the macroscopic maturity stages for G1 and G2 species (both inside MEDITS and DCF) and when available, the macroscopic stages for some G3 species were included (Table 2).

G1 species are species that drive the international management process and for which assessment is regularly carried out, including species under EU management plans, EU recovery plans, EU long-term, multiannual plans, or EU action plans for conservation and management, based on Council Regulation (EC) No 2371/2002. G2 species are other internationally regulated species and major non-internationally regulated by-catch species; they are important in terms of landing and/or economic values, and their assessment is not regularly carried out. G1 and G2 species for the MEDITS project and DCF are listed separately (Table 2). G3 species are represented by all other by-catch (fish and shellfish) species. The list of Group 3 species is established at the regional level by the relevant regional coordination meeting and agreed by the Scientific, Technical and Economic Committee for Fisheries (STECF).

Table 2 – Species included in the DCF and MEDITS programmes in Italy

Species	RFMO/RFO/IO*	Area/stock	DCF	MEDITS
Aristaeomorpha foliacea	GFCM	All areas	G1	G1
Aristeus antennatus	GFCM	All areas	G1	G1
Boops boops	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G2	G2
Chelidonichthys lucerna	GFCM	GSA 9,10,11,16,18,19	G2	G2
Engraulis encrasicolus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G1	G2
Eutrigla gurnardus	GFCM	GSA 16,18,19	G2	G2
Merluccius merluccius	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G1	G1
Mullus barbatus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G1	G1
Mullus surmuletus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G1	G1
Nephrops norvegicus	GFCM	All areas	G1	G1
Parapenaeus longirostris	GFCM	All areas	G1	G1
Pagellus erythrinus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G2	G2
Sardina pilchardus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G1	G2
Trachurus mediterraneus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G2	G2
Trachurus trachurus	GFCM	GSA 9, 10, 11, 16, 17, 18, 19	G2	G2

Continue next page

Table 2 (Continued)

Species	RFMO/RFO/IO*	Area/stock	DCF	MEDITS
Micromesistius poutassou	GFCM	GSA 11, 18, 9	G2	G2
Diplodus annularis	GFCM	GSA 16, 19	G3	G2
Eledone cirrhosa	GFCM	All areas	G2	G2
Eledone moschata	GFCM	All areas	G2	G2
Illex coindetii	GFCM	All areas	G2	G1
Loligo vulgaris	GFCM	All areas	G2	G1
Lophius budegassa	GFCM	GSA 9, 16, 18, 19	G2	G2
Lophius piscatorius	GFCM	GSA 9,10,11,16,18,19	G2	G2
Octopus vulgaris	GFCM	All areas	G2	G2
Penaeus kerathurus	GFCM	All areas	G2	G2
Palinurus elephas	GFCM	GSA 11,16	G3	G2
Scomber japonicus	GFCM	GSA 9, 16, 17, 18, 19	G2	G2
Scomber scombrus	GFCM	GSA 9, 16, 17, 18	G2	G2
Sepia officinalis	GFCM	All areas	G2	G2
Solea solea	GFCM	GSA 17	G1	G2
Spicara smaris	GFCM	GSA 17, 18	G2	G2
Squilla mantis	GFCM	All areas	G2	G2
Todarodes sagittatus	GFCM	All areas	G2	G2
Thunnus alalunga	ICCAT	All areas	G2	---
Thunnus thynnus	ICCAT	All areas	G1	---
Xiphias gladius	ICCAT	All areas	G1	---
Galeus melastomus	ICCAT, GFCM	GSA 9,10,11	G1	G1
Raja asterias	ICCAT, GFCM	GSA 9, 11	G1	G1
Raja clavata	ICCAT, GFCM	GSA 9, 11, 16, 18	G1	G1
Raja miraletus	ICCAT, GFCM	GSA 16	G1	G1
Rays and sharks	GFCM	All areas	G1	G1

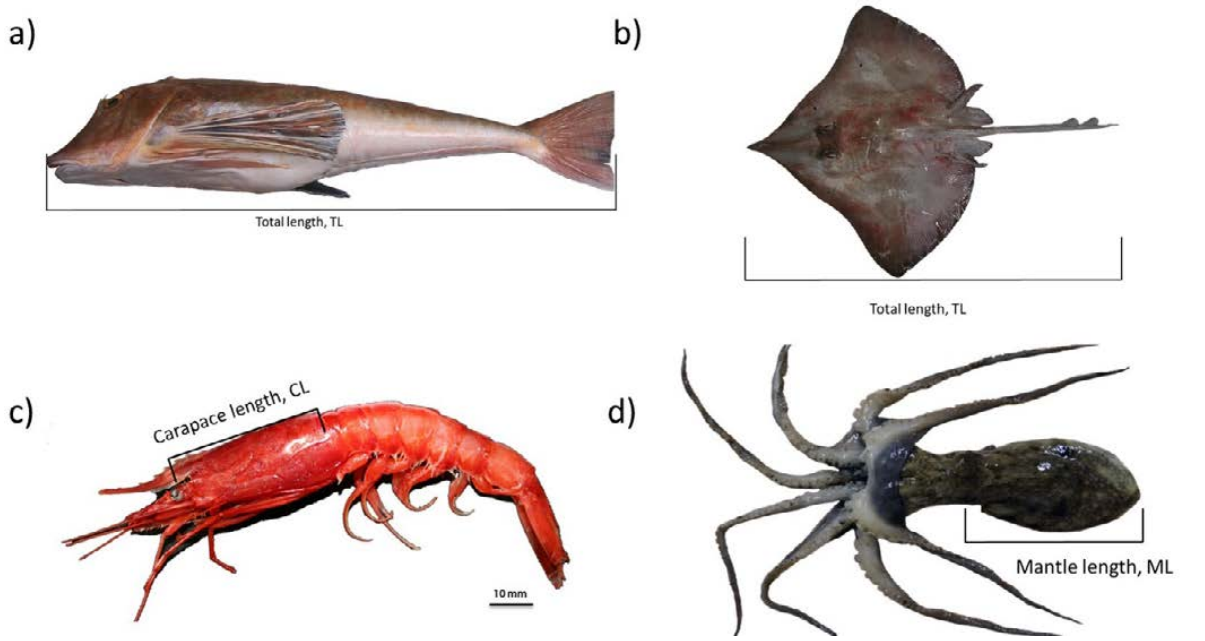
Note: Regional Fisheries Management Organisation (RFMO); Regional Fisheries Organisation (RFO); International Organizations (IO).

2.1.1 Biological collection

For each collected specimen, the following biological parameters were recorded: Length (total length [TL] in centimetres for bony fish and cartilaginous fish with the exception of Holocephali, anal length [AL]; carapace length [CL] in millimetres for crustaceans and mantle length [ML] in centimetres for cephalopods [Plate 1]); total weight (TW in grams) and time of collection (ST).

For species whose tails are often damaged after they are caught, it is suggested to also take other measures such as body length or disc length, or disc width, and then compare measures.

PLATE 1
Standard length measurements for fish, crustaceans and cephalopods



Note: a), b) fish; c) crustaceans and d) cephalopods.

2.1.2 Macro gonad photos

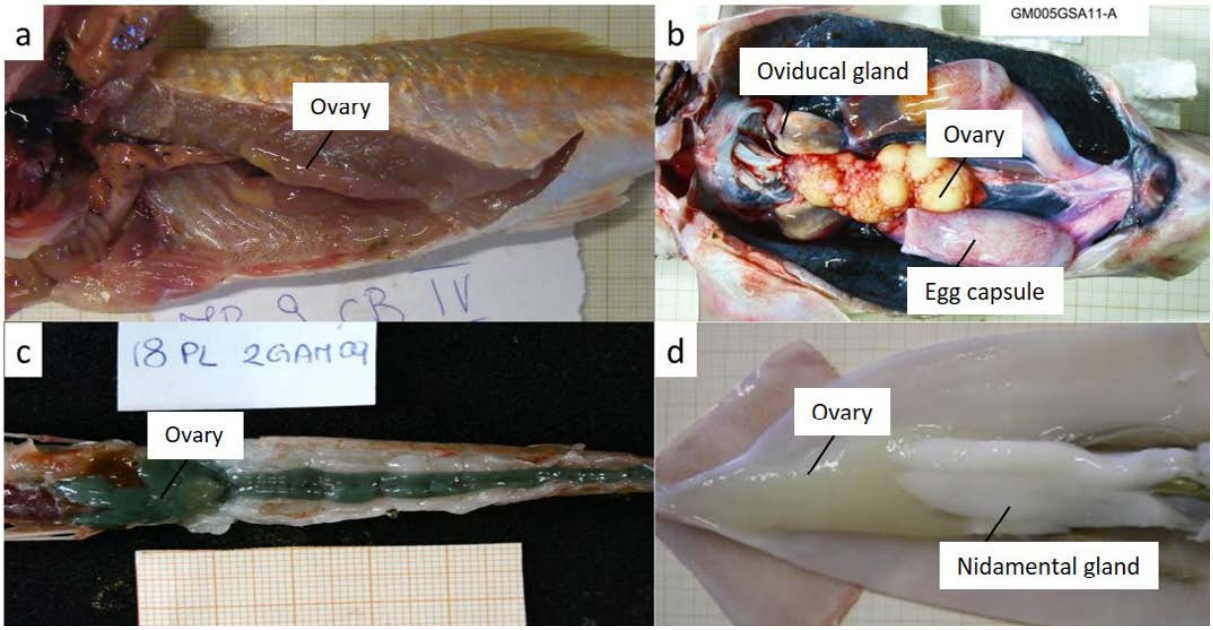
The maturity staging was always assessed on fresh gonads since frozen gonads can present colour change and flaccidity that are not indicative of the post-spawning stage and are not appropriate for histological analyses. Furthermore, a photo of each gonad was taken according to an established protocol (Plate 3). Both the gonad inside the cavity together with the unit of measure had to be perfectly visible in order to perceive the ratio between the gonad and cavity dimensions. Potential secondary maturity structures, especially for cartilaginous fish and cephalopods, were also included in order to better define the maturity stage (Plate 2).

PLATE 2
Egg cases belonging to the seven Rajid species present in Sardinian Seas

Note: Egg cases belonging to the seven Rajid species present in Sardinian Seas. A) *D. nidarosiensis*; B) *D. oxyrinchus*; C) *R. asterias*; D) *R. brachyura*; E) *R. clavata*; F) *R. miraletus*; G) *R. polystigma* (from Porcu *et al.*, 2017a).

For species where histological analyses were available, the histological maturity stage and the histological technique were also explained. Some photos of bony fish, cartilaginous fish, crustaceans and cephalopods are shown in Plate 3.

PLATE 3
a) a bony fish with visible ovaries; b) an oviparous elasmobranch with visible ovary, oviducal glands and egg capsules; c) a crustacean, with visible ovaries; and d) a cephalopod with highly visible gonads and nidamental glands



2.1.3 Histological gonad photos

In order to confirm the assignment of the macroscopic maturity stage (in particular, in the case of problems in the attribution of a stage), a histological analysis was requested. After the photo of the fresh gonad was taken, a piece of its central part of the fresh gonad was stored according to different protocols.

The main methodology used for histological analyses is the one described in Mazzi (1997) for slide staging, and in Cerri and Sasso-Cerri (2003) for staining:

1. **Fixate** in 5 percent buffered formaldehyde (0.1 M, pH 7.4) for a maximum period of 48 hours and storage in 70 percent ethanol.
2. **Dehydrate** through a progressively higher series of alcohol concentrations (70–100 percent).
3. **Embed** in a synthetic resin (GMA, Technovit 7100, Bio-Optica).
4. **Cut** at 3.5 µm with a rotative microtome (LKB, Historange).
5. **Stain** with a different technique. To analyse the histological structure of ovaries, testes and oviducal glands, Gill or Carazzi's haematoxylin and alcoholic eosin (H and E), the Masson's trichrome (MT) or toluidine blue and eosin (TB and E) were used. At times, periodic acid Schiff and Alcian blue (PAS/AB) was used to investigate the chemical nature of oviducal glands.
6. **Dehydrate** quickly in graded ethanol (95–100 percent), cleared in Histolemon and mounted in resinous medium (Eukitt).
7. **Observe** using a Zeiss Primo Star optical microscope equipped with a Canon EOS 1100D at different magnifications (40x, 100x, 400x), edited with Adobe Photoshop CS6.

For the histological maturity staging of *Boops boops* ovaries and testes, the applied technique is described in Bottari *et al.* (2014):

1. **Fixate** in 10 percent buffered formalin solution.
2. **Dehydrate** in graded alcohols.
3. **Embed** in paraffin.
4. **Cut** into 5 µm transverse sections.
5. **Stain** with haematoxylin/eosin (H and E).
6. **Observe** under a light microscope equipped with a Leica IM1000 microscope.

2.2 MEDITS maturity scales

The MEDITS manual includes five maturity tables, i.e bony fish, cartilaginous fish (one for viviparous and one for oviparous), crustaceans and cephalopods. These tables consist of detailed descriptions of maturity stages based on gonadal macroscopical characteristics for both females and males. The column "Maturation state" indicates the specimen phases of the spawning cycle indicated in white for *juveniles* and grey for *adults*.

Table 3 – The MEDITS maturity scale for bony fish

Sex	Reproductive apparatus aspect	Maturation state	Stage
I	The sex is not discernible to the naked eye. Gonads are very small and translucid, almost transparent. Sex is undetermined.	**Undetermined**	**0**
F	The small pinkish and translucent ovary is shorter than ⅓ of the body cavity. Eggs are not visible to the naked eye.	**Immature virgin**	**1**
M	The thin and whitish testis is shorter than ⅓ of the body cavity.		
F	The small pinkish/reddish ovary is shorter than ½ of the body cavity. Eggs are not visible to the naked eye.	**Developing virgin***	**2a**
M	The thin whitish testis is shorter than ½ of the body cavity.		
F	The pinkish-reddish/reddish-orange and translucent ovary has a length of about ½ of the body cavity. The blood vessels are visible. The eggs are not visible to the naked eye.	**Recovering***	**2b**
M	The whitish/pinkish testes, which are more or less symmetrical, have a length of about ½ of the body cavity.		
F	The pinkish-yellow ovary has a granular appearance, and a length of about ⅔ of the body cavity. Eggs are visible to the naked eye through the ovaric tunica, which is not yet translucent. Under light pressure, eggs are not expelled.	**Maturing**	**2c**
M	The whitish to creamy testis has a length of about ⅔ of the body cavity. Under light pressure, sperm is not expelled.		
F	The orange-pink ovary has conspicuous superficial blood vessels, measuring from ⅔ to the full length of the body cavity. The large transparent, ripe eggs are cleary visible and could be expelled under light pressure. In more advanced conditions, eggs escape freely.	**Mature/ spawner**	**3**
M	The testis is whitish-creamy and soft, with a length of about ⅔ to full length of the body cavity. Under light pressure, sperm can be expelled. In more advanced conditions, sperm escapes freely.		
F	The reddish ovary is shrunken to about ½ of the length of the body cavity. Ovaric walls are flaccid; the ovary may contain remnants of disintegrating opaque and/or translucent eggs.	**Spent**	**4a**
M	The bloodshot and flabby testis is shrunken to about ½ of the length of the body cavity.		
F	The pinkish and translucent ovary measures a length of about ⅓ of the body cavity. Eggs are not visible to the naked eye.	**Resting***	**4b**
M	The testis is whitish/pinkish, more or less symmetrical, with a length of about ⅓ of the body cavity.		

* These stages can be easily confused.

Adult specimens

Table 4 – MEDITS maturity scale for oviparous elasmobranchs

Sex	Reproductive apparatus aspect	Maturation state	Stage
F	The ovary with small isodiametric eggs is barely discernible. The distal part of oviducts is thick-walled and whitish. The nidamental glands are not clearly visible.	**Immature Virgin**	**1**
M	The claspers are small and flaccid, and do not reach the posterior edge of the pelvic fins. The sperm ducts are not discernible. The testis is small and narrow.		
F	The whitish and/or a few yellow maturing eggs are visible in the ovary. The distal part of the oviducts (uterus) is well developed but empty. The nidamental glands are small.	**Maturing***	**2**
M	The claspers are larger, but the skeleton is still flexible. They extend to the posterior edge of the pelvic fins. Sperm ducts are well developed and eventually begin to meander.		
F	The ovary contains yellow eggs (large yolk eggs). The nidamental glands are enlarged, and oviducts are distended.	**Mature**	**3a**
M	The claspers extend well beyond the posterior edge of the pelvic fin, and their internal structure is generally hard and ossified. The testis is greatly enlarged. The sperm ducts meander over almost their entire length.		
F	The ovary walls are transparent. Oocytes are of different sizes, white or yellow. The nidamental glands are large. The egg cases are more or less formed in the oviducts (extruding stage).	**Mature/ Extruding Active**	**3b**
M	The claspers are longer than the tips of the posterior pelvic fin lobes; the skeleton has hardened and pointed axial cartilages. The sperm ducts are large. Sperm flows on pressure from the cloaca (active stage).		
F	The ovary walls are transparent. The oocytes are of different sizes, white or yellow. The oviducts appear very enlarged, collapsed and empty. The diameter of the nidamental glands is reducing.	**Resting**	**4a**
M	The clasper is longer than the tips of the posterior pelvic fin lobes; the axial cartilages is still hardened. The sperm ducts are empty and flaccid.		
F	The ovary is full of small follicles similar to stage 2. The oviducal glands and uterus are enlarged.	**Regenerating***	**4b**

* These stages can be easily confused.

Adult specimens

Table 5 – MEDITS maturity scale for viviparous elasmobranchs

Sex	Reproductive apparatus aspect	Maturation state	Stage
F	The ovary is barely visible or small and whitish; the ovarian follicles are not visible. The oviducal (nidamental) gland may be slightly visible. The uterus is thread-like and narrow.	**Immature**	**1**
M	The claspers are flexible and shorter than pelvic fins. The testis is small (in rays, sometimes with visible lobules). The sperm ducts are straight and thread-like.		
F	The ovary is enlarged with small follicles (oocytes) of different sizes. Some relatively larger yellow follicles may be present. The ovary lacks atretic follicles. The oviducal gland and the uterus are developing.	**Developing***	**2**
M	The claspers are slightly more robust but still flexible. They are as long as or longer than pelvic fins. The testis is enlarged; in sharks, testis starts to segment; in rays, lobules are clearly visible but do not occupy the whole surface. The sperm ducts are developing and beginning to meander.		
F	The large ovary has enlarged yolk follicles that have all the same size, hence they can be easily distinguished. The oviducal gland and the uterus are developed. The uterus is not dilated and does not contain yolky matter and embryos.	**Capable of reproducing**	**3a**
M	The claspers are fully formed, and the skeleton is hardened and rigid and is generally longer than the pelvic fins. The testis is greatly enlarged; in sharks, the testis is fully segmented; in rays, it is filled with developed lobules. The sperm ducts are tightly coiled and filled with sperm.	**Capable of reproducing**	
F	The uteri are fully and rounded with yolk content (usually candle-shaped). In general, the segments cannot be discernible, and embryos cannot be observed.	**Early pregnancy**	**3b**
M	The description is similar to stage 3a, but with clasper glands dilated, often swollen and reddish (occasionally open). The sperm is often present in the clasper grooves or glands. Under pressure, sperm is observed flowing out of the cloaca or in the sperm ducts.	**Actively spawning**	
F	The uteri are well filled and rounded, often with visible segments. The embryos are always visible and small, and with a relatively large yolk sac.	**Mid-pregnancy**	**3c**
F	The embryos are fully formed; the yolk sacs are reduced or absent. The embryos can be easily measured and sexed.	**Late pregnancy**	**3d**
F	The ovaries are shrunken without follicle development and with atretic (degenerating) follicles. The diameter of the oviducal glands may be decreasing. The uterus appears much enlarged, collapsed, empty and reddish.	**Regressing**	**4a**
M	The claspers are fully formed, similar to stage 3. The testis and sperm ducts are shrunken and flaccid.	**Regressing**	**4**
F	The ovary has small follicles at different stages of development including atretic ones. The uterus is enlarged with flaccid walls. The oviducal gland is discernible.	**Regenerating***	**4b**

* Please note that these stages can be easily confused.

Adult specimens

Table 6 – MEDITS maturity scale for crustaceans

Sex	Reproductive apparatus aspect	Colouring of fresh ovary	Maturation state	Stage
F	The ovary is barely visible. After dissection of the tegument, the ovary is small, and lobes are flaccid, stringy and poorly developed. *A. foliacea* and *A. antennatus* have no spermatophores on the thelycum.	Whitish or translucid	**Immature virgin***	**1**
M	The petasma is not highly visible and there are no spermatic masses (emi-spermatophores) on the seminal ampullae located on the side of the fifth pair of pereiopods. *A. foliacea* and *A. antennatus* have a long rostrum.			
F	The ovary status is developing. Cephalic and lateral lobes are small but discernible to the naked eye. The abdominal extensions are thin and slightly visible.	*A. foliacea*: flesh-coloured; *A. antennatus:* ivory-coloured with orange pink-violet dotting; *N. norvegicus*: cream- coloured; *P. longirostris*: cream orange-coloured.	**Developing virgin***	**2a**
M	The petasma is visible and nearly or completely joined, but there are no spermatic masses in the seminar amplullae. *A. foliacea* and *A. antennatus:* long or intermediate rostrum.			
F	The ovary is starting a new reproductive cycle. The cephalic and lateral lobes are small but discernible to the naked eye. The abdominal extensions are thin and slightly visible. Occasionally, there are spermatophores in *A. foliacea* and *A. antennatus.*	*A. foliacea*: flesh-coloured; *A. antennatus*: ivory-coloured with orange pink-violet dotting; *N. norvegicus*: cream-coloured; *P. longirostris*: cream orange-coloured.	**Recovering***	**2b**
M	The petasma appears completely joined but there are no spermatic masses in the seminar amplullae. *A. foliacea* and *A. antennatus* have a short rostrum.			
F	The ovary is developed and occupies the dorsal portion almost entirely. The cephalic and lateral lobes are highly developed and have a turgid consistence.	*A. foliacea*: light and dark grey; *A. antennatus:* lilla; *N. norvegicus*: light green; *P. longirostris*: light green or grey green.	**Maturing or almost mature**	**2c**
M	-			
F	The turgid ovary extends to the whole dorsal portion, covering the organs below. The lobes and extensions are well developed; in particular, the abdominal extensions are highly visible. The oocytes are well developed.	*A. foliacea*: black; *A. antennatus:* violet; *N. norvegicus*: dark green; *P. longirostris*: bright green or olive-greencoloured.	**Mature**	**2d**
M	The petasma is perfectly visible and completely joined. There is a spermatic mass in the seminar ampullae. *A. foliacea* and *A. antennatus* have a small rostrum.			
F	It is a resting ovary. Spermatophores are present in *A. foliacea* and *A. antennatus.*	Uncoloured	**Resting adult***	**2e**
F (*N. norvegicus*)	Eggs are present on pleopods.		**Berried**	**3**

* These stages can be easily confused.

Adult specimens

Table 7 – MEDITS maturity scale for cephalopods

Sex	Reproductive apparatus aspect	Egg size (mm)	Spermatophore development	Maturation state	Stage
I	The sex is not discernible to the naked eye; it is undetermined.	Total lack of eggs.	Total lack of spermatophores	**Undetermined**	**0**
F	The nidamental glands (NG)/oviducal glands (OG) are small and translucid The ovary is semi-transparent and stringy, and lacks a granular structure. The oviduct meander is not visible.	*L. vulgaris* and *I. coindetii*: no eggs; *S. officinalis*: Ø<2 mm; *E. moschata*: Ø<4 mm; *E. cirrhosa*: Ø< 2mm; *O. vulgaris*: Ø<1 mm	Total lack of spermatophores	**Immature virgin**	**1**
M	The testis is small. The spermatophoric complex (SC) is semi-transparent, and the vas deferens is not visible. The penis appears as a small prominence of the SC.				
F	The NG/OG are enlarged. The NG cover some internal organs. The whitish ovary has a clearly visible granular structure, which does not reach the posterior half of the mantle cavity. The oviduct meander is clearly visible.	Very small eggs	Lack of spermatophores	**Developing**	**2a**
M	The structure of the enlarged testis is not clearly visible. The vas deferens is whitish or white, and the spermatophoric organ has a white streak.				
F	The large NG covers the viscera below. The ovary occupies the entire posterior cavity of mantle cavity and contains reticulated oocytes of all sizes tightly packed, and probably a few ripe ova at its proximal parts. The oviducts are fully developed but empty.	*L. vulgaris* and *I. coindetii*: maturing eggs are visible to the naked eye; *S. officinalis:* 2.1 mm<Ø<4 mm; *E. moschata:* 4 mm <Ø<11 mm; *E. cirrhosa*: 2 mm<Ø<5 mm; *O. vulgaris*: 1 mm<Ø<2 mm	*L. vulgaris, I. coindettii* and *S. officinalis*: there are a few immature spermatophores in the Needham's sac; *E. moschata, E. cirrhosa* and *O. vulgaris:* there are a few spermatophores, which are slightly developed and not functional.	**Maturing**	**2b**
M	The vas deferens is white, meandering and enlarged. The Needham's sac (SS) has structureless whitish particles inside. Normally, the SS is without functional spermatophores but at times some immature/abortive ones can occur. The testis is tight and crispy, with a visible structure.				
F	The NG as large. The ovary contains a higher percentage of large reticulated eggs and some ripe ova with a smooth surface. In Teuthoidea, the ova in the oviducts are ripe.	*L. vulgaris* and *I. coindetii*: amber- coloured and isodiametric eggs in oviducts and in part of the ovary (Ø=2 mm in *Loligo* and Ø=1 mm in *Illex*) *S. officinalis:* medium eggs (4.1 mm<Ø<6 mm) and large eggs 6.1 mm<Ø<8 mm; *E. moschata:* Ø 11 mm; *E. cirrhosa*: Ø>5 mm; *O. vulgaris*: Ø>2 mm	Well developed spermatophores	**Mature**	**3a**
M	The testis is as above. The spermatophores are packed in the SS.				
F	NG/OG are large but soft and running. The ovary is shrunken and flaccid with only immature oocytes attached to the central tissue and a few loose, large ova in the coelom. In Teuthoidea, the oviduct may contain some mature ova but is no longer packed.	A few large ova	Disintegrating spermatophores	**Spent**	**3b**
M	Spermatophores are disintegrating in the SS and the penis.				

Adult specimens

2.3 Conversion tables

Within the International Council for the Exploration of Sea (ICES), experts on maturity staging regularly organize species-specific workshops to discuss the validity of the scales currently used. In some cases, they agree on new one as happened for the species reported below. In these cases, conversion tables from the old one to the new one are made.

In particular, in 2012, during the Workshop on Sexual Maturity Staging of sole, plaice, dab and flounder (WKMSSPDF2), a new international scale was proposed. However, this scale presents some relevant differences from the MEDITS one, thus requiring a conversion table (Table 8).

Table 8 – Conversion table of Sole (*Solea solea*) maturity scale

Medits scale		ICES WKMSSPDF2 (2012a) scale	
0	Indetermined		
1	Immature virgin	1	Immature
2a	Developing virgin	1	Immature
2b	Recovering	2	Maturing
2c	Maturing	2	Maturing
3	Mature/spawner	3	Spawning
4a	Spent	4	Spent
4b	Resting	5	Skipped spawning
-	Not present	6	Abnormal

Source: ICES WKMSSPDF Report (2012a).

The proposed WKMSSPDF2 scale combines the two MEDITS Stages: 1 Immature virgin and 2a Developing Virgin into a single ICES stage (1 Immature). The 2b Recovering of the MEDITS scale is included in the 2 Maturing ICES stage. During WKMSSPDF2, it was also emphasized that stage 4b of the MEDITS scale (corresponding to stage 5 Skipped spawning of the WKMSSPDF2 scale) was very difficult to identify and often required the use of a microscope. For males, this stage was not considered to be discernible. The abnormal stage (stage 6) in WKMSSPDF2 is not considered in the MEDITS scale.

For two crustacean species, *S. mantis* and *P. elephas* (Tables 9 and 10), two conversion tables from the scales proposed respectively by Froglia (1996) and Marin (1987) to the corresponding MEDITS scale were discussed and approved in the Working Group during the MEDITS meeting in 2015 (Tables 9 and 10).

In the proposed *S. mantis* MEDITS scale, the stage 2 Early maturation was divided into two 2a Developing virgin and 2b Recovering, mainly on the base of brown dots and aspects of the 6th-8th sternites, i.e. hyaline in the 2a stage and whitish in the 2b stage. The stage 1 Quiescent and 5 Spent of the Froglia scale (1996) were merged into a single stage 2e Adult on the MEDITS scale on the bas of the ovaries (Table 9).

In the *P. elephas* scale, a high correspondence of stages between the MEDITS scale and the Marin scale was observed. The description of most of the stages is very similar, with the exception of stages 5 Mature and 6 Spawning of the Marin scale, which were merged into a unique stage 2d Mature in the MEDITS scale. In the MEDITS scale, a stage 3 is present, which differs from the Marin scale, in which the berried stage was not considered.

Table 9 – Conversion table of the *Squilla mantis* maturity scale

Proposed scale (Carbonara *et al.*, 2013)			Froglia (1996)		
0	**Undetermined**				
1	**Immature virgin**	Ovaries filamentous and hyaline; hyaline 6th–8th sternites.	**0**	**Immature**	The ovaries are filamentous and hyaline; hyaline 6th–8th sternites.
2a	**Developing virgin**	Narrow yellow ovaries sometimes filamentous and with brown dots (chromatophores), hyaline 6th–8th sternite.	**2**	**Early maturation**	The ovaries are narrow and yellow; whitish 6th–8th sternites.
2b	**Recovering**	Narrow yellow ovaries sometimes filamentous with clearly visibile brown dots (chromatophores), and there are whitish 6th–8th sternites.			
2c	**Maturing or almost mature**	Yellow ovaries extending up to half of the abdomen width, not visible through cutile on the ventral side of the telson, and there are white 6th–8th sternites.	**3**	**Maturation**	The yellow ovaries extend up to half of abdomen width, and are not visible through cutile on the ventral side of the telson, white 6th–8th sternites.
2d	**Mature**	Yellow ovaries extend over half he abdomen width, visible through the cutile on the ventral side of the telson and there are milky-white 6th–8th sternites.	**4**	**Ripe**	The yellow ovaries extend over half of the abdominal width, visible through cutile on the ventral side of the telson; milky-white 6th–8th sternites.
2e	**Resting adult**	The filamentous hyaline ovaries have clearly visibile brown dots (chromatophores), sometimes still yellow or with a few yellow dots. In this case, the ovaries appear flaccid and shrunken. The 6th–8th sternites are hyaline or still white.	**1**	**Quiescent**	The filamentous ovaries have clearly visible brown dots (chromatophores); hyaline 6th–8th sternites.
			5	**Spent**	Similar to quiescent ovaries, they are sometimes with a few yellow dots, but 6th–8th sternites are still white.

Table 10 – Conversion table of the *Palinurus elephas* maturity scale

Proposed Follesa scale			Marin (1987)		
0	**Undetermined**				
1	**Immature virgin**	The white ovaries are thin and stretched, and do not extend all the way to the first abdominal segment	**1**	**Thin and immature or sexual resting**	The milky-white ovaries are stretched, and do not extend all the way to the first abdominal I segment.
2a	**Developing virgin**	The yellow and turgid ovaries have a granular aspect and extend to the first abdominal segment.	**2**	**Beginning of development**	The narrow, yellow ovaries extend to the first abdominal segment gametes, which are sometimes visible as dots.
2b	**Recovering**	The pale orange ovaries have highly visible oocytes, occupying ¼ of the cephalothorax area.	**3**	**Developing**	The ovaries are orange; gametes are highly visible.
2c	**Maturing or almost mature**	The orange ovaries occupy 50 percent of the cephalothorax area, extending to the second abdominal segment. Each ovarian lobe has many circumvolutions.	**4**	**Maturing**	Orange ovaries, occupying half of the cephalothorax area. Each ovarian lobe has many circumvolutions.
2d	**Mature**	The dark orange ovaries occupy the whole cephalothorax area. The oocytes are dissociated.	**5**	**Mature**	The orange-bright red ovaries occupy ¾ of the cephalothorax area
			6	**Spawning**	The bright red ovaries occupy the whole cephalothorax area; the oocytes are totally dissociated.
2e	**Resting adult**	The ovaries are spent and shrunken, orange-whitish, and sometimes with orange spots; they occupy about half of the cephalothorax area.	**7**	**Spent and in recuperation**	The ovaries are spent and shrunken, orange-whitish, and occupy about half of the cephalothorax area.
3	**Berried**	There is a presence of eggs on pleopods.			

3. Results

In this atlas, the macroscopic maturity scales of 21 species of bony fish, 17 of cartilaginous fish (sub-divided into one oviparous holocephalan, nine oviparous and seven viviparous elasmobranchs), nine of cephalopods and six of crustaceans are collected. The species are listed in Tables 11, 12 and 13.

Some problems were encountered while drafting this atlas. For crustaceans, only female maturity scales were reported due to the known difficulty in recognizing the male stages with the naked eye (mainly for Decapoda Macrura as *N. norvegicus* and *P. elephas*, Decapoda Natantia as *P. longirostris* and Stomatopoda as *S. mantis*).

With respect to cephalopod species, it is known that they are highly dynamic organisms that grow and mature with high individual variability influenced by many factors such as temperature, feeding and genetic differences (e.g. Mangold, 1983; Semmens *et al.*, 2004; Leporati, Pecl and Semmens, 2008). As a consequence, at times no correlation is detected between the progression of the stages and the animal size in the macroscopic scale. The same problem is reported for species belonging to other systematic categories as bony fish, cartilaginous fish and crustaceans.

Moreover, the spent stage (stage 3b) of cephalopods scales and the female regenerating stage (stage 4b) in cartilaginous fish scales are considered "short-duration" stages, difficult to sample. For this reason, these stages are often absent in the collected macroscopic scales. For each species, together with macroscopic and microscopic scales, the listed data mainly known in the literature for the different areas of Mediterranean and Atlantic waters have been reported:

- geographic distribution;
- reproductive aspects;
- spawning periods;
- size at first maturity (the length of the smallest mature specimen recorded) and size at maturity (L_{50}).

Table 11 – List of the bony fish species and relative DCF group whose maturity stages have been photographed

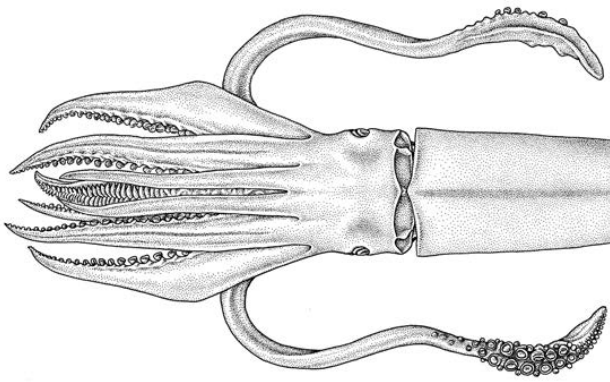
Bony fish			
Species	**DCF group**	**Species**	**DCF group**
Boops boops	G2	*Pagellus acarne*	G3
Chelidonichthys cuculus	G3	*Pagellus erythrinus*	G2
Engraulis encrasicolus	G1	*Phycis blennoides*	G2
Eutrigla gurnardus	G2	*Scomber colias*	G1
Helicolenus dactylopterus	G3	*Solea solea*	G3
Lepidorhombus boscii	G3	*Spicara flexuosa*	G3
Lophius budegassa	G2	*Trachurus mediterraneus*	G2
Merluccius merluccius	G1	*Trachurus trachurus*	G2
Micromesistius poutassou	G2	*Trigloporus lastoviza*	G3
Mullus barbatus	G1	*Zeus faber*	G3
Mullus surmuletus	G1		

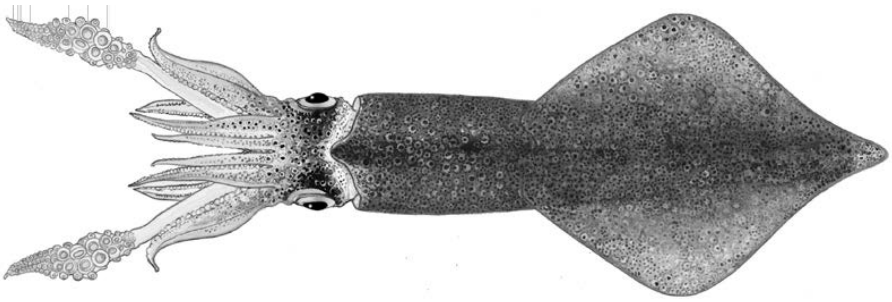
Table 12 – List of the cartilaginous fish species and relative DCF group whose maturity stages have been photographed

Viviparous elasmobranchs		Oviparous elasmobranchs		Oviparous Holocephali	
Species	**DCF group**	**Species**	**DCF group**	**Species**	**DCF group**
Centrophorus granulosus	G1	*Dipturus nidarosiensis*	G1	*Chimaera monstrosa*	G1
Dalatias licha	G1	*Dipturus oxyrinchus*	G1		
Etmopterus spinax	G1	*Galeus melastomus*	G1		
Oxynotus centrina	G1	*Raja asterias*	G1		
Squalus blainville	G1	*Raja brachyura*	G1		
Torpedo marmorata	G1	*Raja clavata*	G1		
Torpedo torpedo	G1	*Raja miraletus*	G1		
		Raja polystigma	G1		
		Scyliorhinus canicula	G1		

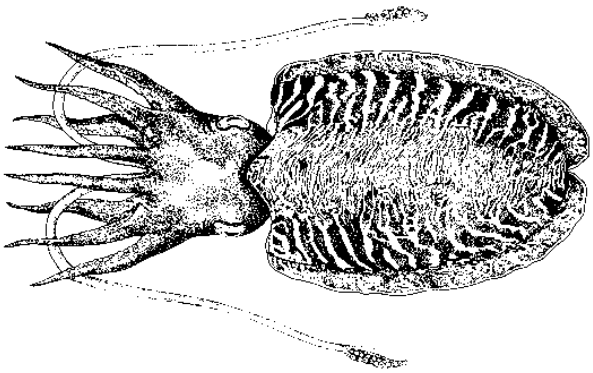
Table 13 – List of the cephalopods and crustacean species and relative DCF whose maturity stages have been photographed

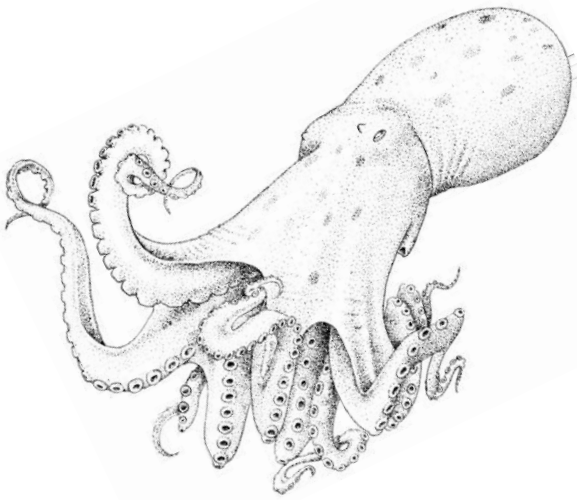
Cephalopods		Crustaceans	
Species	**DCF group/MEDITS**	**Species**	**DCF group**
Eledone cirrhosa	G2	*Aristaeomorpha foliacea*	G1
Eledone moschata	G2	*Aristeus antennatus*	G1
Illex coindetii	G2/G1	*Nephrops norvegicus*	G1
Loligo vulgaris	G2/G1	*Parapenaeus longirostris*	G1
Loligo forbesii	G2	*Palinurus elephas*	G3
Octopus vulgaris	G2	*Squilla mantis*	G3
Sepia officinalis	G2		
Todaropsis eblanae	G2		
Todarodes sagittatus	G2		

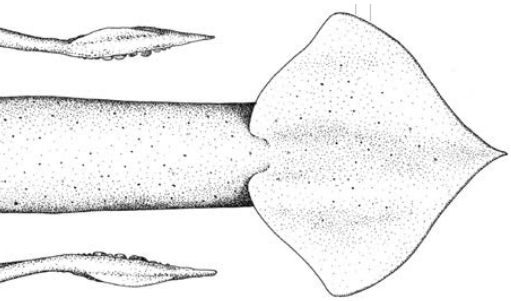


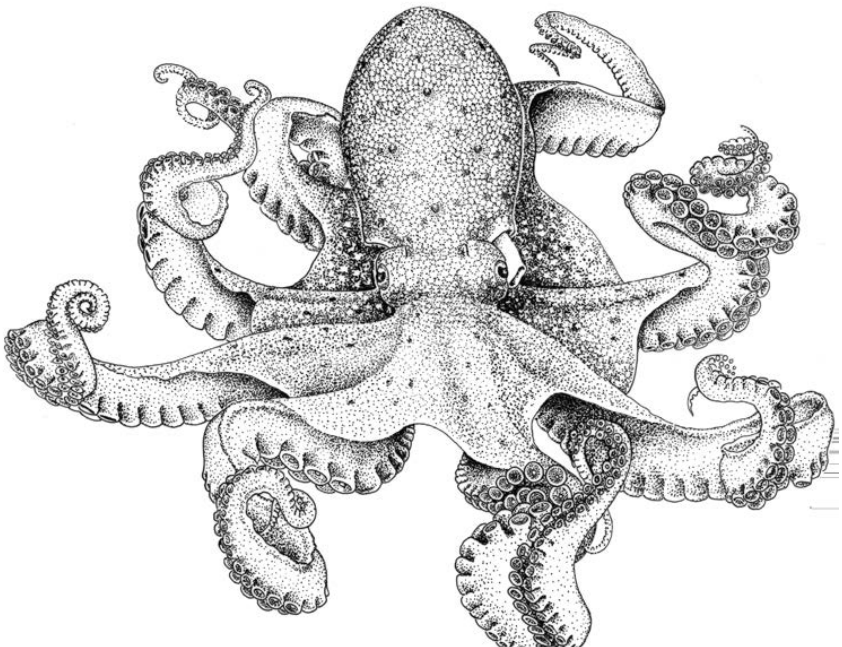


CEPHALOPODS









Cephalopods

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Order: Myopsida **Family: Loliginidae** ***Loligo forbesii* (Steenstrup, 1856)**

Photo by B. Agus

FAO CODE: SQF

MEDITS CODE: LOLI FOR

Common name:
Veined squid (English)
Encornet veiné (French)
Calamaro venato (Italian)
Calamar veteado (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found throughout the Mediterranean and in the eastern North Atlantic from 20° north to 60° north latitude, including the North Sea. Its southern boundary is unknown or not confirmed (Pierce *et al.*, 2015; Jereb, Vecchione and Roper, 2010).

REPRODUCTION

Reproductive strategy: dioic, semelparous; spermatophores transferred in female's buccal seminal receptacle, intermittent terminal spawning (*e.g.* Mangold, 1989; Nesis, 1995; Rocha and Guerra, 1996; Rocha, Guerra and Gonzalez, 2001).

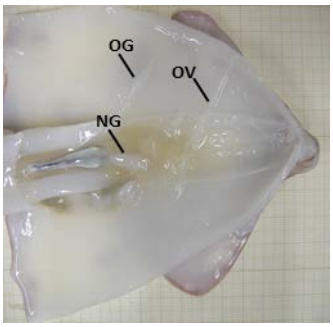
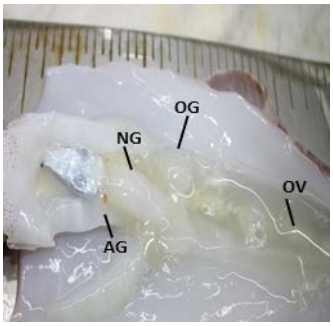
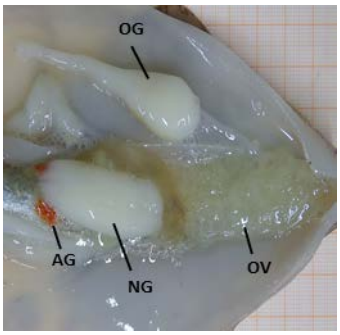
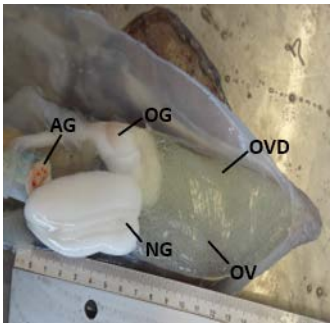
REPRODUCTIVE PERIOD

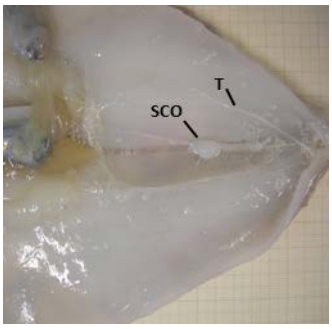
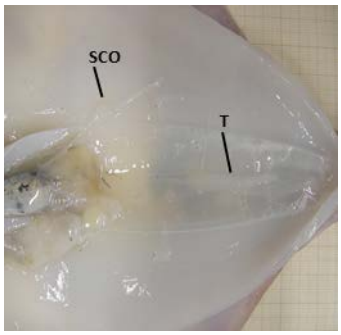
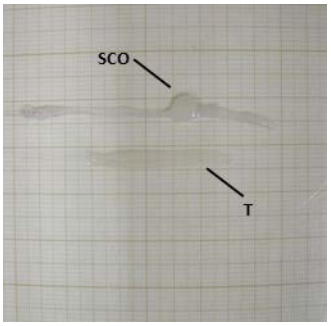
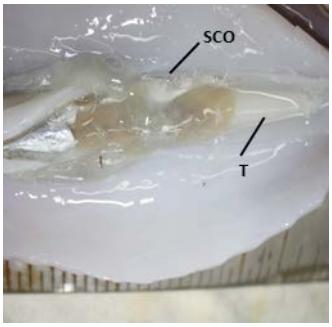
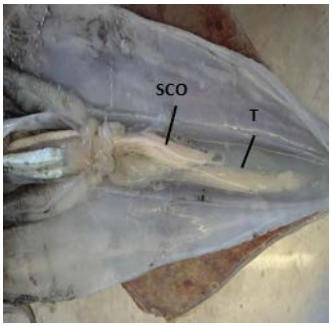
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 11 Sardinian Seas	F													Agus (2015)
	M													
GSA 16 Sicilian Channel	F													Ragonese and Jereb (1986)
	M													
N.E. Atlantic Ocean														
IE 6a Scottish waters	F													Lum-Kong, Pierce and Yau (1992)
	M													
	F													Boyle and Ngoile (1993)
	M													
IE 9a Portugal	F													Moreno *et al.* (1994)
	M													

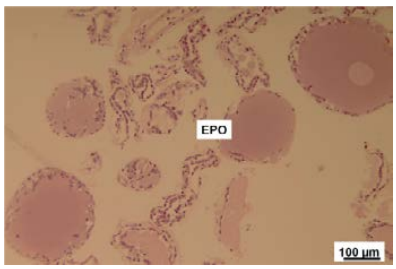
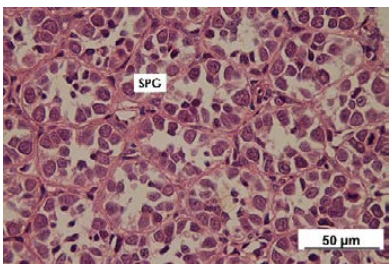
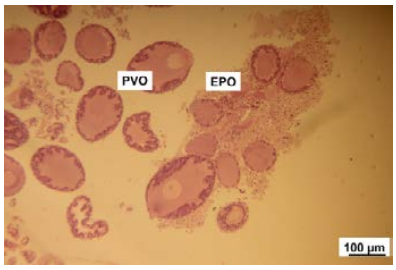
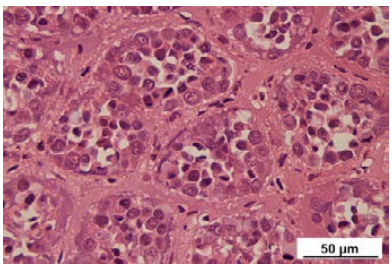
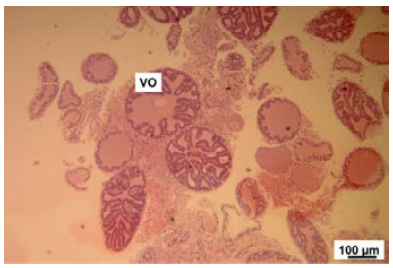
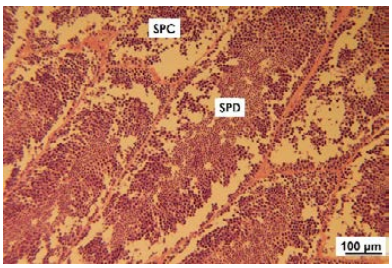
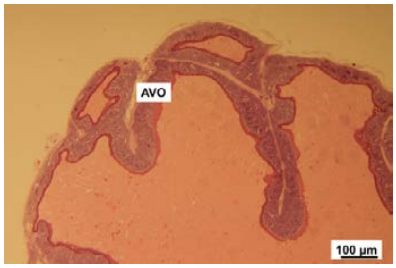
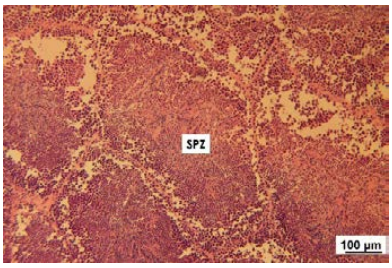
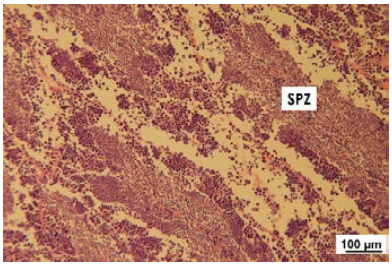
Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSA 9 N. Tyrrhenian Sea				203.0 216.0	Ria *et al.* (2005)
GSA 11 Sardinian Seas	F	82.0-282.0	150.0	231.0	Agus (2015)
	M	68.0-576.0	132.0	282.0	
GSA 16 Strait of Sicily	F	45.0-305.0		225.0	Ragonese and Jereb (1986)
N.E. Atlantic Ocean					
IE 5b.1 Faroe Islands	F		180.0		Gaard (1987)
	M		200.0		
IE 6a Scottish waters	F		150.0		Lum-Kong, Pierce and Yau (1992)
	M		140.0		
	F		140.0	192.0	Boyle and Ngoile (1993)
	M		160.0	250.0	
IE 6a W. Scotland	F		160.0		Boyle, Pierce and Hastie (1995)
	M		120.0		
IE 8c Galicia	F		160.0		Guerra and Rocha (1994)
	M		160.0		

Loligo forbesii (FAO CODE: SQF – MEDITS CODE: LOLI FOR)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 **ML 155 mm; TW 152 g; ST: June; GSA 11**
2a	**DEVELOPING**	 **ML 140 mm; TW 110 g; ST: January; GSA 10**
2b	**MATURING**	 **ML 125 mm; TW 102 g; ST: June; GSA 11**
3a	**MATURE**	 **ML 242 mm; TW 320 g; ST: November; GSA 11**
3b	**SPENT**	

Loligo forbesii (FAO CODE: SQF – MEDITS CODE: LOLI FOR)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 **ML 220 mm; TW 367 g; ST: June; GSA 11**
2a	**DEVELOPING**	  **ML 221 mm; TW 397 g; ST: June; GSA 11**
2b	**MATURING**	 **ML 150 mm; TW 115 g; GSA 10**
3a	**MATURE**	 **ML 540 mm; TW 1760 g; ST: November; GSA 11**
3b	**SPENT**	

Loligo forbesii (FAO CODE: SQF – MEDITS CODE: LOLI FOR)			
STAGE	**PHASE**	**FEMALES (ovary)**	**MALES (testis)**
1	**IMMATURE VIRGIN**	 **GSA 11* (H and E)**	 **GSA 11* (H and E)**
2a	**DEVELOPING**	 **GSA 11* (H and E)***	 **GSA 11* (H and E)**
2b	**MATURING**	 **GSA 11* (H and E)**	 **GSA 11* (H and E)**
3a	**MATURE**	 **GSA 11* (H and E)**	 **GSA 11* (H and E)**
3b	**SPENT**		 **GSA 11* (H and E)**

* from Agus (2015).

Order: Myopsida **Family: Loliginadae** ***Loligo vulgaris* (Lamarck, 1798)**

Photo by B. Agus

FAO CODE: SQR

MEDITS CODE: LOLI VUL

Common name:
European squid (English)
Encornet européen (French)
Calamaro comune (Italian)
Calamar europeo (Spanish)

GEOGRAPHIC DISTRIBUTION

Eastern Atlantic Ocean: from the north-west Scotland, United Kingdom (about 57°N) to South Africa (20°S), the North Sea and the Mediterranean Sea (Jereb, Vecchione and Roper, 2010; Moreno *et al.*, 2015).

REPRODUCTION

Reproductive strategy: dioic, semelparous; spermatophores transferred in female's buccal seminal receptacle, intermittent terminal spawning (*e.g.* Mangold-Wirz, 1963; Mangold, 1989; Nesis, 1995; Rocha and Guerra, 1996; Rocha, Guerra and Gonzalez, 2001).

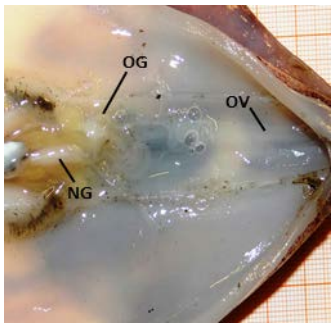
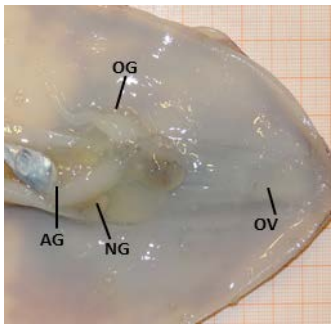
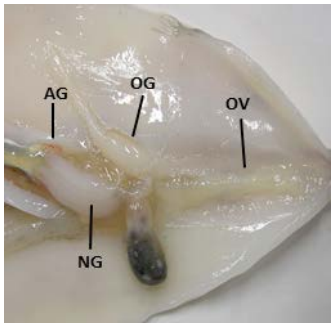
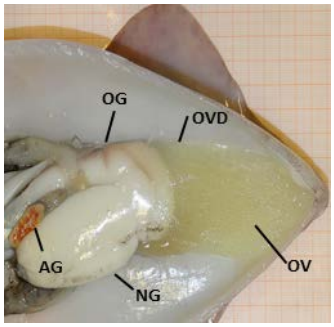
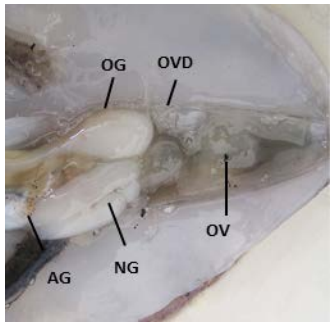
REPRODUCTIVE PERIOD

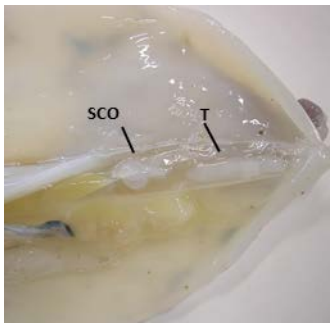
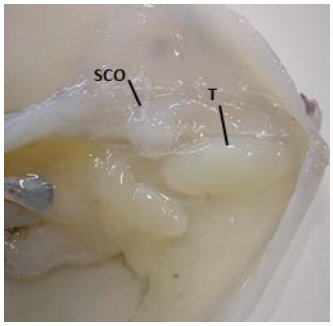
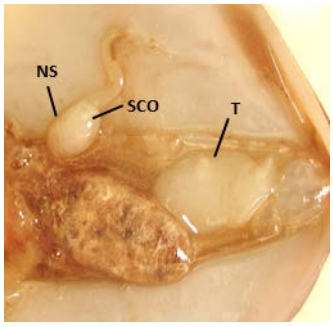
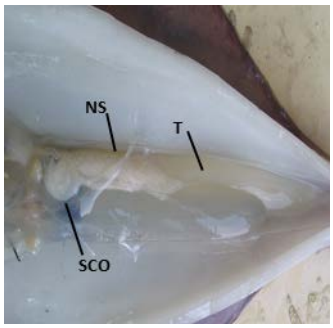
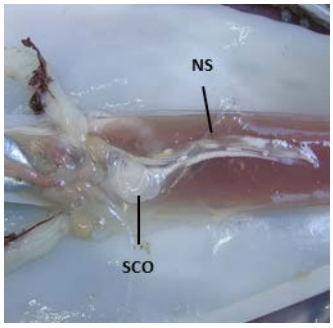
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F													Mangold-Wirz (1963)
	M													
GSA 6 Catalan Sea	F													Sánchez and Guerra (1994)
	M													
GSA 11 Sardinian Seas	F													Agus (2015)
	M													
GSA 17 C. Adriatic Sea	F													Krstulovič Šifner and Vrgoč (2004)
	M													
GSA 20 Greek waters	F													Moreno *et al.* (2002)
	M													
N.E. Atlantic Ocean														
IE 7e N. France	F													Moreno *et al.* (2002)
	M													
IE 9a Portugal	F													Moreno *et al.* (1994)
	M													
IE 9a N.W. Portugal	F													Moreno *et al.* (2002)
	M													
IE 9a S. Portugal	F													Coelho *et al.* (1994)
	M													

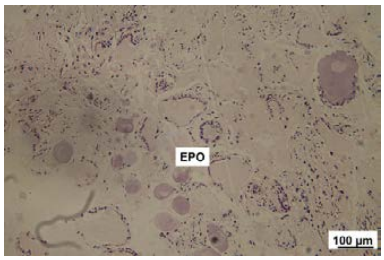
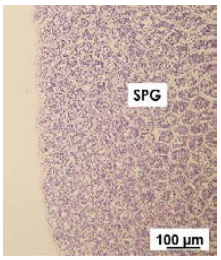
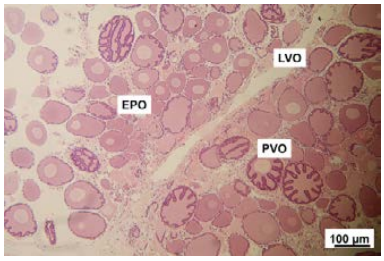
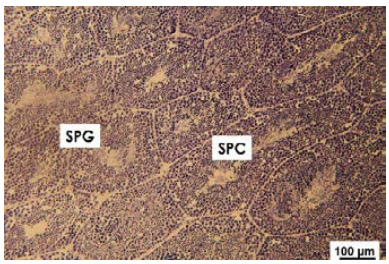
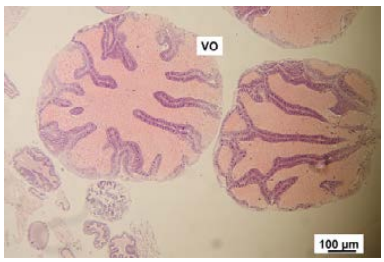
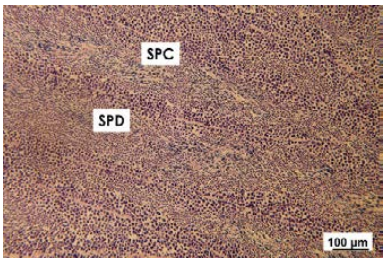
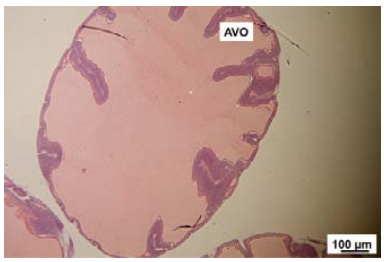
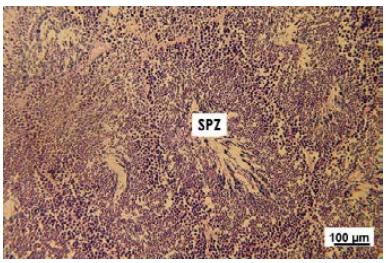
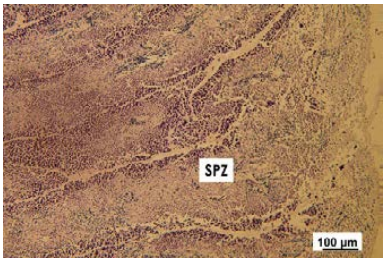
Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSAs 6, 7 Rosas Port-Vendres (Spain, France)	F		160.0		Mangold-Wirz (1963)
	M		110.0		
GSA 9 Ligurian Sea	F		180.0	200.0	Würtz and Giuffra (1989)
	M		155.0	250.0	
GSA 9 N. Tyrrhenian Sea	F			170.0	Ria *et al.* (2005)
	M			188.0	
GSA 11 Sardinian Seas	F	62.0-262.0	135.0	205.0	Agus (2015)
	M	58.0-387.0	106.0	214.0	
GSA 17 C. Adriatic Sea	F			158.0	Flamigni and Giovanardi (1984)
	M			118.0	
	F			150.0-160.0	Soro and Piccinetti-Manfrin (1989)
	M			140.0-150.0	
	F		118.0	160.0	Krstulovič Šifner and Vrgoč (2004)
	M		90.0	125.0	
GSA 20 Greek waters	F		119.0	189.0	Moreno *et al.* (2002)
	M		95.0	135.0	
N.E. Atlantic Ocean					
IE 7e N. France	F		140.0	181.0	Moreno *et al.* (2002)
	M		120.0	179.0	
IE 9a Portugal	F		150.0	176.0	Moreno *et al.* (2005)
	M		80.0	153.0	
IE 9a N.W. Portugal	F		120.0	182.0	Moreno *et al.* (2002)
	M		80.0	166.0	
IE 9a S. Portugal	F		175.0	227.0	Coelho *et al.* (1994)
	M		115.0	245.0	

Loligo vulgaris (FAO CODE: SQR – MEDITS CODE: LOLI VUL)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 **ML 145 mm; TW 90 g; ST: July; GSA 11**
2a	**DEVELOPING**	 **ML 150 mm; TW 103 g; ST: July; GSA 11**
2b	**MATURING**	 **ML 146 mm; TW 83 g; ST: July; GSA 11**
3a	**MATURE**	 **ML 262 mm; TW 442 g; ST: July; GSA 11**
3b	**SPENT**	 **ML 211 mm; TW 251 g; ST: September; GSA 11**

Loligo vulgaris (FAO CODE: SQR – MEDITS CODE: LOLI VUL)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 ML 136 mm; TW 74 g; ST: September; GSA 11
2a	**DEVELOPING**	 ML 135 mm; TW 82 g; ST: July; GSA 11
2b	**MATURING**	 ML 150 mm; TW 98 g; ST: June; GSA 11
3a	**MATURE**	 ML 155 mm; TW 107 g; ST: May; GSA 11
3b	**SPENT**	  ML 145 mm; TW 101 g; ST: September; GSA 11

Loligo vulgaris (FAO CODE: SQR – MEDITS CODE: LOLI VUL)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**	 GSA 11 (H and E)	 GSA 11 (H and E)
2a	**DEVELOPING**	 GSA 11 (H and E)	 GSA 11 (H and E)
2b	**MATURING**	 GSA 11 (H and E)	 GSA 11 (H and E)
3a	**MATURE**	 GSA 11 (H and E)	 GSA 11 (H and E)
3b	**SPENT**		 GSA 11 (H and E)

Order: Oegopsida **Family: Ommastrephidae** ***Illex coindetii* (Verany, 1839)**

Photo by M. Mereu

FAO CODE: SQM

MEDITS CODE: ILLE COI

Common name:
Broadtail shortfin (English)
Encornet rouge (French)
Totano (Italian)
Pota voladora (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the eastern Atlantic Ocean from 60° north to 17° south and 30° west latitude, and in the western Atlantic Ocean from 37° north to around 3° north. It is widely distributed throughout the Mediterranean Sea. It has also been recorded in the Sea of Marmara (Jereb *et al.*, 2015; Roper, Nigmatullin and Jereb, 2010).

REPRODUCTION

Reproductive strategy: dioic, semelparous; spermatophores transferred in female's mantle cavity, intermittent terminal spawning (e.g. Mangold-Wirz, 1963; Mangold, 1989; Nesis, 1995; Rocha, Guerra and Gonzalez, 2001).

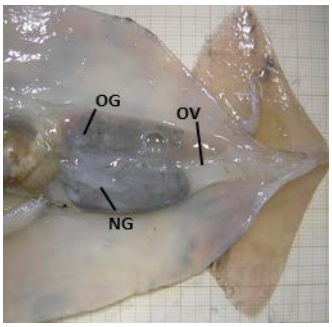
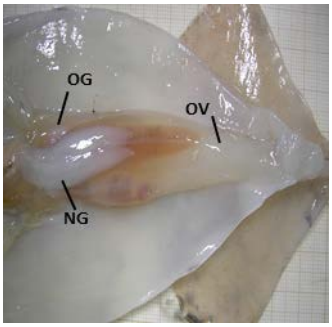
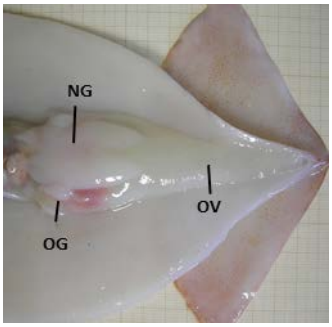
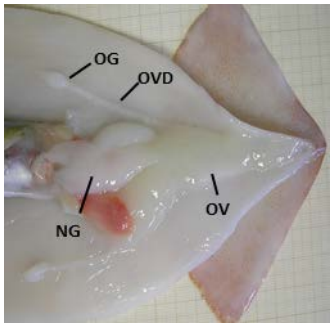
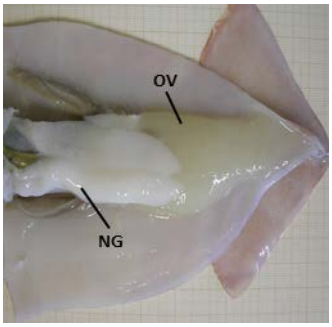
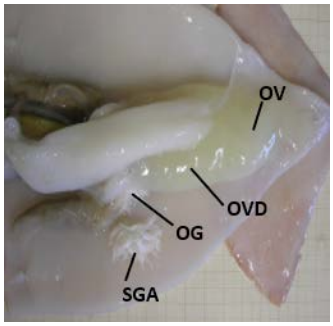
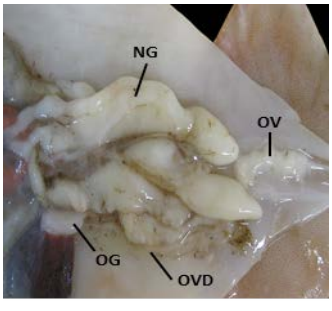
REPRODUCTIVE PERIOD

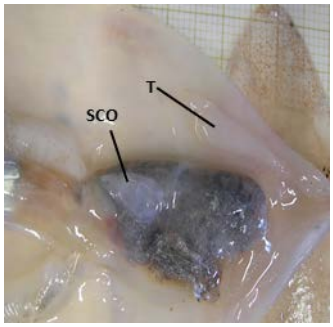
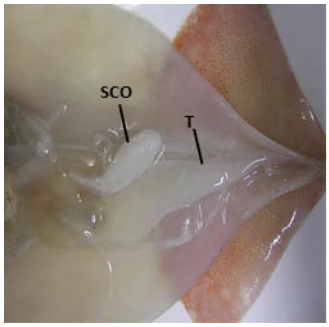
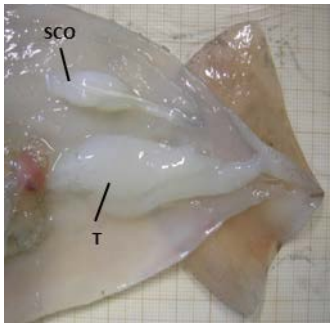
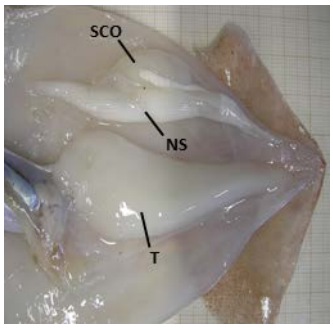
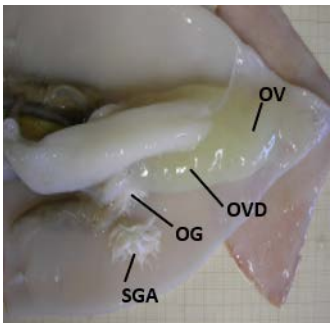
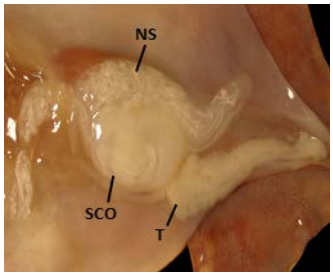
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 6 Catalan Sea	F													Sánchez (1984)
	M													
	F													Sánchez *et al.* (1998)
GSA 6 Port of Blanes (Spain)	F													Sánchez (1995)
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F													Mangold-Wirz (1963)
	M													
GSA 9 N. Tyrrhenian Sea	F													Belcari, Fedi and Viva (1989)
	M													
GSA 10 C. Tyrrhenian Sea	F													Gentiloni *et al.* (2001)
	M													
GSA 10 S. Tyrrhenian Sea	F													Maragliano and Spedicato (1994)
	M													
GSA 16 Sicilian Channel	F													Jereb and Ragonese (1995)
	M													
	F													Sánchez *et al.* (1998)
	M													
GSA17 N. and C. Adriatic Sea	F													Soro and Paolini (1994)
	M													
GSA 18 S.W. Adriatic Sea	C													Ceriola, Ungaro and Toteda (2006)
N.E. Atlantic Ocean														
IE 8c N. Spanish waters	F													González, Rasero and Guerra (1994)
	M													
IE 8c Galician waters	F													González and Guerra (1996)
	M													
IE 8c N.W. Spanish Seas (42-43 °N)	F													Sánchez *et al.* (1998)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSA 6 Catalan Sea	F		120.0		Sánchez *et al.* (1998)
	M		100.0		
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F		160.0		Mangold-Wirz (1963)
	M		100.0		
GSA 9 N. Tyrrhenian Sea	F			150.0	Bigongiari (1992)
	M			120.0	
GSA 10 C. Tyrrhenian Sea	F			120.0	Gentiloni *et al.* (2001)
	M			105.0	
GSA 10 S. Tyrrhenian Sea	F			150.0	Perdichizzi *et al.* (2011)
	M			105.0	
GSA 16 Sicilian Channel	F		115.0	150.0	Jereb and Ragonese (1995)
	M		90.0	120.0	
	F		117.5		Sánchez *et al.* (1998)
	M		92.5		
GSA 17 N. and C. Adriatic Sea	F	Up to 280.0	131.0	162.0	Soro and Paolini (1994)
	M	up to 183.0	101.0	126.0	
GSA 18 S. Adriatic Sea	F	30.0-300.0		146.0	Marano *et al.* (2006)
	M	40.0-200.0		137.0	
GSA 18 S.W. Adriatic Sea	F	30.0-300.0	110.0	146.0	Ceriola, Ungaro and Toteda (2006)
	M		100.0	137.0	
GSA 22 Aegean Sea	F			146.0-188.0	Lefkaditou *et al.* (2012)
	M			116.0-151.0	
N.E. Atlantic Ocean					
IE 8c N. Spanish waters	F		148.0	200.0-219.0	González, Rasero and Guerra (1994)
	M		93.0	160.0-179.0	
IE 8c Galician waters	F	48.0-379.0	103.0	184.0	González and Guerra (1996)
	M	45.0-279.0	93.0	128.0	

Illex coindetii (FAO CODE: SQM – MEDITS CODE: ILLE COI)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 **ML 149 mm; TW 74 g; ST: April; GSA 11**	
2a	**DEVELOPING**	 **ML 176 mm; TW 109 g; ST: April; GSA 11**	
2b	**MATURING**	 **ML 132 mm; TW 108 g; ST: February; GSA 11**	
3a	**MATURE**	 **ML 180 mm; TW 164 g; ST: February; GSA 11**	 **ML 190 mm; TW 198 g; ST: December; GSA 11**
3b	**SPENT**	 **ML 230 mm; TW 218 g; ST: July; GSA 11**	

Illex coindetii (FAO CODE: SQM – MEDITS CODE: ILLE COI)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE VIRGIN	 ML 97 mm; TW 27 g; ST: February; GSA 11	
2a	DEVELOPING	 ML 100 mm; TW 33 g; ST: November; GSA 10-18	
2b	MATURING	 ML 135 mm; TW 69 g; ST: April; GSA 11	
3a	MATURE	 ML 128 mm; TW 69 g; ST: February; GSA 11	 ML 145 mm; TW130 g; ST: November; GSA 10-18
3b	SPENT	 ML 162 mm; TW 155 g; ST: July; GSA 11	

Order: Oegopsida **Family: Ommastrephidae**

***Todarodes sagittatus* (Lamarck, 1798)**

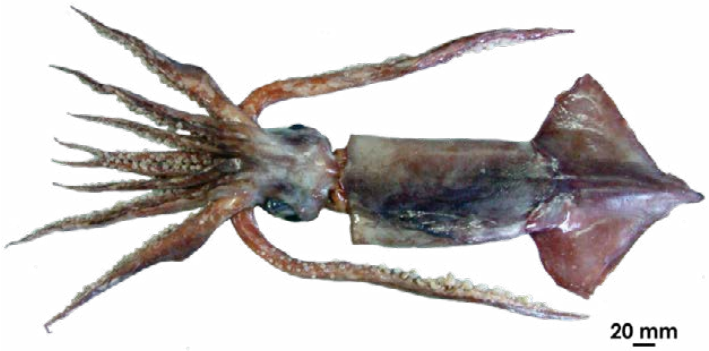


Photo by M. Mereu

FAO CODE: SQE

MEDITS CODE: TODA SAG

Common name:
European flying squid (English)
Toutenon commun (French)
Totano viola (Italian)
Pota europea (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the eastern North and South Atlantic Ocean, from the lower Barents and Kara Sea (Arctic Ocean) southward to about 13° south latitude (south of the Gulf of Guinea), the North Sea, the Mediterranean Sea and the Sea of Marmara (Roper, Nigmatullin and Jereb, 2010; Piatkowski *et al.*, 2015).

REPRODUCTION

Reproductive strategy: dioic, semelparous; spermatophores transferred in female's buccal membrane, intermittent terminal spawning (*e.g.* Mangold, 1989; Nesis, 1995; Rocha, Guerra and Gonzalez, 2001).

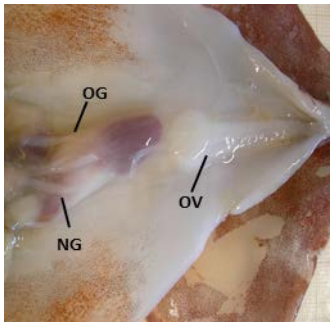
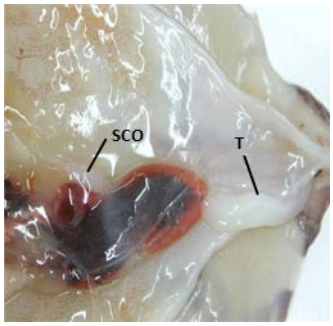
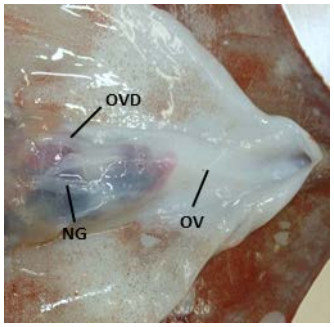
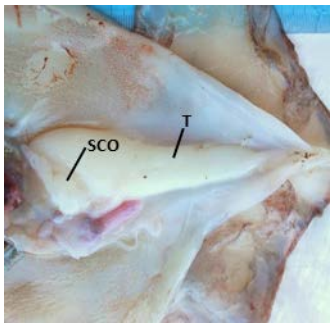
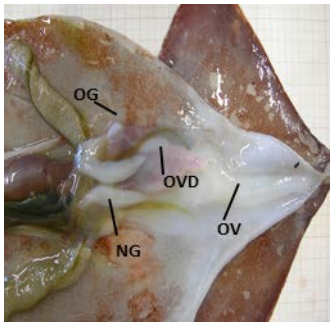
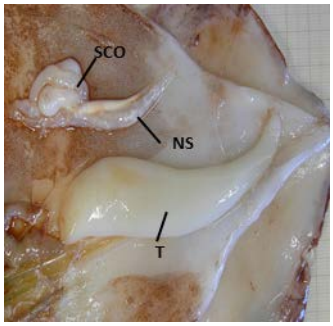
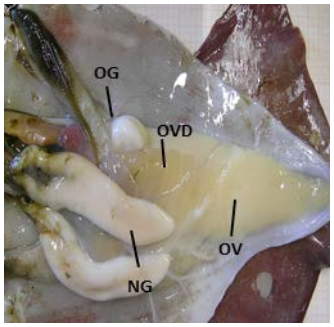
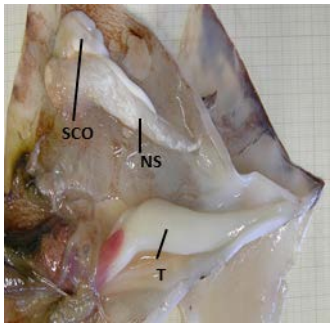
REPRODUCTIVE PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 5 Balearic Sea	F													Quetglas *et al.* (1998a)
	M													
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F													Mangold-Wirz (1963)
	M													
N.E. Atlantic Ocean														
IE 6a Scottish waters	F													Lordan *et al.* (2001)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSA 5 Balearic Sea	F		318.0	337.0	Quetglas *et al.* (1998a)
	M		196.0	232.0	
	F		318.0		Quetglas and Morales-Nin (2004)
	M		222.0		
N.E. Atlantic Ocean					
IE 6a Scottish waters	F	122.0-520.0	310.0	500.0	Lordan *et al.* (2001)
	M	94.0-426.0	>280.0	340.0	

Todarodes sagittatus (FAO CODE: SQE – MEDITS CODE: TODA SAG)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 ML 205 mm; TW 231 g; ST: March; GSA 11	 ML 170 mm; TW 126 g; ST: December; GSA 10-18
2a	DEVELOPING	 ML 290 mm; TW 649 g; ST: December; GSA 10-18	 ML 225 mm; TW 323 g; ST: December; GSA 10-18
2b	MATURING	 ML 280 mm; TW 644 g; ST: February; GSA 11	 ML 209 mm; TW 279 g; ST: March; GSA 11
3a	MATURE	 ML 380 mm; TW 1643 g; ST: February; GSA 11	 ML 207 mm; TW 299 g; ST: March; GSA 11
3b	SPENT		

Order: Oegopsida **Family: Ommastrephidae**

Todaropsis eblanae (Ball, 1841)

Photo by D. Cuccu

FAO CODE: TDQ

MEDITS CODE: TODI EBL

Common name:

Lesser flying squid (English)
Toutenon souffleur (French)
Totano tozzo (Italian)
Pota costera (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the eastern Atlantic Ocean from 61° north to 36° south latitude, the Mediterranean Sea, the western Indian Ocean, the western Pacific Ocean, the South China Sea and Australian waters. Recent findings extend its distribution north to the Arctic (Belcari *et al.*, 2015; Roper, Nigmatullin and Jereb, 2010).

REPRODUCTION

Reproductive strategy: dioic, semelparous; spermatophores transferred in female's buccal membrane, intermittent terminal spawning (*e.g.* Mangold, 1989; Nesis, 1995; Rocha, Guerra and Gonzalez, 2001).

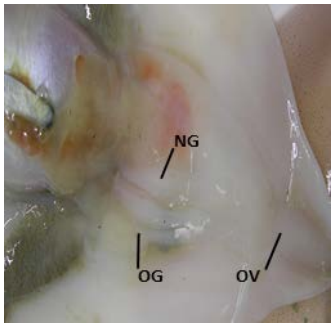
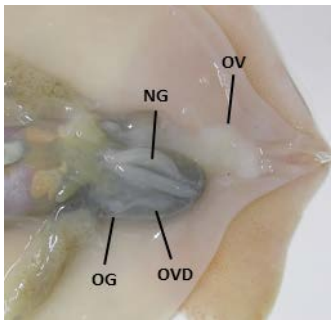
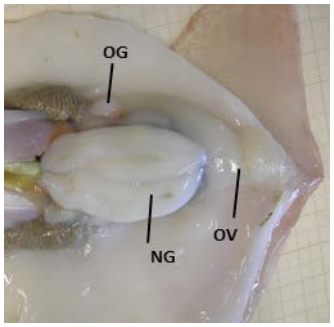
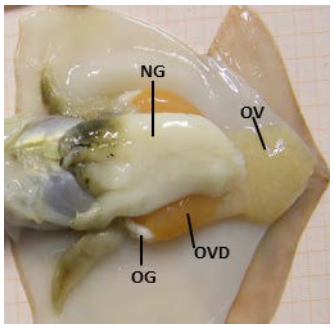
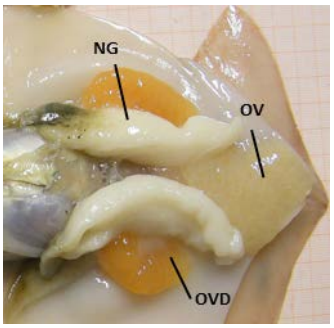
REPRODUCTIVE PERIOD

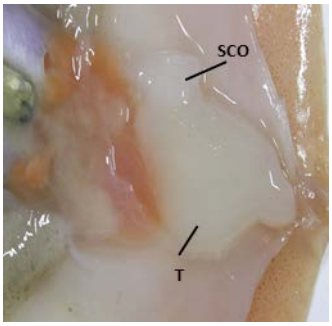
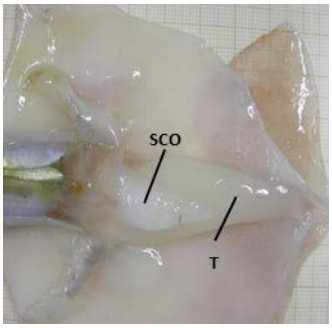
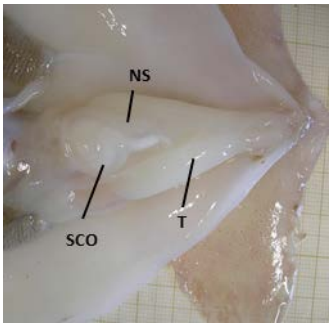
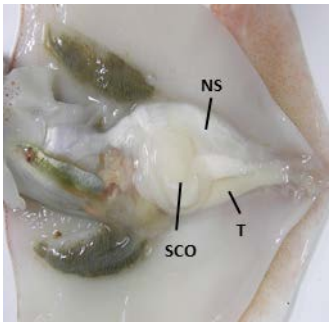
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 6,7 Rosas and Port-Vendres (Spain, France)	C													Mangold-Wirz (1963)
GSA 9 N. Tyrrhenian Sea	C													Favilla (1996)
N.E. Atlantic Ocean														
IE 4a, b Scottish waters	F													Hastie *et al.* (1994); Zumholz and Piatkwoski (2005)
	M													
IE 8c N. Spanish waters	F													González, Rasero and Guerra (1994)
	M													
IE 8e N. Bay of Biscay	F													Robin *et al.* (2002)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSAs 6,7 Rosas and Port-Vendres (Spain, France)	F		160.0	180.0	Mangold-Wirz (1963)
	M		110.0	120.0	
GSA 9 Ligurian Sea	F			144.0	Chelli (2003)
	M			118.0	
GSA 9 N. Tyrrhenian Sea	F		120.0	142.0	Favilla (1996)
	M		100.0	116.0	
N.E. Atlantic Ocean					
IE 4 North Sea	F		120.0	164.0	Zumholz and Piatkwoski (2005)
	M		85.0	123.0	
IE 8c N. Spanish waters	F	140.0-219.0	140.0	180.0-199.0	González, Rasero and Guerra (1994)
	M	104.0-169.0	104.0	130.0-149.0	
IE 8e Northern Biscay Bay	F			165.0	Robin *et al.* (2002)
	M			135.0	

Todaropsis eblanae (FAO CODE: TDQ – MEDITS CODE: TODI EBL)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 **ML 110 mm; TW 82 g; ST: February; GSA 11**
2a	**DEVELOPING**	 **ML 135 mm; TW 166 g; ST: July; GSA 11**
2b	**MATURING**	 **ML 145 mm; TW 252 g; ST: February; GSA 11**
3a	**MATURE**	  **ML 170 mm; TW 362 g; ST: June; GSA 11**
3b	**SPENT**	

Todaropsis eblanae (FAO CODE: TDQ – MEDITS CODE: TODI EBL)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 **ML 85 mm; TW 62 g; ST: January; GSA 11**
2a	**DEVELOPING**	 **ML 122 mm; TW 151 g; ST: February; GSA 11**
2b	**MATURING**	 **ML 120 mm; TW 139 g; ST: February; GSA 11**
3a	**MATURE**	 **ML 110 mm; TW 146 g; ST: February; GSA 11**
3b	**SPENT**	

Order: Octopoda **Family: Octopodidae** ***Eledone cirrhosa* (Lamarck, 1798)**

Photo by D. Cuccu

FAO CODE: EOI

MEDITS CODE: ELED CIR

Common name:
Horned octopus (English)
Elédone commune (French)
Moscardino bianco (Italian)
Pulpo blanco (Spanish)

GEOGRAPHIC DISTRIBUTION

It is commonly found in the northeast Atlantic Ocean, extending from 67° north latitude to the northwest African coasts, and throughout the Mediterranean Sea. It occasionally appears in Kattegat and in the Sea of Marmara (Belcari *et al.*, 2015, Norman *et al.*, 2016).

REPRODUCTION

Reproductive strategy: dioic, semelparous; internal fertilization (ovary) (*e.g.* Mangold-Wirz, 1963; Mangold, 1989).

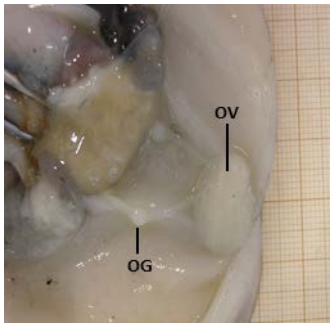
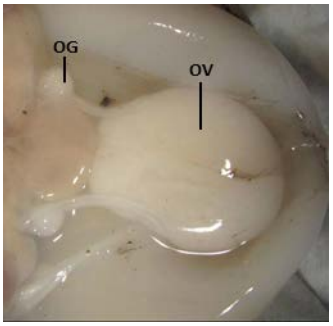
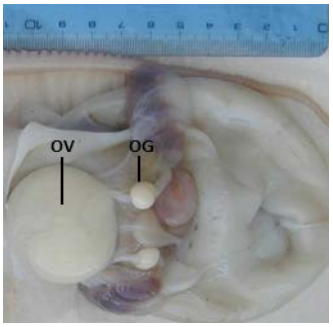
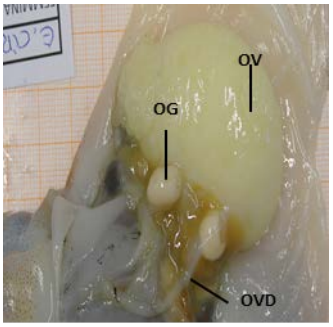
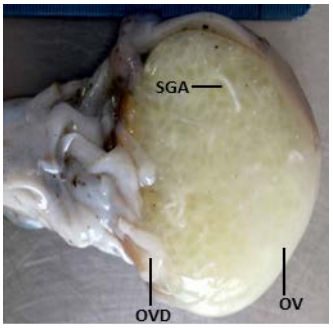
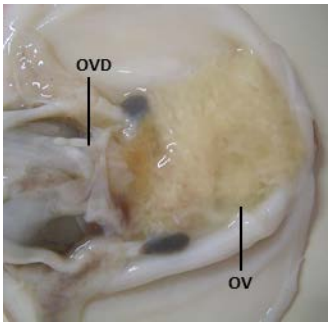
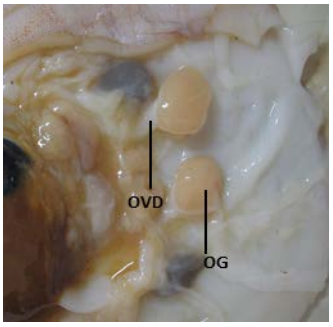
REPRODUCTIVE PERIOD

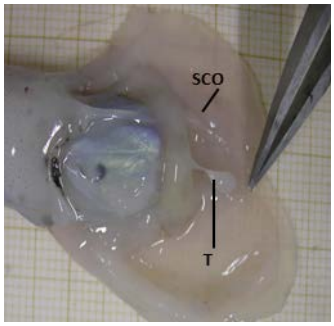
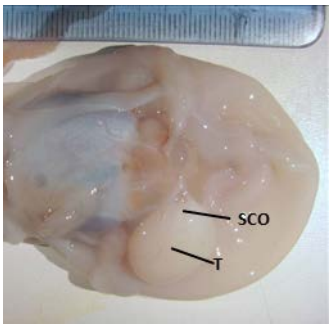
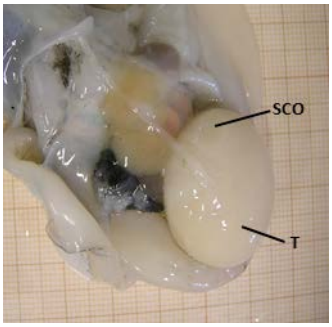
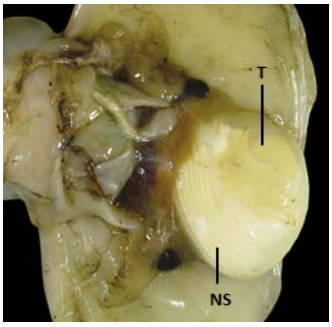
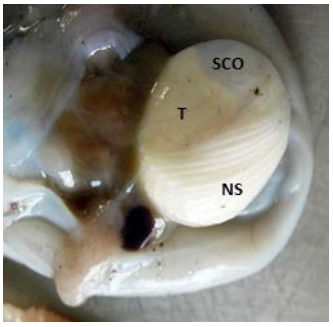
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F													Mangold-Wirz (1963)
	M													
GSA 9 Ligurian Sea	F													Palumbo and Würtz (1983/1984)
	M													
GSA 9 N. Tyrrhenian Sea	F													Belcari and Sartor (1993)
	M													
GSA 10 C.S. Tyrrhenian Sea	C													Giordano *et al.* (2010)
	F													Agnesi, Belluscio and Ardizzone (1998)
	M													
GSA 11 Sardinian Seas	F													Cuccu *et al.* (2003)
	M													
GSAs 12, 13 N. and E. Tunisian waters	F													Rjeibi *et al.* (2013)
	M													
GSA 18 S. Adriatic Sea	F													Donnaloia *et al.* (2010)
	M													
GSA 22 N. Aegean Sea	F													Tursi *et al.* (1995)
	M													
N.E. Atlantic Ocean														
IE 8c N.W. Galician waters	F													Regueira *et al.* (2013)
	M													
IE 9a W. Portugal waters	F													Regueira *et al.* (2013)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSAs 6, 7 Rosas, Port-Vendres (Spain, France)	F		70.0		Mangold-Wirz (1963)
	M		50.0		
GSA 7 Gulf of Lion	M			80.0-90.0	Moriyasu (1983)
GSA 9 Ligurian Sea	F			100.0	Palumbo and Würtz (1983/1984)
	M			55.0	
	F			82.0	Relini, Bertrand and Zamboni (1999)
	M			76.0	
GSA 10 C. S. Tyrrhenian Sea	F	45.0-130.0	80.0		Giordano, Perdichizzi and Greco (1998)
	M	40.0-110.0	65.0		
	F	up to 150.0	90.0	105.0-120.0	Agnesi, Belluscio and Ardizzone (1998)
	M	up to 125.0	65.0	65.0	
	F			91.0	Donnaloia *et al.* (2010)
	M			88.0	
GSA 11 Sardinian Seas	F		65.0	80.0	Cuccu *et al.* (2003)
	M		55.0	60.0	
GSAs 12, 13 N. and E. Tunisian waters	F		65.0	88.0	Rjeibi *et al.* (2013)
	M		58.0	68.8	
GSA 18 S. Adriatic Sea	F			97.0	Donnaloia *et al.* (2010)
	M			78.0	
GSA 22 Thracian Sea	C			109.0	Lefkaditou and Papacostantinou (1995)
GSA 22 N. Aegean Sea	F	up to 125.0	59.0	89.0	Tursi *et al.* (1995)
	M	up to122.0	53.0	77.0	
N.E. Atlantic Ocean					
IE 8c N.W. Galician waters	F	45.0-191.0	75.0	134.5-121.4	Regueira *et al.* (2013)
	M	56.0-158.0	75.0	108.9-99.25	
IE 9a W. Portugal waters	F	55.0-160.0	94.0	100.8	
	M	50.0-139.0	78.0	91.4	

Eledone cirrhosa (FAO CODE: EOI – MEDITS CODE: ELED CIR)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 ML 75 mm; TW 99 g; ST: April; GSA 11
2a	**DEVELOPING**	 ML 95 mm; TW 232 g; ST: March; GSA 10-18
2b	**MATURING**	 ML 110 mm; TW 409 g; ST: May; GSA 10-18
3a	**MATURE**	 ML 89 mm; TW 167 g; ST: July; GSA 11  ML 90 mm; TW 156 g; ST: August; GSA 10-18
3b	**SPENT**	 ML 100 mm; TW 200 g; ST: July; GSA 11 

Eledone cirrhosa (FAO CODE: EOI – MEDITS CODE: ELED CIR			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE VIRGIN**	 **ML 27 mm; TW 7 g; ST: June; GSA 11**	
2a	**DEVELOPING**	 **ML 70 mm; TW 50 g; ST: October; GSA 10-18**	
2b	**MATURING**	 **ML 58 mm; TW 72 g; ST: June; GSA 11**	
3a	**MATURE**	 **ML 88 mm; TW 136 g; ST: June; GSA 11**	 **ML 95 mm; TW 141 g; ST: August; GSA 10-18**
3b	**SPENT**		

Order: Octopoda **Family: Octopodidae**

***Eledone moschata* (Lamarck, 1798)**

Photo by M. Mereu

FAO CODE: EDT

MEDITS CODE: ELED MOS

Common name:
Musky octopus (English)
Elédone musquée (French)
Moscardino muschiato (Italian)
Pulpo almizclado (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the Mediterranean Sea and the Gulf of Cadiz (Atlantic Ocean), to about 40° north latitude. It has been recorded in the Sea of Marmara (Sobrino *et al.*, 2015; Norman *et al.*, 2016).

REPRODUCTION

Reproductive strategy: dioic, semelparous; internal fertilization (ovary) (*e.g.* Mangold-Wirz, 1963; Mangold, 1989).

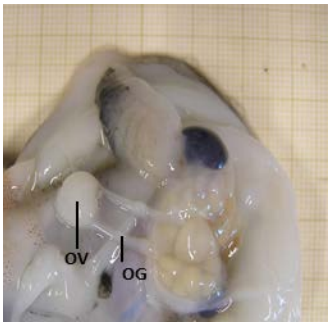
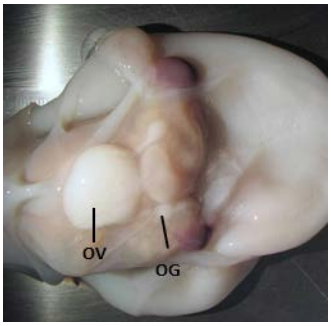
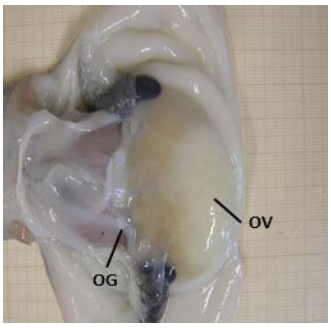
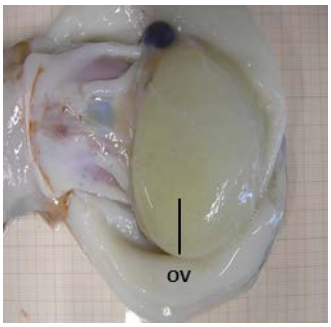
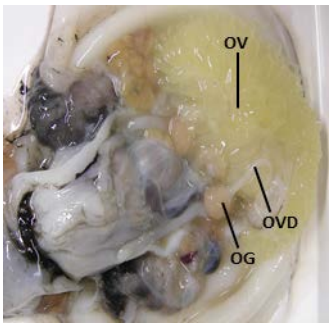
REPRODUCTIVE PERIOD

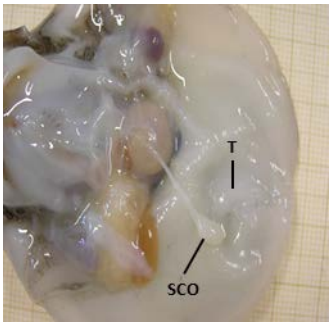
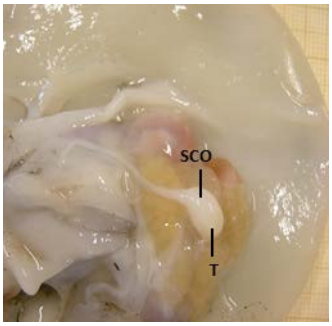
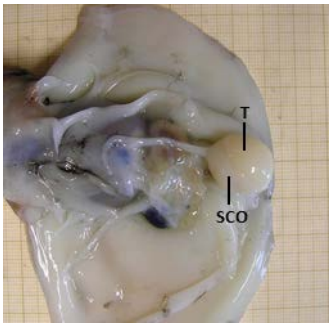
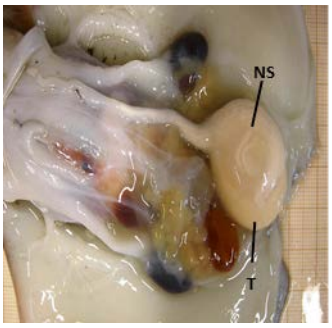
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 7 Port-Vendres (France)	F													Mangold-Wirz (1963)
	M													
GSA 14 Gulf of Gabès	F													Ezzeddine-Najai (1997)
	M													
GSAs 17, 18 N. and C. Adriatic Sea	F													Krstulović Šifner and Vrgoč (2009)
	M													
GSA 22 Aegean Sea	F													Akyol, Sxen and Kinacigil (2007)
	M													
GSA 26 S. Levant Sea	F													Riad and Kilada (2012)
	M													
N.E. Atlantic Ocean														
IE 9a Gulf of Cádiz	F													Silva, Ramos and Sobrino (2004)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSA 7 Port-Vendres (France)	F		110.0		Mangold-Wirz (1963)
	M		60.0		
GSAs 17, 18 N. and C. Adriatic Sea	F	32.0-140.0	72.0	95.0	Krstulović Šifner and Vrgoč (2009)
	M	34.0-118.0	58.0	85.0	
GSA 18 Montenegrin waters	F	40.0-116.0		95.0	Ikica, Krstulović Šifner and Joksimović (2011)
	M	52.0-117.0		72.0	
GSA 26 S. Levant Sea	F	44.0-112.0	59.0	74.0	Riad and Kilada (2012)
	M	46.0-126.0	57.0	72.0	
N.E. Atlantic Ocean					
IE 9a Gulf of Cádiz	F	40.0-150.0	65.0	122.0	Silva, Ramos and Sobrino (2004)
	M		61.0	78.0	

Eledone moschata (FAO CODE: EDT – MEDITS CODE: ELED MOS)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 **ML 73 mm; TW 69 g; ST: June; GSA 11**	
2a	**DEVELOPING**	 **ML 85 mm; TW 101 g; ST: November; GSA 10-18**	
2b	**MATURING**	 **ML 110 mm; TW 243 g; ST: June; GSA 11**	
3a	**MATURE**	 **ML 133 mm; TW 589 g; ST: June; GSA 11**	 **ML 116 mm; TW 384 g; ST: June; GSA 11**
3b	**SPENT**		

Eledone moschata (FAO CODE: EDT – MEDITS CODE: ELED MOS)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 ML 70 mm; TW 58 g; ST: June; GSA 11
2a	**DEVELOPING**	 ML 86 mm; TW 151 g; ST: June; GSA 11
2b	**MATURING**	 ML 80 mm; TW 95 g; ST: September; GSA 11
3a	**MATURE**	 ML 100 mm; TW 199 g; ST: November; GSA 11
3b	**SPENT**	

Order: Octopoda **Family: Octopodidae** ***Octopus vulgaris* (Cuvier, 1797)**

Photo by M. Mereu

FAO CODE: OCC

MEDITS CODE: OCTO VUL

Common name:
Common octopus (English)
Poulpe de roche, Pieuvre (French)
Polpo comune (Italian)
Pulpo común (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the northeast Atlantic Ocean and the Mediterranean Sea, and its presence is also reported in the western Atlantic (Caribbean Sea and northern South America), South Africa, India and East Asia (Sanchez *et al.*, 2015). Recent molecular studies have demonstrated that this genus is polyphyletic, *i.e.* it is an artificial grouping of multiple groups of unrelated species. A major taxonomic revision of the classification of octopuses is currently underway (Norman *et al.*, 2016).

REPRODUCTION

Reproductive strategy: dioic, semelparous; internal fertilization (oviducal gland), simultaneous terminal spawning; parental care (*e.g.* Mangold-Wirz, 1963; Mangold, 1989; Rocha, Guerra and Gonzalez, 2001; Cuccu *et al.*, 2013b; Sanchez *et al.*, 2015; Mereu *et al.*, 2018).

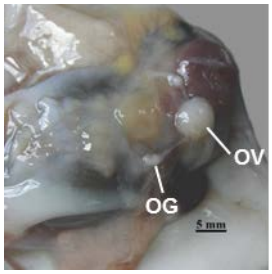
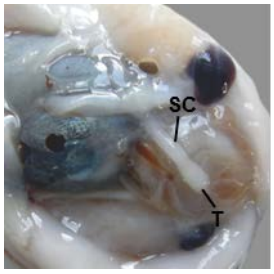
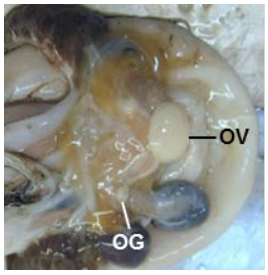
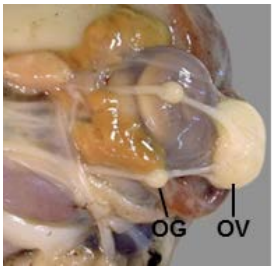
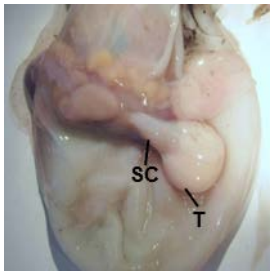
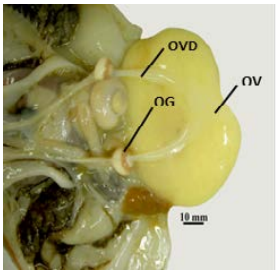
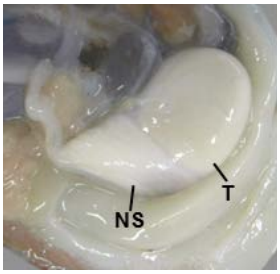
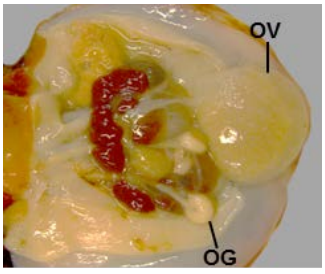
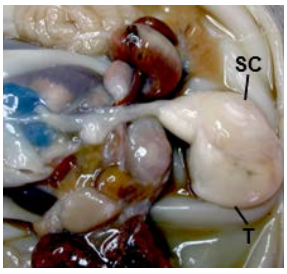
REPRODUCTIVE PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 6 Catalan Sea	F													Guerra (1975)
	M													
	F													Guerra and Manriquez (1980)
	M													
GSA 7 Port-Vendres and Banyuls sur Mer	F													Mangold-Wirz (1963)
	M													
GSA 7 Banyuls sur Mer	F													Mangold and Boletzky (1973)
	M													
GSA 11 Sardinian Seas	F													Cuccu *et al.* (2013a)
	M													
N.E. Atlantic Ocean														
IE 8c Andalucia	F													Rodríguez-Rúa *et al.* (2005)
	M													
IE 8c Asturias	F													Fernández-Rueda and García-Flórez (2007)
IE 8c Galician waters	F													Otero *et al.* (2007)
	M													
IE 9a Gulf of Cádiz	F													Silva, Sobrino and Ramos (2002)
	M													

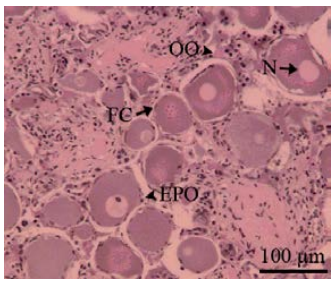
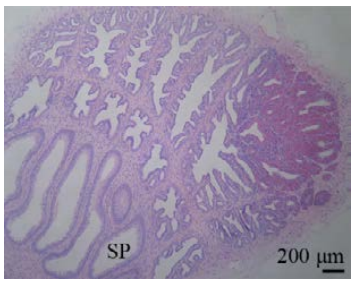
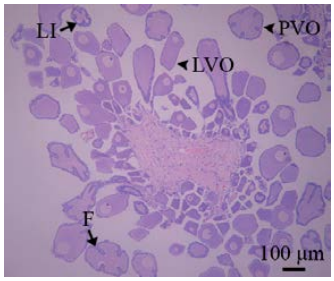
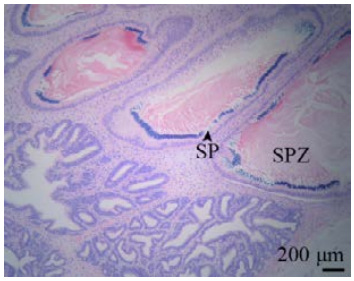
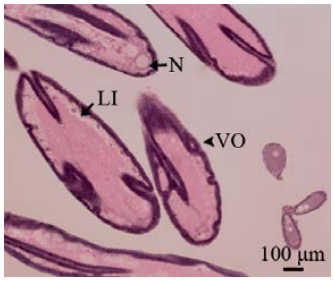
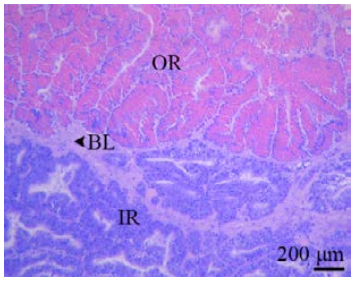
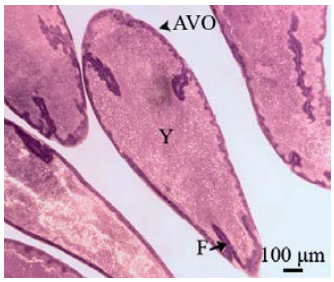
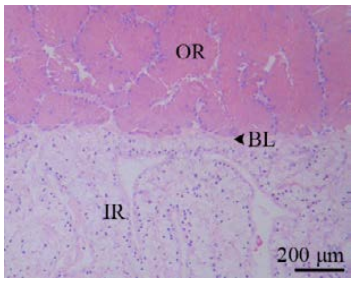
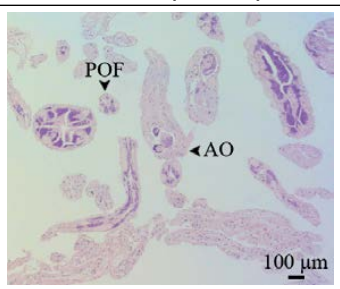
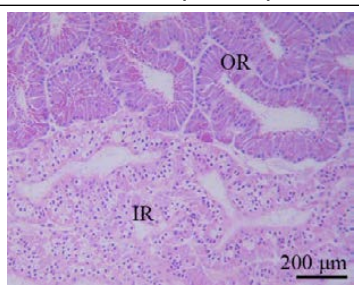
Peak of spawning period

MATURITY

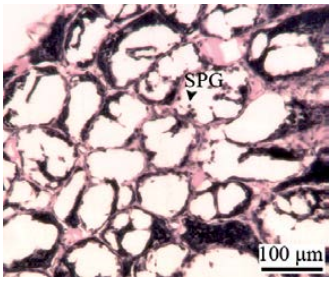
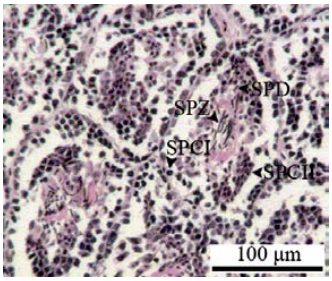
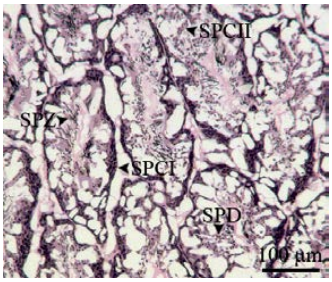
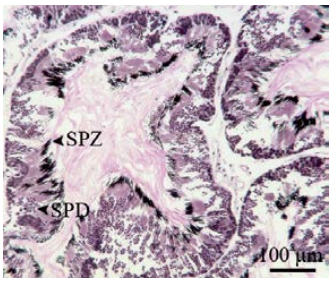
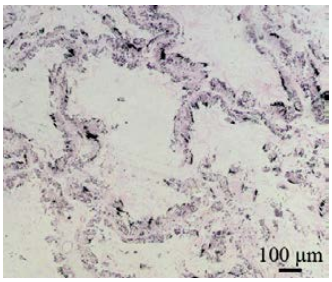
Geographic area	Sex	Size range ML, mm; TW, g	Minimum size Mature ML, mm; TW, g	50% Mature (L_{50}, TW_{50}) ML, mm; TW, g	References
Mediterranean Sea					
GSA 5 Balearic Sea	M		80.0 mm		Quetglas *et al.* (1998b)
GSA 6 Catalan Sea	F		200.0 g	140.0 mm	Guerra (1975)
	M		150.0-300.0 g	90.0-100.0 mm	
	F		600.0 g		Guerra and Manriquez (1980)
	M		180.0 g		
GSA 7 Banyuls sur Mer	F		130.0 mm		Mangold-Wirz (1963)
	M		65.0 mm		
	F		800.0 g		Mangold and Boletzky (1973)
	M		140.0 g		
GSA 9 Tyrrhenian Sea	F		145.0 mm		Belcari and Sartor (1993)
	M		70.0 mm		
GSA 11 Sardinian Seas	F	14.0-238.9 mm 20.0-4661.0 g	90.0 mm 310.0 g	120.0 mm 520.0 g	Cuccu *et al.* (2013a)
	M	14.0-250.0 mm 20.0-5850.0 g	45.0 mm 190.0 g	70.0 mm 320.0 g	
GSA 14 Gulf of Gabès	F		145.0 mm		Ezzeddine and El Abed (2004)
N.E. Atlantic Ocean					
IE 8c Andalucia	F			1250.0 g	Rodríguez-Rúa *et al.* (2005)
	M			850.0 g	
IE 8c Galician waters	F	80.0-300.0 mm 206.0-6303.0 g	120.0 mm 394.0 g	1788.3 g	Otero *et al.* (2007)
	M	85.0-350.0 mm 136.0-6000.0 g	100.0 mm 323.0 g	903.4 g	
IE 9a Portugal	F			2548.01 g	Lourenço *et al.* (2012)
	M			1577.54 g	
IE 9a Gulf of Cádiz	F	70.0-270.0 mm 150.0-7764.0 g	120.0 mm 580.0 g	176.0 mm 2023.0 g	Silva, Sobrino and Ramos (2002)
	M	20.0-270.0 mm 20.0-9332.0 g	94.0 mm 250.0 g	104.0 mm 671.0 g	

Octopus vulgaris (FAO CODE: OCC – MEDITS CODE: OCTO VUL)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**	 **ML 40 mm; TW 51 g; ST: October; GSA 11***	 **ML 48 mm; TW 50 g; ST: September; GSA 11***
2a	**DEVELOPING**	 **ML 145 mm; TW 1196 g; ST: June ; GSA 10-18**	 **ML 85 mm; TW 244 g; ST: November; GSA 11***
2b	**MATURING**	 **ML 130 mm; TW 760 g; ST: May; GSA 11***	 **ML 90 mm; TW 175 g; ST: November; GSA 10-18**
3a	**MATURE**	 **ML 158 mm; TW 1251 g; ST: July; GSA 11**	 **ML 150 mm; TW 1198 g; ST: June; GSA 11***
3b	**SPENT**	 **ML 120 mm; TW 980 g; ST: August; GSA 11***	 **ML 121 mm; TW 980 g; ST: September; GSA 11***

* from Cuccu *et al.* (2013b).

Octopus vulgaris (FAO CODE: OCC – MEDITS CODE: OCTO VUL)			
		FEMALES	
STAGE	PHASE	OVARY	OVIDUCAL GLAND
1	IMMATURE VIRGIN	 GSA 11* (H and E)	 GSA 11* (H and E)
2a	DEVELOPING	 GSA 11* (H and E)	 GSA 11* (H and E)
2b	MATURING	 GSA 11* (H and E)	 GSA 11* (H and E)
3a	MATURE	 GSA 11* (H and E)	 GSA 11* (H and E)
3b	SPENT	 GSA 11* (H and E)	 GSA 11* (H and E)

* from Cuccu *et al.* (2013b).

Octopus vulgaris (FAO CODE: OCC – MEDITS CODE: OCTO VUL)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 **GSA 11* (H and E)**
2a	**DEVELOPING**	 **GSA 11* (H and E)**
2b	**MATURING**	 **GSA 11* (H and E)**
3a	**MATURE**	 **GSA 11* (H and E)**
3b	**SPENT**	 **GSA 11* (H and E)**

* from Cuccu *et al.* (2013b).

Order: Sepiida **Family: Sepiidae**

***Sepia officinalis* (Linnaeus, 1758)**

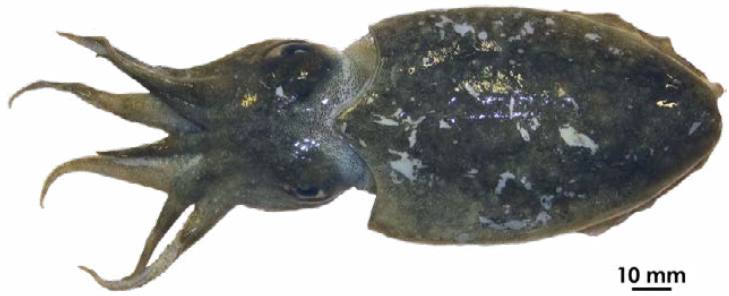


Photo by D. Cuccu

FAO CODE: CTC

MEDITS CODE: SEPI OFF

Common name:
Common cuttlefish (English)
Seiche commune (French)
Seppia comune (Italian)
Sepia común (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the northeast and east Atlantic Ocean, from the Shetland Islands and southern Norway (not present in the Baltic Sea, except for occasional incursions with the north easternmost Atlantic waters), south through the Mediterranean Sea (including in the Aegean Sea, the Sea of Marmara and Levantine Sea) to northwestern Africa, with the southern boundary coinciding approximately with the border between Mauritania and Senegal (16° north latitude) (Guerra *et al.*, 2015; Reid *et al.*, 2005).

REPRODUCTION

Reproductive strategy: dioic, semelparous; intermittent terminal spawning (individual exceptions can be found and, in some specimens, continuous spawning may occur) (*e.g.* Mangold-Wirz, 1963; Mangold, 1989; Rocha, Guerra and Gonzalez, 2001).

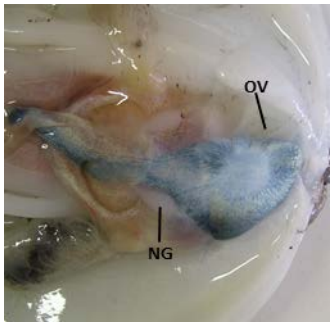
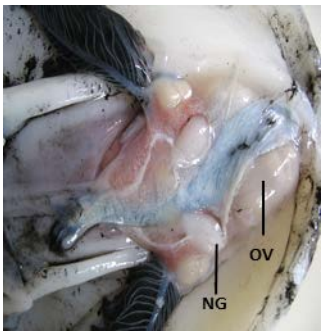
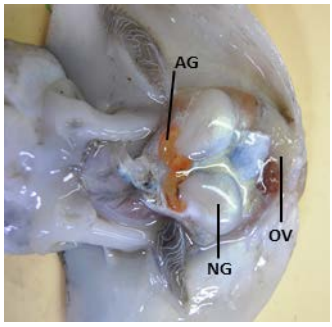
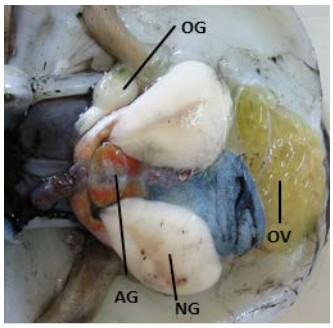
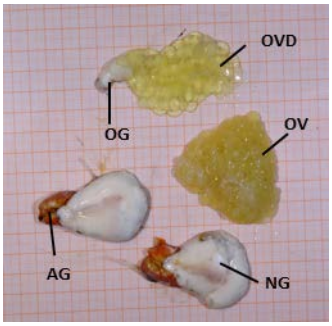
REPRODUCTIVE PERIOD

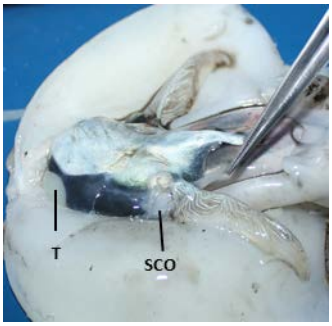
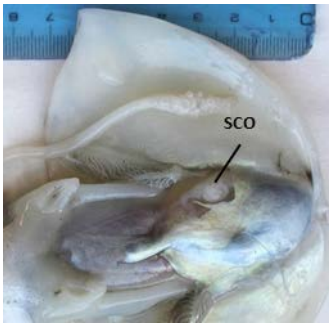
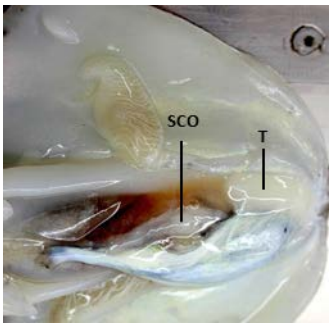
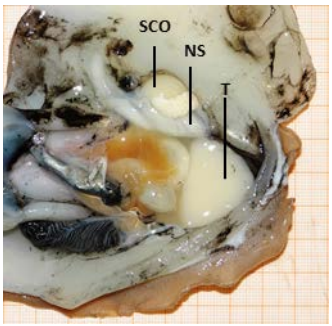
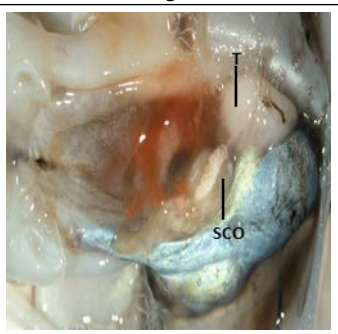
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 7 Port-Vendres (France)	F													Mangold-Wirz (1963)
	M													
GSA17Adriatic Sea	C													Manfrin-Piccinetti and Giovanardi (1984)
GSA 22 Aegean Sea	F													Önsoy and Salman (2005)
	M													
GSA 22 Izmir Bay	F													Akyol, Tellibayraktar and Ceyhan (2011)
	M													
GSA 24 Antalya Bay	F													Olgaç and Özbaş (2007)
	M													
GSA 24 Iskenderun Bay	F													Duysak *et al.* (2014)
	M													
NE Atlantic Ocean														
IE 7d English Channel	F													Dunn (1999)
	M													
IE 9a Sado estuary (Portugal)	C													Neves *et al.* (2009)

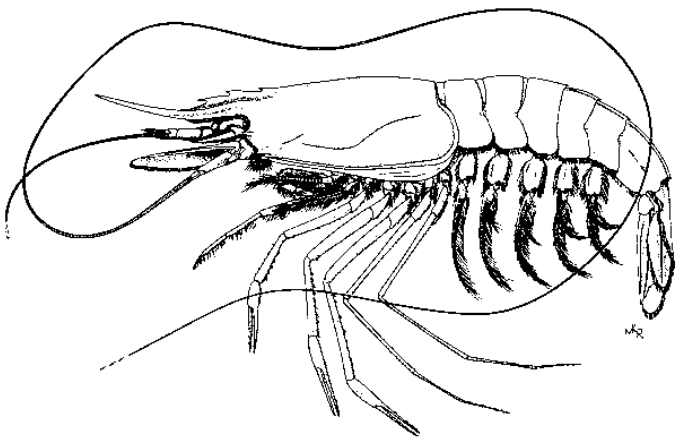
Peak of spawning period

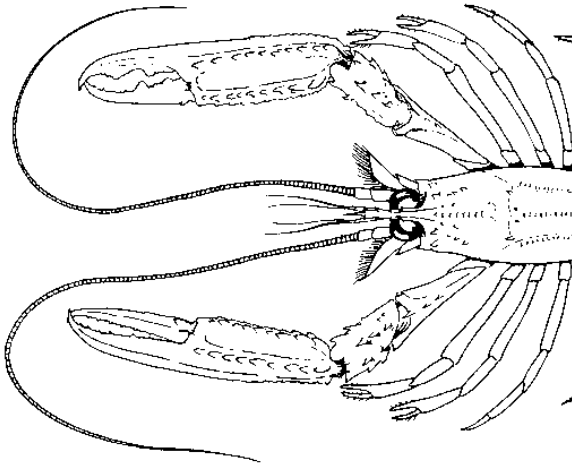
MATURITY

Geographic area	Sex	Size range ML, mm	Minimum size Mature, ML, mm	50% Mature (L_{50}) ML, mm	References
Mediterranean Sea					
GSA 7 Port-Vendres (France)	F	110.0-232.0	110.0		Mangold-Wirz (1963)
	M	60.0-250.0	60.0		
GSA 12 Gulf of Tunis	F		80.0	100.0	Ezzeddine-Najai (1984)
	M		50.0	80.0	
GSA 17 N. Adriatic Sea	F			80.0	Bettoso, Faresi and Aleffi (2006)
	M			70.0	
GSA 18 S. Adriatic Sea	F			80.0-150.0	Santojanni *et al.* (2012)
GSA 22 Aegean Sea	F	68.0-241.0	90.0	130.0	Önsoy and Salman (2005)
	M	65.0-214.0	70.0	90.0	
GSA 22 Izmir Bay	F			80.0	Akyol, Tellibayraktar and Ceyhan (2011)
	M			90.0	
GSA 24 Iskenderun Bay	F	51.0-164.0		120.4	Duysak *et al.* (2014)
	M	48.0-192.0		103.0	
NE Atlantic Ocean					
IE 7d English Channel	F			164.0	Dunn (1999)
	M			146.0	
IE 8e Bay of Biscay	F		100.0		Gauvrit, Le Goff and Daguzan (1997)
	M		60.0		
IE 9a Sado estuary	F	28.0-205.0		80.0	Neves *et al.* (2009)
	M	28.0-156.0		59.0	

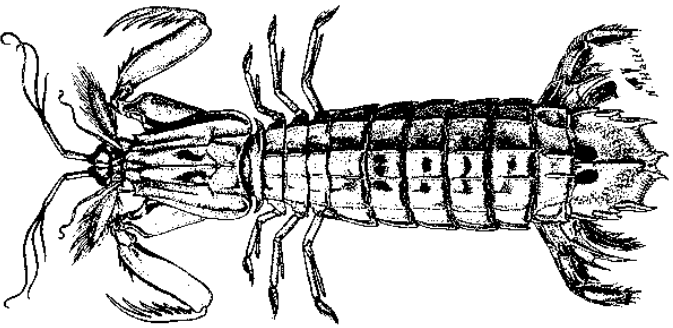
Sepia officinalis (FAO CODE: CTC – MEDITS CODE: SEPI OFF)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 ML 85 mm; TW 71 g; ST: July; GSA 11
2a	**DEVELOPING**	 ML117 mm; TW 180 g; ST: March; GSA 11
2b	**MATURING**	 ML 95 mm; TW 106.3 g; ST: October; GSA 9
3a	**MATURE**	  ML 190 mm; TW 700 g; ST: March; GSA 11
3b	**SPENT**	

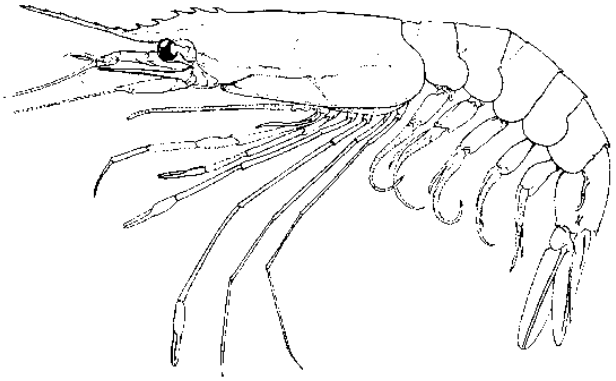
Sepia officinalis (FAO CODE: CTC – MEDITS CODE: SEPI OFF)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 **ML 75 mm; TW 56 g; ST: October; GSA 10**
2a	**DEVELOPING**	 **ML 80 mm; TW 73 g; ST: November; GSA 10-18**
2b	**MATURING**	 **ML 80 mm; TW 75 g; ST: November; GSA 10-18**
3a	**MATURE**	 **ML 94 mm; TW 92 g; ST: June; GSA 11**
3b	**SPENT**	 **ML: 85 mm; TW: 102 g; ST: November; GSA 10-18**

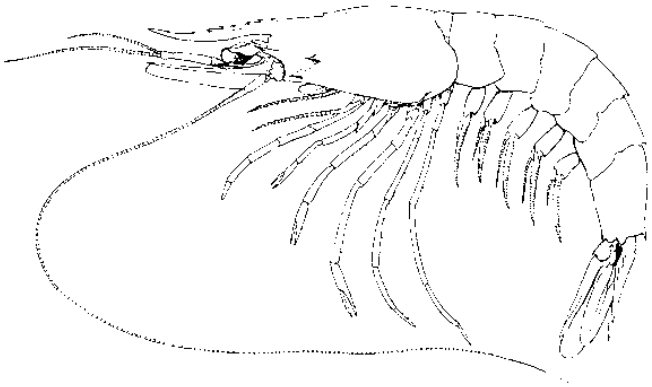


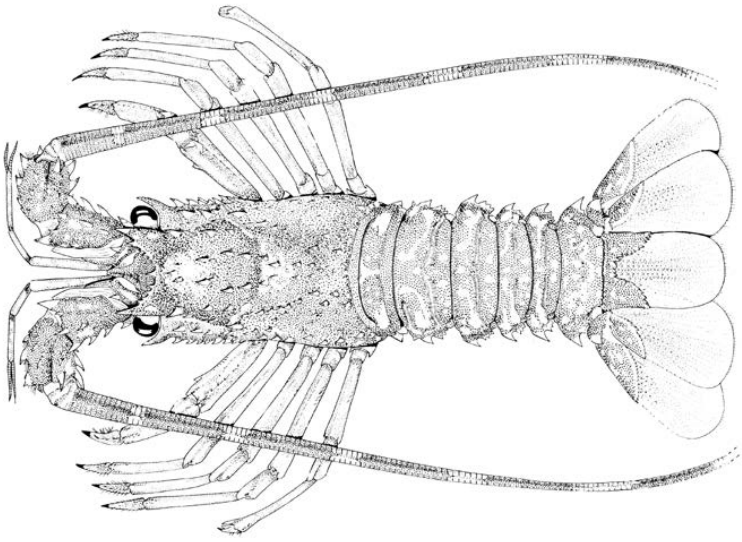


CRUSTACEANS









Crustaceans

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Order: Decapoda **Family: Aristeidae** ***Aristaeomorpha foliacea* (Risso, 1827)**

Photo by D. Cuccu

FAO CODE: ARS

MEDITS CODE: ARIS FOL

Common name:

Giant red shrimp (English)
Crevette rouge (French)
Gambero rosso (Italian)
Gamba roja (Spanish)

GEOGRAPHIC DISTRIBUTION

A. foliacea is a cosmopolitan species common in the western and eastern Atlantic Ocean, the western Pacific Ocean, the Indian Ocean and the Mediterranean Sea (Holthuis, 1980).

REPRODUCTION

Reproductive strategy: dioic.

SPAWNING PERIOD

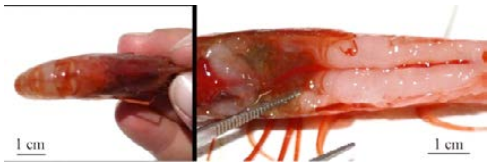
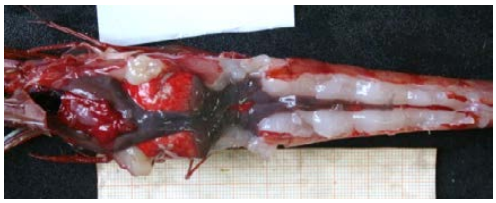
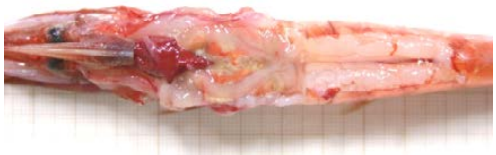
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GAS 9 Ligurian Sea	F													Orsi Relini and Semeira (1983)
	F													Orsi Relini and Relini (1985)
GSA 9 N. Tyrrhenian Sea	F													Belcari, Viva and Mori (2003)
GSA 9 C. Tyrrhenian Sea	F													Mori, Biagi and De Ranieri (1994)
	M													
	F													Leonardi and Ardizzone (1994)
	M													
GSA 10 S. Tyrrhenian Sea	F													Spedicato *et al.* (1994)
	F													
	M													Perdichizzi *et al.* (2012)
GSA 11 Sardinian Seas	F													Mura, Campisi and Cau (1992)
	F													Follesa *et al.* (1998)
GSA 16 Strait of Sicily	F													Ragonese *et al.* (1994)
	F													Ragonese and Bianchini (1995)
GSA 19 Ionian Sea	F													D'Onghia *et al.* (1998)
GSA 20 E. Ionian Sea	F													Papaconstantinou and Kapiris (2003)
	F													Kapiris and Thessalou-Legaki (2009)
	M													
Atlantic Ocean														
IE 9.a Portuguese slope														Figueiredo, Figueiredo and Bordalo Machado (2001)

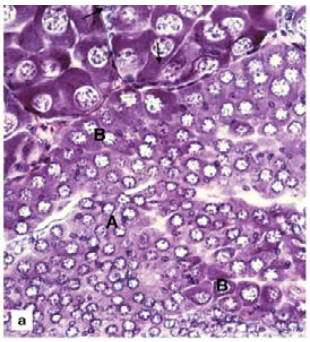
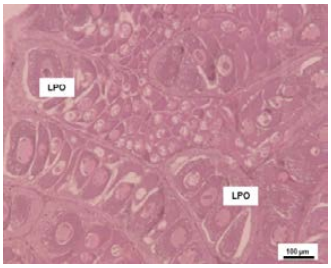
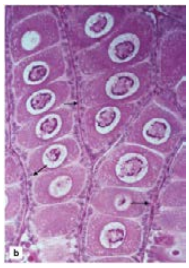
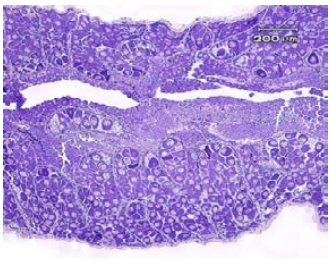
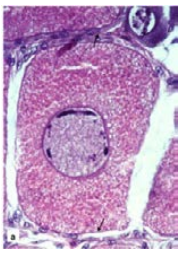
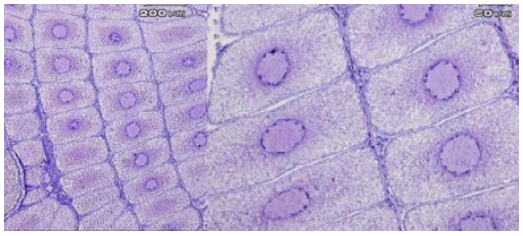
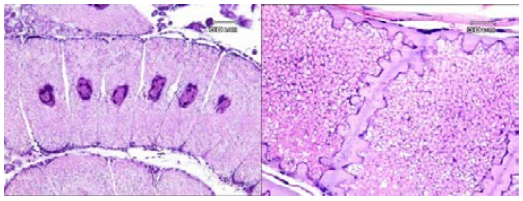
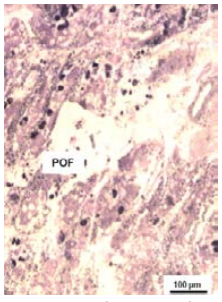
Peak of spawning period

MATURITY

Geographic area	Sex	Size range CL, mm	Minimum size Mature, CL, mm	50% Mature (L_{50}) CL, mm	References
Mediterranean Sea					
GSA 9 N. Tyrrhenian Sea	F			35.5	Belcari, Viva and Mori (2003)
GSA 9 C. Tyrrhenian Sea	F		28.0	45.0	Mori, Biagi and De Ranieri (1994)
	M		29.0	32.0	
	M			30.0-31.0	Leonardi and Ardizzone (1994)
GSA 10 S.E. Tyrrhenian Sea	F			34.0°	Greco *et al.* (1994)
	M			31.0-34.0	
GSA10 S. Tyrrhenian Sea	F		38.0		Spedicato *et al.* (1994)
	F			41.0	Perdichizzi *et al.* (2012)
	M			22.0-45.0	
GSA 11 Sardinian Seas	F			35.0	Cau, Deiana and Mura (1982)
	M			30.0-32.5	
	F		34.0		Mura *et al.* (1992)
	F			39.0	Cau *et al.* (1994)
	F			37.0-40.0	Follesa *et al.* (1998)
GSA16 Strait of Sicily	F			39.7*	Ragonese *et al.* (1994)
	F		36.4	41.8	Ragonese and Bianchini (1995)
	M			31.0•	Ragonese, Bertolino and Bianchini (1997)
	M			29.0#	
	M			29.5≠	
GSA 19 N.W. Ionian Sea	F		35.0	39.0	D'Onghia *et al.* (1994)
	M		27.0	29.0	
	F	10.0-65.0	33.0	43.0	Matarrese *et al.* (1997)
	F	9.0-65.0	33.0	43.0 (37.1*)	D'Onghia *et al.* (1998)
	F		35.9	44.1	Carlucci *et al.* (2006)
GSA 20 E. Ionian Sea	F			38.8-36.8°	Kapiris and Thessalou-Legaki (2009)
	M			26.6	

• short rostrum; # petasma welded; ≠ ampullae with spermatophores.
* maximum reproductive potential.
° on the basis of the presence of spermatophores.

Aristaeomorpha foliacea (FAO CODE: ARS – MEDITS CODE: ARIS FOL)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 CL 24 mm; TW 6 g; ST: May; GSA 10
2a	DEVELOPING VIRGIN	 CL 30 mm; TW 11 g; ST: June; GSA 10
2b	RECOVERING	 CL 46 mm; TW 30 g; ST: April; GSA 19
2c	MATURING OR ALMOST MATURE	 CL 61 mm; TW 64 g; ST: May; GSA 11
2d	MATURE	 CL 61.7 mm; TW 64 g; ST: May; GSA 11
2e	RESTING ADULT	 CL 48.1mm; TW 36 g; ST: September; GSA 11

Aristaeomorpha foliacea (FAO CODE: ARS – MEDITS CODE: ARIS FOL)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 **GSA 19 (H and E)**	
2a	**DEVELOPING VIRGIN**	 **GSA 11 (H and E)**	 **GSA 19 (H and E)**
2b	**RECOVERING**	 **GSA 10 (H and E)**	 **GSA 19 (H and E)**
2c	**MATURING OR ALMOST MATURE**	 **GSA 10 (H and E)**	
2d	**MATURE**	 **GSA 10 (H and E)**	
2e	**RESTING ADULT**	 **GSA 11 (H and E)**	

Order: Decapoda **Family: Aristeidae** ***Aristeus antennatus* (Risso, 1816)**

Photo by M.C. Follesa

FAO CODE: ARA

MEDITS CODE: ARIT ANT

Common name:
Blue and red shrimp (English)
Crevette rouge (French)
Gambero viola (Italian)
Gamba rosada (Spanish)

GEOGRAPHIC DISTRIBUTION

A. antennatus is found in the Mediterranean Sea, in the eastern Atlantic ocean, from Cabo Verde to Portugal, in the Indian Ocean, Mozambique and South Africa waters (Freitas, 1985); in recent years, it was also reported near the northern coast of Brazil (Serejo *et al.*, 2007).

REPRODUCTION

Reproductive strategy: dioic.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 5 Catalan Sea	F													Sardà and Demestre (1987)
	M													
	M													Demestre (1990)
	F													Demestre and Fortuño (1992)
	F													Demestre (1994)
	M													
	F													Sardà and Cartes (1994)
GSA 5 Ibiza Island	F													Martinez Baños and Mas (1994)
	M													
	F													Martinez Baños and Mas (1996)
	M													
	F													Garcia-Rodriguez and Esteban (1996)
	M													
	F													Garcia-Rodriguez and Esteban (1999)
GSA 5 Balearic Sea	F													Massuti (1978)
GSA 5 Balearic Sea	F													Carbonell (1994)
	F													Carbonell *et al.* (1999)
	M													
	F													Carbonell, Lloret and Demestre (2008)
	M													
GSA 6 W. Mediterranean Sea	F													Garcia-Rodriguez and Esteban (1996)
GSA 7 Gulf of Lion	F													Campillo (1994)

Table continues next page ➜

SPAWNING PERIOD (continued)

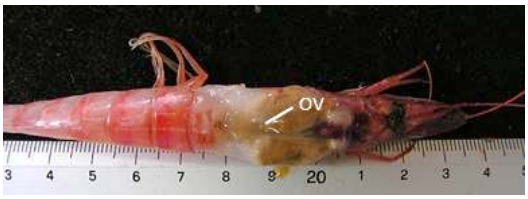
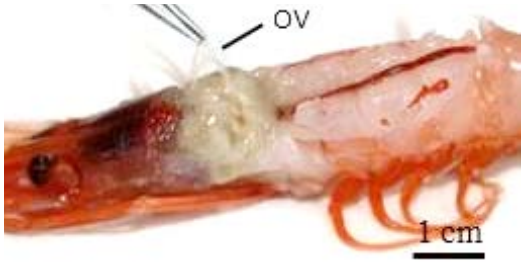
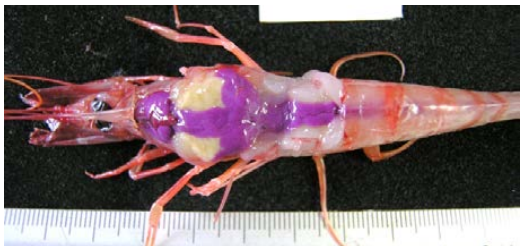
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSA 9 Ligurian Sea	F													Orsi Relini and Relini (1979)
	F													Orsi Relini (1979)
	F													Orsi Relini and Pestarino (1981)
	F													Orsi Relini and Semeira (1983)
GSA 9 N. Tyrrhenian Sea	F													Righini and Abella (1994)
	F													Orsi Relini and Relini (2012)
GSA 10 C.W. Tyrrhenian Sea	F													Spedicato *et al.* (1995)
	F													Colloca *et al.* (1998)
GSA 10 S. Tyrrhenian	F													Bitetto *et al.* (2012)
GSA 11 Sardinian Seas	F													Mura and Cau (1989)
	F													Mura, Campisi and Cau (1992)
	F													Follesa *et al.* (1998)
GSA 16 N.W. of Sicily	F													Arculeo *et al.* (1992)
	F													Arculeo, Payen and Riggio (1994)
GSA 18 S. Adriatic Sea	F													Casciaro *et al.* (2012)
GA 19 Ionian Sea	F													Matarrese, D'Onghia and Tursi (1992)
	F													Carlucci et al. (2006)
GSA 19 N.W. Ionian Sea	F													D'Onghia *et al.* (1997)
	M													
GSA 19 W. Ionian Sea	F													D'Onghia *et al.* (2005)
GSA 20 E. Ionian Sea	F													D'Onghia *et al.* (2005)
GSA 20 Greek Ionian Sea	F													Papacostantinou and Kapiris (2001)
	F													Kapiris and Thessalou-Legaki (2009)
	M													
GSA 24 N. Levant Sea	F													Deval and Kapiris (2016)
Atlantic Ocean														
IE 9.a Portuguese coast	F													Arrobas and Ribeiro Cascalho (1987)
	F													Santos and Cascalho (1994)

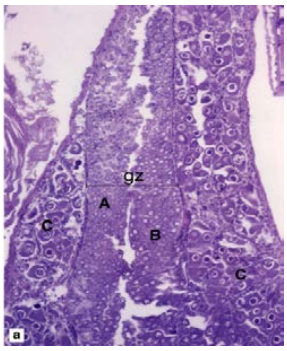
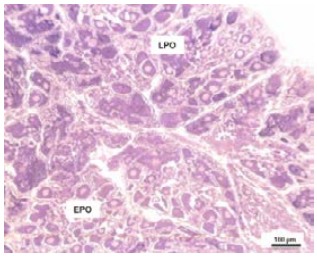
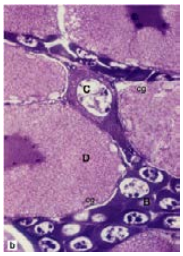
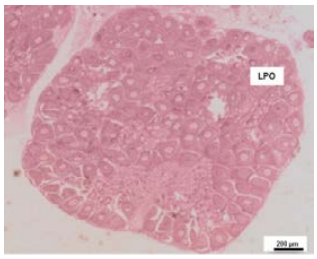
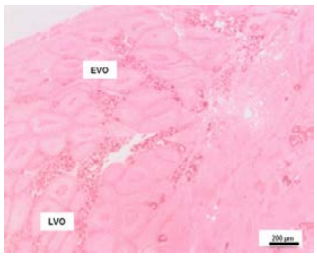
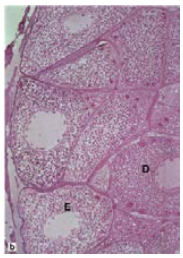
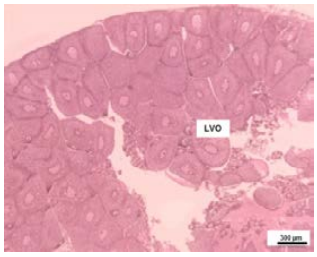
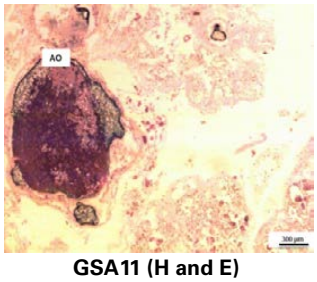
Peak of spawning period

MATURITY

Geographic area	Sex	Size range CL, cm	Minimum size Mature, CL, cm	50% Mature (L_{50}) CL, cm	References
Mediterranean Sea					
GSA 4 Algeria	F			23.0	Yahiauoi (1994)
GSA 5 Catalan Sea	F			27.0	Sardà and Demestre (1987)
	M			24.0	
	F			21.0	Demestre (1994)
	F				Sardà and Cartes (1994)
GSA 5 W. Mediterranean (Spain)	F			22.5	Garcia-Rodriguez and Esteban (1996)
	M			17.0	
	F		15.0	21.1	Garcia-Rodriguez and Esteban (1999)
GSA 5 Majorca Island	F			26.0	Carbonell (1994)
	M			26.0	
GSA 5 Balearic Sea	F	15.0-63.0		24.9-29.3†	Carbonell *et al.* (1999)
	M	15.0-38.0		21.3-22.3†	
	F		19.0	24.6-28.5#	Carbonell, Lloret and Demestre (2008)
	M		19.0	18.7-22.1#	
	F		19.0	26.0•	
	M		19.0	21.0•	
GSA 5 Ibiza Island	F			27.0	Martinez Baños and Mas (1994)
	M			21.0	
	F			24.0	Martinez Baños and Mas (1996)
	M			20.0	
GSA 7 Gulf of Lion	F			28.8	Campillo (1994)
GSA 9 Ligurian Sea	F		31.0		Orsi Relini and Relini (1979)
	F			24 (1987) 19 (1994-2004)	Orsi Relini and Relini (2012)
GSA 9 N. Tyrrhenian Sea	F		32.0		Righini and Abella (1994)
GSA 9 C. Tyrrhenian Sea	F		24.0	27.0	Colloca *et al.* (1998)
GSA 10 C.W. Tyrrhenian Sea	F		20.0	35.0	Spedicato *et al.* (1995)
GSA 10 S. Tyrrhenian Sea	F			25.8	Bitetto *et al.* (2012)
GSA 11 Sardinian Seas	M			21.0-25.0	Mura and Cau (1989)
	F			18.0-24.0	Mura, Campisi and Cau (1992)
	F			21.0	Cau *et al.* (1994)
	F			23.0-25.0	Follesa *et al.* (1998)
GSA 16 N.W. of Sicily	F		27.0		Arculeo *et al.* (1994)
GSA 18 S. Adriatic Sea	F			25.6	Casciaro *et al.* (2012)
GSA 19 Ionian Sea	F			42.0	Matarrese *et al.* (1992)
	M			31.0	
	F		27.0	35.0	D'Onghia *et al.* (1994)
	M		21.0	25.0	
GSA 19 N.W. Ionian Sea	F			46.0-48.0	D'Onghia *et al.* (1997)
	F			35.4	Carlucci *et al.* (2006)
GSA 19 W. Ionian Sea	F	14.0-64.0	20.0		D'Onghia *et al.* (2005)
GSA 19 C. Ionian Sea	F			42.0-44.0	D'Onghia *et al.* (1997)
GSA 19 S. Ionian Sea	F			34.0-36.0	D'Onghia *et al.* (1997)
GSA 20 E. Ionian Sea	F			29.4	Kapiris and Thessalou-Legaki (2009)
	F	24.0-64.0	25.0		D'Onghia *et al.* (2005)
GSA 24 N. Levant Sea	F	12.0-61.0	24.0		Deval and Kapiris (2016)

minimum and maximum value registered between 1992 and 2003; • mean value between 1992 and 2003.
† minimum and maximum value registered between 1992 and 1997.
° on the basis of the presence of spermatophores.

Aristeus antennatus (FAO CODE: ARA – MEDITS CODE: ARIT ANT)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 CL 20.3 mm; TW 4 g; ST: March; GSA 11
2a	**DEVELOPING VIRGIN**	 CL 24 mm; TW 8 g; ST: June; GSA 10
2b	**RECOVERING**	 CL 53.6mm; TW 52 g; ST: May; GSA 11
2c	**MATURING OR ALMOST MATURE**	 CL 39.2 mm; TW 21 g; ST: June; GSA 11
2d	**MATURE**	 CL 29.8 mm; TW 11 g; ST: June; GSA 11
2e	**RESTING ADULT**	 CL 45.7mm; TW 30 g; ST: September; GSA 11

Aristeus antennatus (FAO CODE: ARA – MEDITS CODE: ARIT ANT)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 GSA 19 (H and E)	
2a	**DEVELOPING VIRGIN**	 GSA 11 (H and E)	 GSA 19 (H and E)
2b	**RECOVERING**	 GSA11 (H and E)	
2c	**MATURING OR ALMOST MATURE**	 GSA11 (H and E)	 GSA19 (H and E)
2d	**MATURE**	 GSA11 (H and E)	
2e	**RESTING ADULT**	 GSA11 (H and E)	

Order: Decapoda **Family: Nephropidae**

***Nephrops norvegicus* (Linnaeus, 1758)**

Photo by C. Porcu

FAO CODE: NEP

MEDITS CODE: NEPR NOR

Common name:
Norway lobster (English)
Langoustine (French)
Scampo (Italian)
Cigala (Spanish)

GEOGRAPHIC DISTRIBUTION

The species is distributed in the eastern Atlantic Ocean, from Iceland, the Faeroes and northwestern Norway (Lofoten Islands), in the south to the Atlantic coast of Morocco, and in the western and central basin of the Mediterranean. It is absent from the eastern Mediterranean Sea east of 28° east latitude and from the Baltic Sea, the Bosphorus and the Black Sea (Fischer, Bauchot and Schneider, 1987; Relini, Bertrand and Zamboni, 1999).

REPRODUCTION

Reproductive strategy: dioic.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 1 Alboran Sea	F	*	*	*					*	**	**	*	**	Orsi Relini *et al.* (1998)
GSA 6 N.E. Spain	F		*						*	*	*	*	*	Sardá (1991)
GSA 6 Catalan Sea	F	*	*						**	*	*	*	**	Orsi Relini *et al.* (1998)
	F	*	*						*	*	*	*	*	Aguzzi, Allué and Sardà (2004)
GSA 9 Ligurian Sea	F	*	*						*	**	*	**	*	Orsi Relini *et al.* (1998)
GSA 9 Tyrrhenian Sea	F	*	*						*	**	*	**	*	Orsi Relini *et al.* (1998)
GSA 10 C.S. Tyrrhenian Sea	F									*	*	*		Carbonara *et al.* (2006)
GSA 16 Strait of Sicily	F	*	*					*	*	*	*	*	*	Bianchini, Di Stefano and Ragonese (1998)
GSA 17 N. Adriatic Sea	F													Karlovac (1953)
GSA 17 Adriatic Sea	F	*	*				*	*	*	*	*	*	*	Froglia and Gramitto (1981a)
	F	*	*		*	*	*	*	*	*	**	**	*	Orsi Relini *et al.* (1998)
GSA 17 C. Adriatic Sea	F													Colella and Santojanni (2012)
GSA 22 Aegean Sea	F	*	*	*						*	*	*	*	Mytilineou, Fourtouni and Papaconstantinou (1995)
GSA 22 Aegean Sea	F	*	*		*	*	*	**	*	*	*	*	**	Orsi Relini *et al.* (1998);
GSA 22 N. Aegean Sea	F	*	*	*						*	*	*	*	Mytilineou, Fourtouni and Papaconstantinou (1993)
GSA 22 N. Aegean Sea	F	*	*	*	*	*		*	*	*	*	**	**	Mente *et al.* (2009)
Atlantic Ocean														
IE 7.a Irish Sea	F			*	*	*	*	*	*	*	*	*	*	Farmer (1974)
IE 9.a Algarve (Portugal)	F	**	*					*	*	**	*	*	**	Orsi Relini *et al.* (1998)

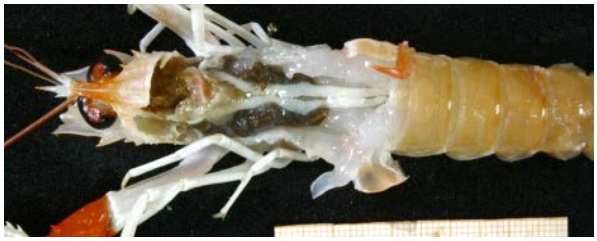
Peak of spawning period

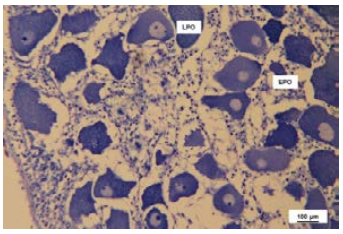
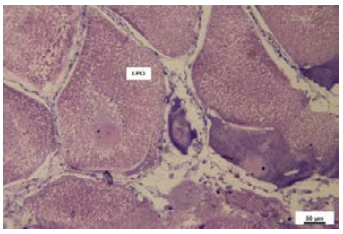
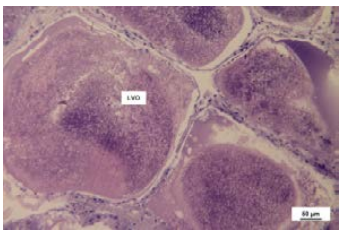
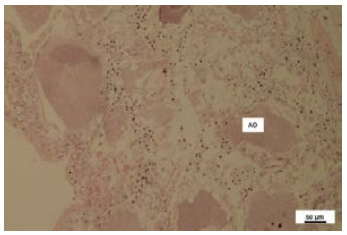
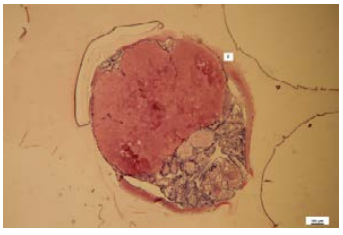
* Brooding period (berried females).
** Peak of brooding period.

MATURITY

Geographic area	Sex	Size range CL, mm	Minimum size Mature, CL, mm	50% Mature (L_{50}) CL, mm	References
Mediterranean Sea					
GSA 1 Alboran Sea	F		30.0†, 30.0*	36.0	Orsi Relini *et al.* (1998)
GSA 6 N.E. Spain	F		22.0†; 27.0*	30.0-33.0	Sardá (1991)
GSA 6 Catalan Sea	F		24.0†, 27.0*	30.0	Orsi Relini *et al.* (1998)
GSA 9 Ligurian Sea	F		29.0†, 27.0*	32.0	Orsi Relini *et al.* (1998)
GSA 9 Tyrrhenian Sea	F		27.0†, 27.0*	32.0	Orsi Relini *et al.* (1998)
GSA 10 C.S. Tyrrhenian Sea	F		29.2†; 23.5*	30.6-34.8	Carbonara *et al.* (2006)
GSA 16 Strait of Sicily	F		22.0*	29.9-32.1	Bianchini *et al.* (1998)
GSA 17 N. Adriatic Sea	F	12.0-72.0	18.0	27.0	Karlovac (1953)
GSA 17 Adriatic Sea	F		16.0*	81.0-105.0 (TL)	Froglia and Gramitto (1981a)
	F		18.0-22.0*		Froglia and Gramitto (1988)
	F		25.0†, 24.0*	30.0	Orsi Relini *et al.* (1998)
GSA 17 C. Adriatic Sea	F			29.9	Colella and Santojanni (2012)
GSA 18 S.W. Adriatic Sea	F		16.0*	25.0	Marano *et al.* (1998)
	F		17.0-18.0*	27.5	Ungaro *et al.* (1999)
GSA 22 Aegean Sea	F	12.0-53.0	25.0	34.0	Mytilineou, Fourtouni and Papaconstantinou (1995)
GSA 22 Aegean Sea	F		19.0†, 23.0*	33.0	Orsi Relini *et al.* (1998)
GSA 22 N. Aegean Sea	F	12.0-58.0		28.5	Mytilineou, Fourtouni and Papaconstantinou (1993)
GSA 22 N. Aegean Sea	F		29.2*	28.1	Mente *et al.* (2009)
Atlantic Ocean					
IE 5.a Iceland	F			23.9-34.4	Eiríksson (2014)
IE 9 Portuguese waters	F		26.0*	33.0	Figueiredo and Thomas (1967)
	f			23.0	Abelló and Sardá (1982)
	F			46.9-50.7	Ayza, Tuset and González (2011)
IE 9.a Algarve (Portugal)	F		25.0†, 24.0*	30.0	Orsi Relini *et al.* (1998)
IE 7.a Irish Sea	F		21.0*	22.0	Figueiredo and Thomas (1967)
	F			20.9-23.4	McQuaid, Briggs and Roberts (2006)
IE 6 Scottish waters	F		22.0*	22.6-33.5	Tuck, Atkinson and Chapman (2000)

† females with mature ovary; * berried females.

Nephrops norvegicus (FAO CODE: NEP – MEDITS CODE: NEPR NOR)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 CL 21 mm; ST: June; GSA 17
2a	**DEVELOPING VIRGIN**	 CL 24.1 mm; TW 10 g; ST: December; GSA 11
2b	**RECOVERING**	 CL 32.3 mm; TW 21 g; ST: April; GSA 11
2c	**MATURING OR ALMOST MATURE**	 CL 35 mm; TW 32 g; ST: May; GSA 17
2d	**MATURE**	 CL 38 mm; TW 33.5 g; ST: October; GSA 9
2e	**RESTING ADULT**	 CL 36 mm; TW 33.4 g; ST: October; GSA 9
3	**BERRIED**	 GSA 9

Nephrops norvegicus (FAO CODE: NEP – MEDITS CODE: NEPR NOR)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)
2a	DEVELOPING VIRGIN	 GSA 11 (H and E)
2b	RECOVERING	
2c	MATURING OR ALMOST MATURE	 GSA 11 (H and E)
2d	MATURE	
2e	RESTING ADULT	 GSA 11 (H and E)
3	BERRIED	 GSA 11 (H and E)

Order: Decapoda **Family: Palinuridae**

***Palinurus elephas* (Fabricius, 1787)**

Photo by M.C. Follesa

FAO CODE: SLO

MEDITS CODE: PALI ELE

Common name:
Common spiny lobster (English)
Langouste rouge (French)
Aragosta rossa (Italian)
Langosta (Spanish)

GEOGRAPHIC DISTRIBUTION

This species is distributed in the eastern Atlantic Ocean from Norway to Morocco and throughout the Mediterranean, except in the extreme eastern and southeastern regions (Holthuis, 1991). It is also present in the Canary Islands, the Azores (d'Udekem d'Acoz, 1999), and probably also in the Madeira Islands (Goñi and Latrouite, 2005).

REPRODUCTION

Reproductive strategy: dioic; total spawner.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 6 Spain	F	*	*	*					*	*	*	*	*	Goñi, Quetglas and Reñones (2003)
	M													
GSA 8 Corsica, France	F	*	*							**	*	*	*	Campillo and Amadei (1978); Marin (1985)
GSA 11 Sardinian Seas	F	*	*							*	*	*	*	Follesa (2012)
GSA 17 Adriatic Sea	F	*	*							**	*	*	*	Gamulin (1955)
Greek waters	F									*	*	*		Moraitopoulou-Kassimati (1973)
Atlantic Ocean														
IE 9.a Portugal	F	*	*	*						**	**	*	*	Vasconcellos (1960)
IE 9.a S.W. Portugal	F	*	*	*						*	*	*	*	Galhardo, Serafim and Castro (2006)
IEs 8.a, 7.e Brittany, France	F									**	**			Latrouite and Nöel (1997)
IE 7.b Ireland	F									**	**			Mercer (1973)
IE 7.f S. Wales and Cornwall	F									**	**			Hunter, Shackley and Bennett (1996)

Peak of spawning period

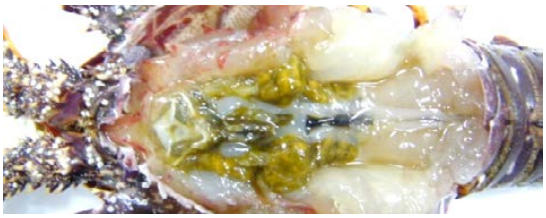
* Brooding period (berried females).

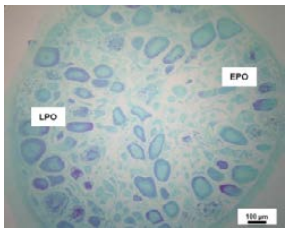
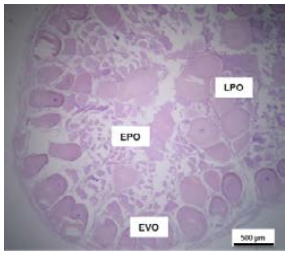
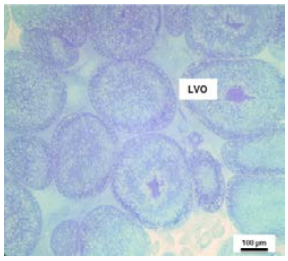
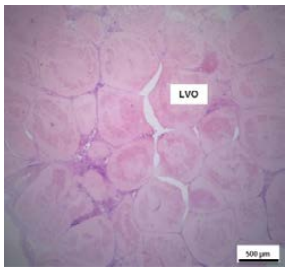
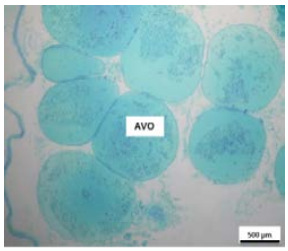
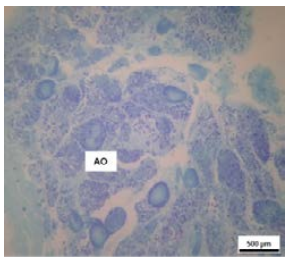
** Peak of brooding period.

MATURITY

Geographic area	Sex	Size range CL, mm	Minimum size Mature, CL, mm	50% Mature (L_{50}) CL, mm	References
Mediterranean Sea					
GSA 6 Spain	F			77.2, 76.0-77.0*	Goñi, Quetglas and Reñones (2003)
	M			82.5	
GSA 8 Corsica, France	F			86.0*	Marin (1987); Latrouite (1992); Ceccaldi and Latrouite (1994)
	M			76.0	
GSA 11 Sardinian Seas	F			17.0 (TL, ~ 64.0 CL)	Cottiglia *et al.* (1977)
	M			18.0 (TL, ~ 68.0 CL)	
	F			85.1*	Follesa (2012)
Atlantic Ocean					
IE 9.a S.W. Portugal	F		84.0*	110.0*	Galhardo, Serafim and Castro (2006)
IEs 8.a, 7.e Brittany, France	F			95.0*	Latrouite and Nöel (1997)
IE 7.b Ireland	F			82.0	Mercer (1973)
	M			85.0	

* berried females.

Palinurus elephas (FAO CODE: SLO – MEDITS CODE: PALI ELE)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 CL 61.6 mm; TW 158 g; ST: November; GSA 11
2a	DEVELOPING VIRGIN	 CL 76 mm; TW 318 g; ST: July; GSA 11
2b	RECOVERING	 CL 79.8 mm; TW 110 g; ST: July; GSA 11
2c	MATURING OR ALMOST MATURE	 CL 83.5 mm; TW 407 g; ST: May; GSA 11
2d	MATURE	 CL 78.3 mm; TW 360 g; ST: June; GSA 11
2e	RESTING ADULT	 CL 79.5 mm; TW 399 g; ST: September; GSA 11
3	BERRIED	 CL 88.2 mm; TW 391 g; ST: November; GSA 11

Palinurus elephas (FAO CODE: SLO – MEDITS CODE: PALI ELE)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 **GSA 11 (TM)**
2a	**DEVELOPING VIRGIN**	 **GSA 11 (H and E)**
2b	**RECOVERING**	 **GSA 11 (TM)**
2c	**MATURING OR ALMOST MATURE**	 **GSA 11 (H and E)**
2d	**MATURE**	 **GSA 11 (TM)**
2e	**RESTING ADULT**	 **GSA 11 (TM)**
3	**BERRIED**	

Order: Decapoda **Family: Penaeidae**

***Parapenaeus longirostris* (Lucas, 1846)**

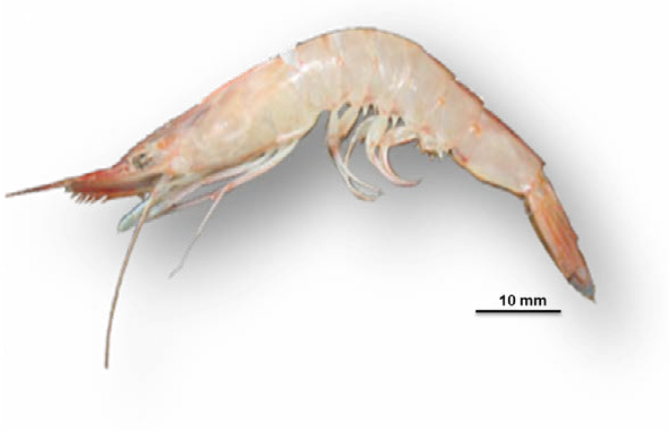


Photo by C. Porcu

FAO CODE: DPS

MEDITS CODE: PAPE LON

Common name:
Deep-water rose shrimp (English)
Crevette rose du large (French)
Gambero rosa (Italian)
Gamba de altura (Spanish)

GEOGRAPHIC DISTRIBUTION

The deep-water rose shrimp shows a wide geographic distribution, from the eastern Atlantic Ocean north of Spain (Holthuis, 1980; Olaso, 1990) to the southern waters of Angola (Crosnier, De Bondy and Lefevere, 1968), as well as in the Mediterranean Sea and its adjacent seas (Tyrrhenian, Adriatic and Aegean Seas and the Sea of Marmara) (Massutí, 1963).

REPRODUCTION

Reproductive strategy: dioic.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 4 Algerian waters	F													Bekadja *et al.* (2009)
GSA 6 Gulf of Alicante	F													García-Rodríguez, Pérez Gil and Barcala (2009)
GSA 9 N. Tyrrhenian	F													De Ranieri, Mori and Sbrana (1998)
	F													Mori, Sbrana and De Ranieri (2000)
GSA 9 C. Tyrrhenian	F													Ardizzone *et al.* (1990)
GSAs 12, 13, 14 Tunisian waters	F													Heldt (1938)
	F													Ben Meriem, Fehri-Bedoul and Gharbi (2001)
GSA 10 S. Tyrrhenian Sea	F													Arculeo *et al.* (2014)
GSA 16 N.W. Sicily	F													Arculeo, Galioto and Cuttitta (1993)
GSA 16 Strait of Sicily	F													Levi, Andreoli and Giusto (1995)
GSA 18 S. Adriatic Sea	F													Kasalica *et al.* (2011)
GSA 19 Ionian Sea	F													D'Onghia *et al.* (1998)
GSA 22 Aegean Sea	F													Dereli and Erdem (2011)
GSA 28 Sea of Marmara	F													Bayhan, Unluer and Akkaya (2005)
GSA 26 Egyptian waters	F													Drobisheva (1970)
	F													Abdel Razek *et al.* (2006)

Table continues next page ➜

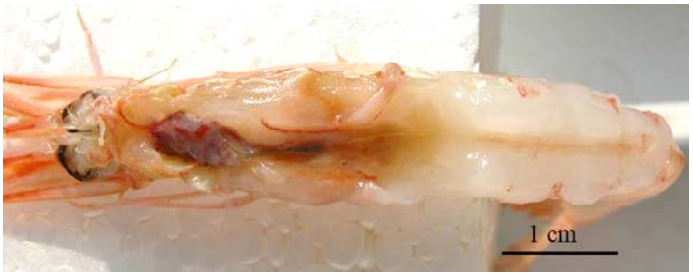
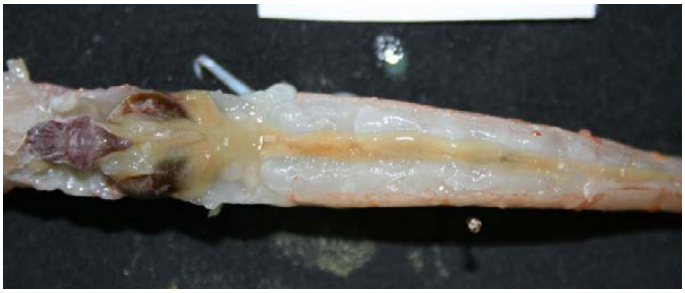
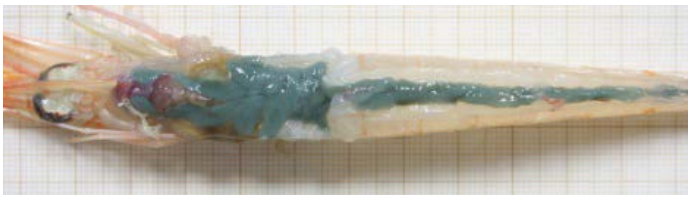
SPAWNING PERIOD (continued)

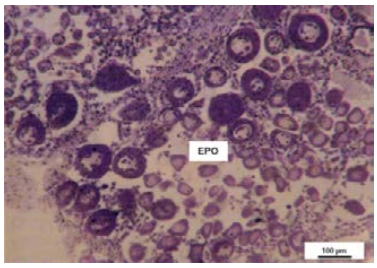
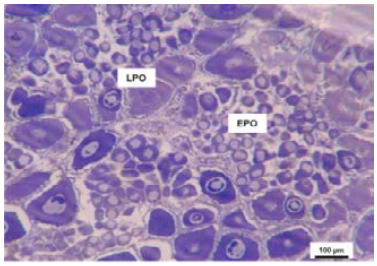
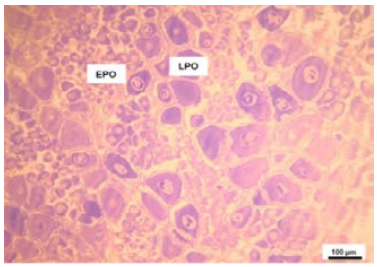
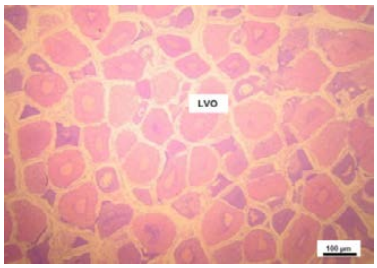
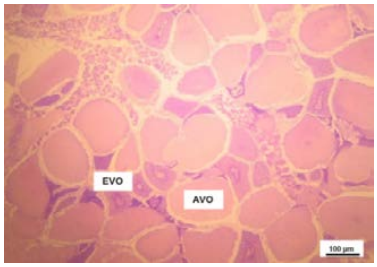
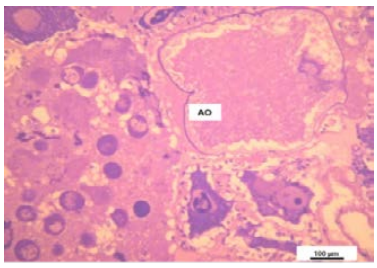
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSA 24 N.E. Mediterranean	F													Manaşirli and Avşar (2008)
GSA 27 Israeli coast (sup. waters)	F													Tom, Goren and Ovadia (1988)
GSA 27 Israeli coast (deep waters)	F													
Atlantic Ocean														
IE 9.a S. Portugal	F													Ribeiro-Cascalho and Arrobas (1987)
IE 9.a Gulf of Cádiz	F													Sobrino and García (2007)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range CL, mm	Minimum size Mature, CL, mm	50% Mature (L_{50}) CL, mm	References
Mediterranean Sea					
GSA 4 Algerian waters	F	11.0-38.0		19.6	Bekadja *et al.* (2009)
GSA 6 Gulf of Alicante	F	7.0-42.0		25.6	García-Rodríguez, Pérez Gil and Barcala (2009)
GSA 9 N. Tyrrhenian	F		16.0	19.5	De Ranieri, Mori and Sbrana (1998)
	F		16.0	22.0	Mori, Sbrana and De Ranieri (2000)
GSAs 12, 13, 14 Tunisian waters	F	10.0-35.0		20.1	Ben Meriem, Fehri-Bedoul and Gharbi (2001)
GSA 10 S. Tyrrhenian Sea	F		18.5	28.4	Spedicato *et al.* (1996)
	F	8.0-32.0		26.6/27.8	Arculeo *et al.* (2014)
GSA 18 S. Adriatic Sea	F		16.0	21.9	Kasalica *et al.* (2011)
	F	14.0-37.0	16.0		Kapiris *et al.* (2013)
GSA 20 S. Ionian Sea	F	7.0-38.0	10.0		Kapiris *et al.* (2013)
GSA 22 Aegean Sea	F		13.7	24.6	Dereli and Erdem (2011)
GSA 28 Sea of Marmara	F	10.0-160.0 (TL)		97.0 (TL)	Bayhan, Unluer and Akkaya (2005)
GSA 26 Egyptian waters	F	40.0-145.0 (TL)	70.0 (TL)	56.0 (TL)	Abdel Razek *et al.* (2006)
GSA 24 N.E. Mediterranean Sea	F		13.4	18.0	Manaşirli and Avşar (2008)
Atlantic Ocean					
IE 9.a S. Portugal	F			26.0	Ribeiro-Cascalho and Arrobas (1987)
IE 9.a Gulf of Cadiz	F			22.2	Sobrino and García (2007)

Parapenaeus longirostris (FAO CODE: DPS – MEDITS CODE: PAPE LON)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 **CL 15 mm; TW 3 g; ST: June; GSA 10**
2a	**DEVELOPING VIRGIN**	 **CL 20 mm; TW 7 g; ST: March; GSA 19**
2b	**RECOVERING**	 **CL 32.1 mm; TW 13 g; ST: March; GSA 11**
2c	**MATURING OR ALMOST MATURE**	 **CL 28 mm; TW 12.3 g; ST: October; GSA 9**
2d	**MATURE**	 **CL 37.3 mm; TW 21 g; ST: September; GSA 11**
2e	**RESTING ADULT**	 **CL 25.9 mm; TW 10 g; ST: June; GSA 11**

Parapenaeus longirostris (FAO CODE: DPS – MEDITS CODE: PAPE LON)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)
2a	DEVELOPING VIRGIN	 GSA 11 (H and E)
2b	RECOVERING	 GSA 11 (H and E)
2c	MATURING OR ALMOST MATURE	 GSA 11 (H and E)
2d	MATURE	 GSA11 (H and E)
2e	RESTING ADULT	 GSA 11 (H and E)

Order: Stomatopoda **Family: Squillidae**

***Squilla mantis* (Linnaeus, 1758)**

Photo by S. Colella

FAO CODE: MTS

MEDITS CODE: SQUI MAN

Common name:
Spot-tail mantis shrimp (English)
Squille ocelleé (French)
Canocchia (Italian)
Galera (Spanish)

GEOGRAPHIC DISTRIBUTION

The spot-tail mantis shrimp, *Squilla mantis,* is found in Mediterranean Sea and in the adjacent Atlantic Ocean where it has been reported from the Gulf of Cádiz and from the Canary Islands and Madeira; its southernmost distribution is Angola (Maynou, Abelló and Sartor [2004]).

REPRODUCTION

Reproductive strategy: dioic.

SPAWNING PERIOD

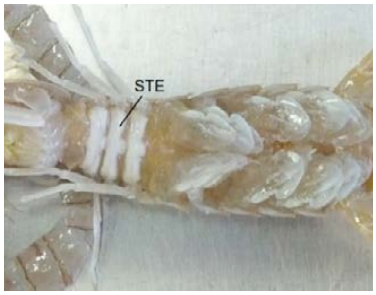
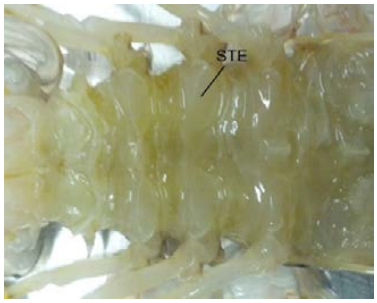
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 9 E. Ligurian Sea	F													Mori and Sartor (unpubl. data)*
GSAs 12, 13, 14 Tunisian waters	F													Mili *et al.* (2011)
GSAs 10, 18, 19 C. Mediterranean	F													Carbonara *et al.* (2013)
GSA 17 C. Adriatic Sea	F													Froglia (1996)

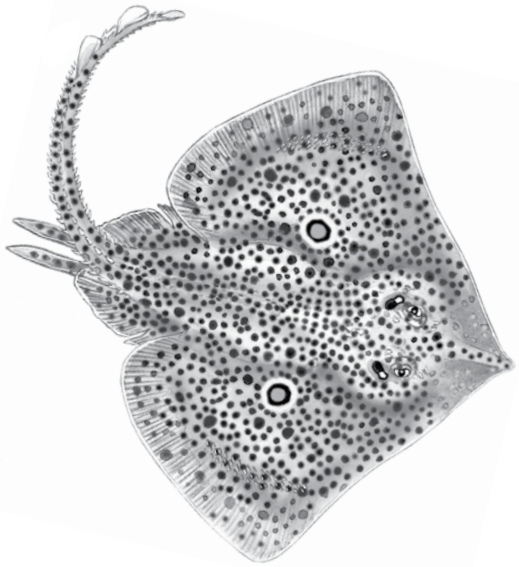
Peak of spawning period

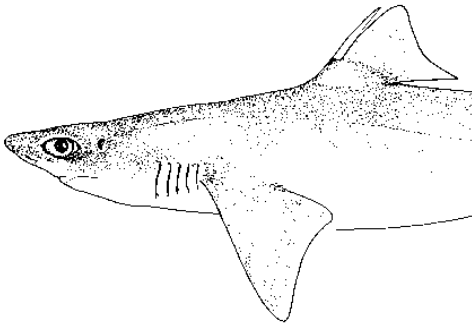
* In Maynou *et al.* (2004).

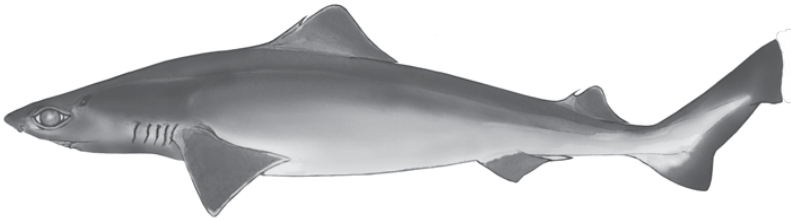
MATURITY

Geographic area	Sex	Size range CL, mm	Minimum size Mature, CL, mm	50% Mature (L_{50}) CL, mm	References
Mediterranean Sea					
Mediterranean Sea	F			20.0-24.0	Piccinetti and Piccinetti-Manfrin (1970)
GSA 6 Catalan Sea	F			20.0-24.0	Abelló and Sardà (1989)
GSA 7 N.W. Mediterranean Sea	F			20.0-24.0	Do Chi (1975)
GSAs 12, 13, 14Tunisian waters	F		93.0 (TL)	147.2 (TL)	Mili *et al.* (2011)
GSA 10 C.S.Tyrrhenian Sea	F			19.6	Carbonara *et al.* (2013)
GSA 17 C. Adriatic Sea	F			27.0	Froglia (1996)
GSA 18 S. Adriatic Sea	F			21.1	Carbonara *et al.* (2013)
GSA 19 Ionian Sea	F			20.3	Carbonara *et al.* (2013)

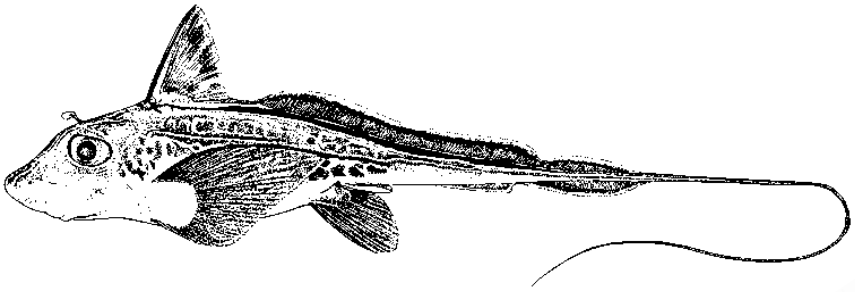
Squilla mantis (FAO CODE: MTS – MEDITS CODE: SQUI MAN)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 CL 15 mm; ST: September; GSA 10-18	
2a	**DEVELOPING VIRGIN**	 CL 18.5 mm; ST: October; GSA 10-18	
2b	**RECOVERING**	 CL 32 mm; TW 41 g; ST: February; GSA 17	
2c	**MATURING OR ALMOST MATURE**	 CL 25.3 mm; ST: December; GSA 10-18	
2d	**MATURE**	 CL 28 mm; ST: January; GSA 10-18	
2e	**RESTING ADULT**	 CL 27.8 mm; ST: July; GSA 10-18	

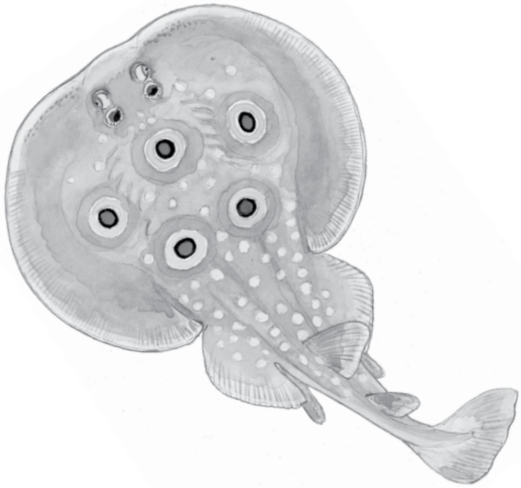


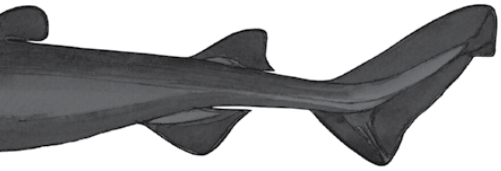


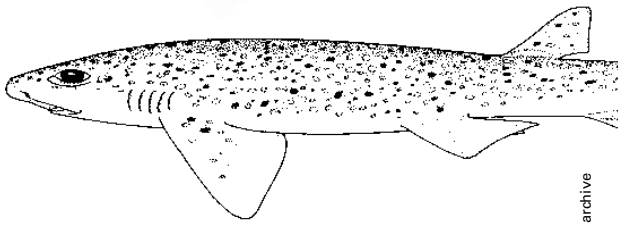


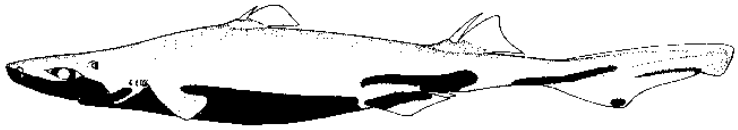
CARTILAGINOUS FISH

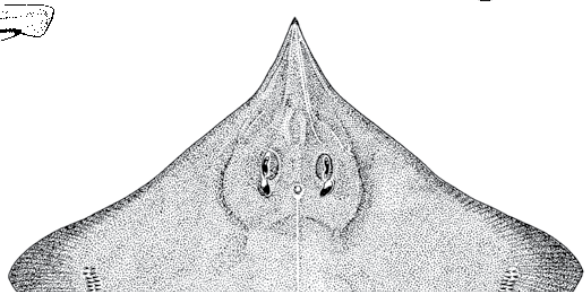












Holocephali

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Order: Chimaeriformes **Family: Chimaeridae**

***Chimaera monstrosa* (Linnaeus, 1758)**

Photo by S. Colella

FAO CODE: CMO

MEDITS CODE: CHIM MON

Common name:
Rabbitfish (English)
Chimère commun (French)
Chimera (Italian)
Gato, Quimera (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found throughout the northeastern Atlantic Ocean from the southern Arctic to Morocco (approximately 80° north to 30° north latitude) including the Mid-Atlantic Ridge and the Mediterranean. It is common in the western and central Mediterranean, rare in the eastern Mediterranean, and absent from the north and central Adriatic (Dagit, Hareide and Clò, 2007).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

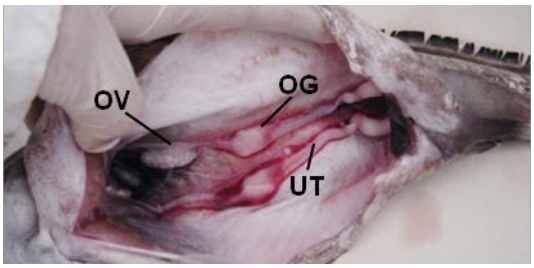
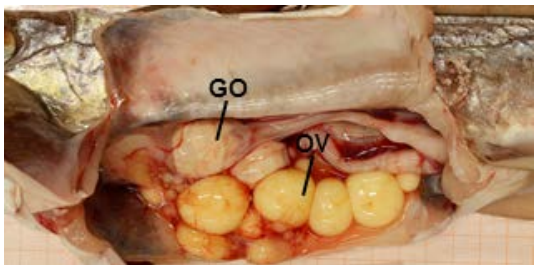
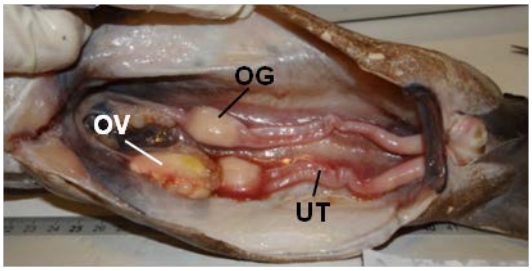
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea	C													Dagit, Hareide and Clò (2007)
N.E. Atlantic Ocean														
Atlantic Ocean	C													Dagit, Hareide and Clò (2007)
	F													Stehmann and Bürkel (1984a)
British Isles	F													Wheeler (1969)

MATURITY

Geographic area	Sex	Size range cm	Minimum size Mature, cm	50% Mature (L_{50}) cm	References
Mediterranean Sea					
GSA 18 Adriatic Sea	F			24.7*	Ungaro, Marano and Musci (1997)
	M			21.4*	
N.E. Atlantic Ocean					
IE 9.b.2, 9.a Portuguese waters	F	8.1-57.1**		45.9**	Moura *et al.* (2004)
	M	9.1-50.3**		40.2**	

*Anal length; ** Precaudal length.

Chimaera monstrosa (FAO CODE: CMO – MEDITS CODE: CHIM MON)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 TL 34.5 cm; TW 26 g; ST: January; GSA 9
2	MATURING	 TL 77.0 cm; TW 771 g; ST: May; GSA 9
3a	MATURE	 AL 22.9 cm; TW 788.1 g; ST: May; GSA 11
3b	MATURE/ EXTRUDING	
4a	RESTING	 TL 50.1 cm; TW 699 g; ST: December; GSA 11
4b	REGENERATING	

Oviparous elasmobranchs

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Order: Rajiformes **Family: Rajidae** ***Dipturus nidarosiensis* (Storm, 1881)**

Photo by M.C. Follesa

FAO CODE: NONE

MEDITS CODE: RAJA NID

Common name:

Norwegian skate (English)
Pocheteau de Norvège (French)
Razza norvegese (Italian)
Raya noruega (Spanish)

GEOGRAPHIC DISTRIBUTION

It is known as the only species of *Dipturus* endemic to the northeastern Atlantic Ocean and has been found mainly in the slopes of the eastern Atlantic from the fjords of central and southern Norway to southern Iceland, around Rockall Trough in Ireland and in northern Mauritania (Boeseman, 1967; Stehmann and Bürkel, 1984b; Stehmann, 2008; Williams, Helle and Aschan, 2008; Iglésias, Toulhoat and Sellos, 2010; Priede *et al.,* 2010). Recently, specimens of the Norwegian skate were caught in the Cantabrian Sea (Rodriguez-Cabello, Pérez and Sánchez, 2013), in the Mediterranean Sea off the Sardinian coast (Cannas *et al.*, 2010; Follesa *et al.*, 2012), in the southern Adriatic and Ionian Seas (Carbonara *et al.*, 2013) and in the Alboran Sea (Ramírez-Amaro *et al.,* 2017).

REPRODUCTION

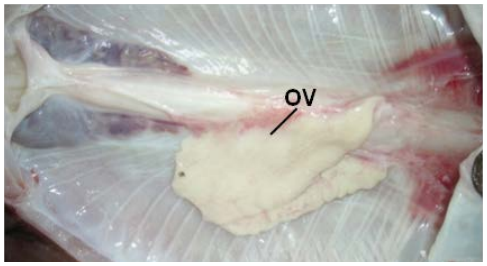
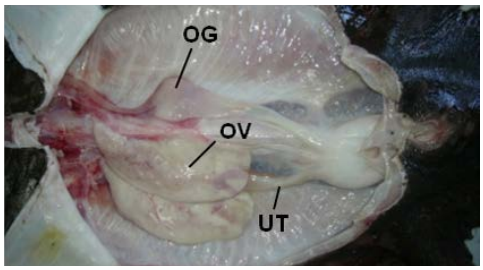
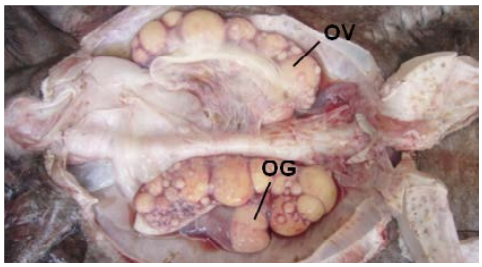
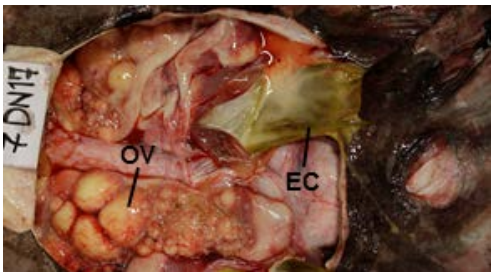
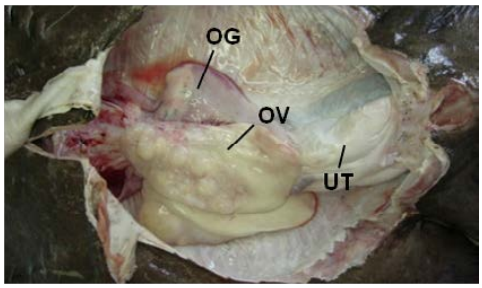
Reproductive strategy: lecithotrophic, single oviparity.

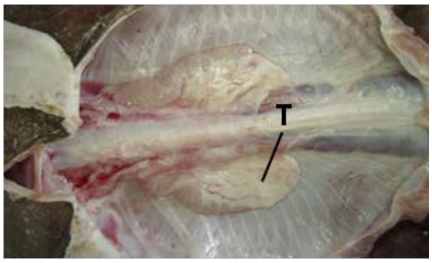
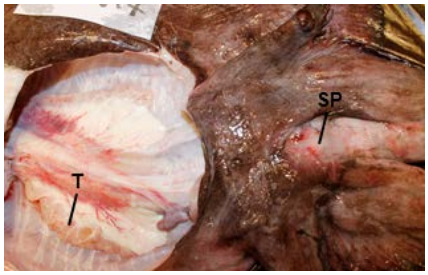
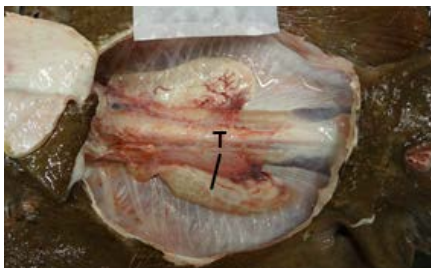
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 11 Sardinian Seas	F													Follesa *et al.* (2012)
	M													
N.E. Atlantic Ocean														
British waters	F													Boeseman (1967)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 11 Sardinian Seas	F	24.7-148.2	127.0		Follesa *et al.* (2012)
	M	24.0-118.0	118.0		

Dipturus nidarosiensis (MEDITS CODE: RAJA NID)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 TL 24.7 cm; TW 200 g; ST: June; GSA 11
2	**MATURING**	 TL 128.8 cm; TW 10778 g; ST: July; GSA 11
3a	**MATURE**	 TL 131.0 cm; TW 9402 g; ST: December; GSA 11
3b	**MATURE/ EXTRUDING**	 TL 137.6 cm; TW 12670 g; ST: August; GSA 11
4a	**RESTING**	
4b	**REGENERATING**	 TL 136.5 cm; TW 11200 g; ST: May; GSA11

Dipturus nidarosiensis (MEDITS CODE: RAJA NID)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE VIRGIN		
		TL 25.7 cm; TW 274 g; ST: September; GSA 11	
2	MATURING		
		TL 105.8 cm; TW 5332 g; ST: July; GSA 11	
3a	MATURE		
		TL 118.0 cm; TW 6948 g; ST: May; GSA 11	
3b	MATURE/ ACTIVE		
		TL 112.0 cm; TW 6754 g; ST: September; GSA 11	
4	REGRESSING		
		TL 119.0 cm; TW 7486 g; ST: December; GSA 11	

Order: Rajiformes **Family: Rajidae**

Dipturus oxyrinchus
(Linnaeus, 1758)

Photo by M.C. Follesa

FAO CODE: RJO

MEDITS CODE: RAJA OXY

Common name:
Longnosed skate (English)
Pocheteau noir (French)
Razza monaca (Italian)
Picon (Spain)

GEOGRAPHIC DISTRIBUTION

It typically inhabits sandy and muddy bottoms, but could also be found in loose rock areas and on gravel beds, at depths between 90 and 900 m; however, it is mostly concentrated from 200 to 500 m (Serena, 2005; Ebert and Stehmann, 2013). It ranges from the northeastern Atlantic Ocean, central Norway to Senegal, including the Faeroes, Skagerrak and, the Canary and Madeira Islands, to the Mediterranean (excluding the Black Sea) (Serena, 2005).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

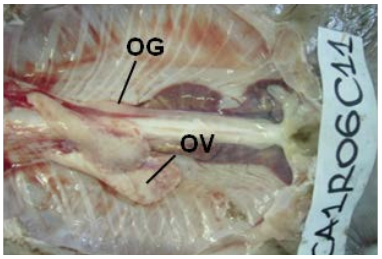
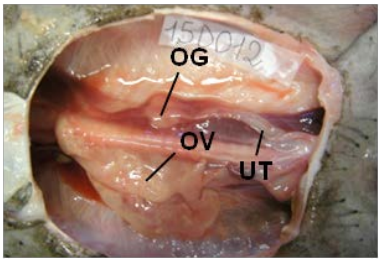
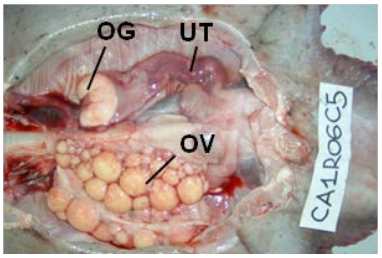
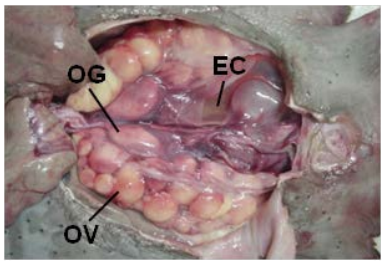
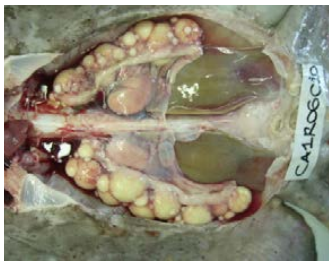
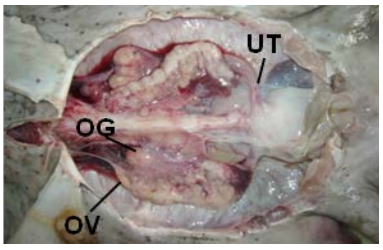
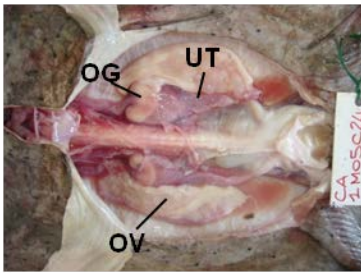
SPAWNING PERIOD

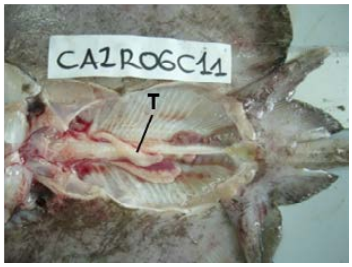
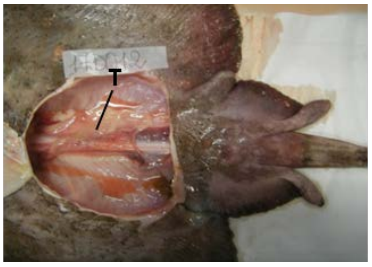
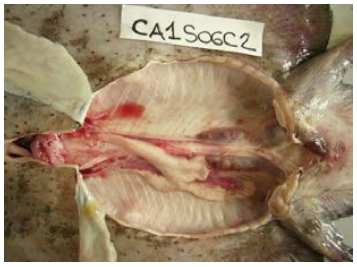
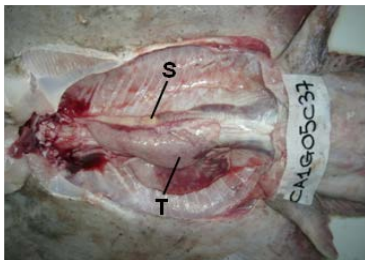
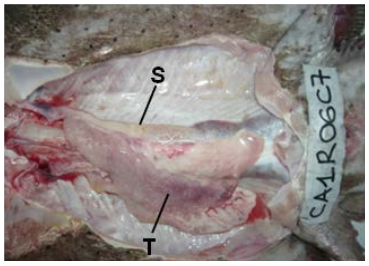
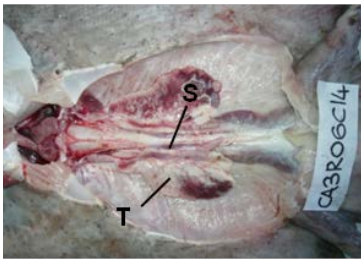
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean Sea	F													Bauchot (1987)
Mediterranean Sea	F													Serena (2005)
GSA 11 Sardinian Seas	F													Cabiddu *et al.* (2012)
	M													
	F													Bellodi *et al.* (2017)
	M													
GSA 14 Gulf of Gabès	F													Kadri *et al.* (2014a)
	M													
GSA 22 Syrian waters	F													Alkusairy and Saad (2017)
	M													

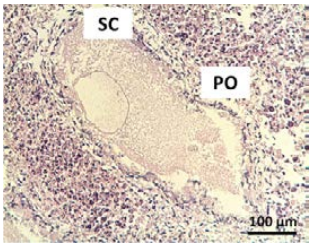
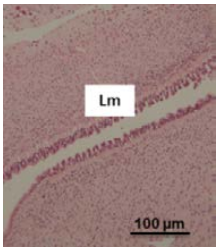
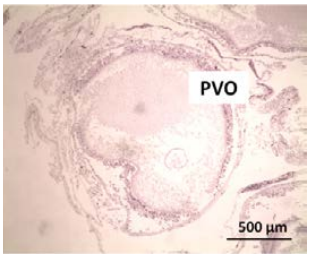
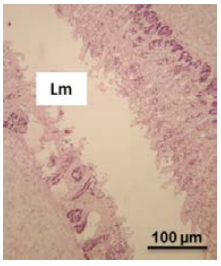
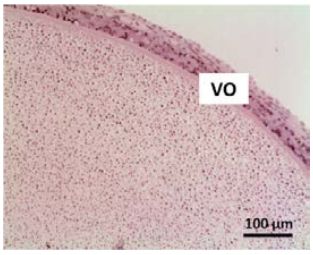
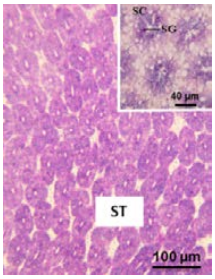
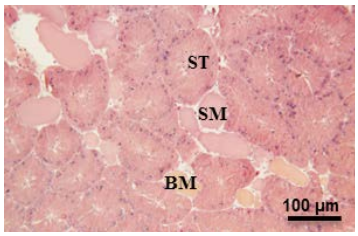
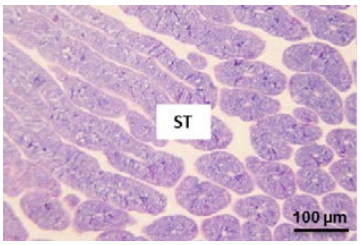
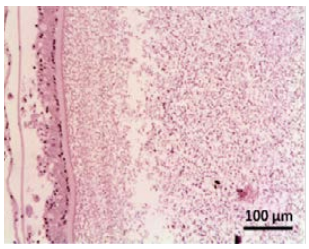
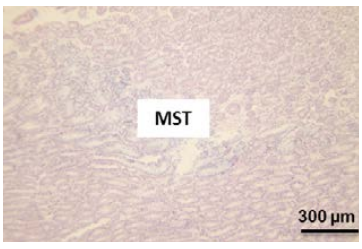
Peak of spawning period

MATURITY

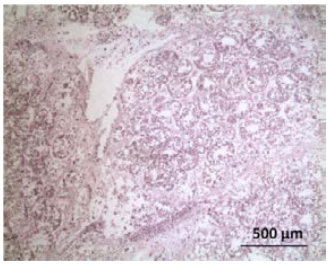
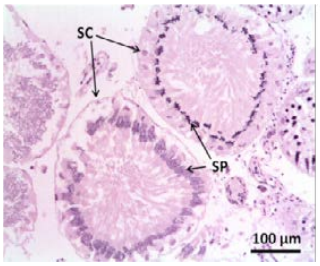
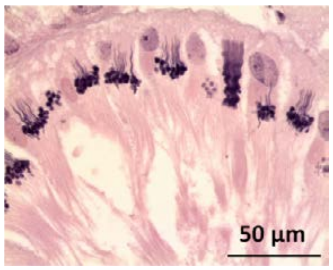
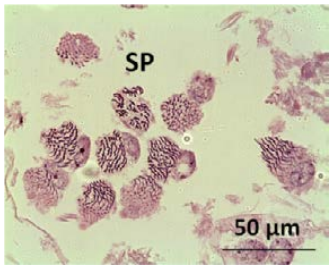
Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 11 Sardinian Seas	F	10.9-115.5	101.0	103.5	Bellodi *et al.* (2017)
	M	11.0-101.5	86.0	91.0	
GSA 14 Gulf of Gabès	F	16.5-105.0	70.0	82.1	Kadri *et al.* (2014a)
	M	15.5-95.0	65.0	72.05	
GSA 22 N. Aegean Sea	F	14.9-100.0		82.0-83.0	Yigin and Ismen (2010)
	M	15.2-86.5		64.0-65.0	
GSA 22 Syrian waters	F	34.1-100.0		79.5	Alkusairy and Saad (2017)
	M	34.5-81.6		70.9	

Dipturus oxyrinchus (FAO CODE: RJO – MEDITS CODE: RAJA OXY)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 TL 74.3 cm; TW 1318 g; ST: June; GSA 11
2	MATURING	 TL 95.9 cm; TW 3849 g; ST: October; GSA 11
3a	MATURE	 TL 108.0 cm; TW 5696 g; ST: November; GSA 11
3b	MATURE/ EXTRUDING	   TL 111.4 cm; TW 6011 g; ST: March; GSA 11
4a	RESTING	 TL 109.0 cm; TW 5244 g; ST: May; GSA 11
4b	REGENERATING	 TL 111.3 cm; TW 5472 g; ST: January; GSA 11

Dipturus oxyrinchus (FAO CODE: RJO – MEDITS CODE: RAJA OXY)			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE VIRGIN**	 TL 25.7 cm; TW 274 g; ST: September; GSA 11	
2	**MATURING**	 TL 91.0 cm; TW 2772 g; ST: June; GSA 11	 TL 89.0 cm; TW 2693 g; ST: June; GSA 11
3a	**MATURE**	 TL 93.5 cm; TW 3270 g; ST: January; GSA 11	
3b	**MATURE/ ACTIVE**	 TL 93.5 cm; TW 4178 g; ST: February; GSA 11	
4	**REGRESSING**	 TL 93.5 cm; TW 3407 g; ST: March; GSA 11	

Dipturus oxyrinchus (FAO CODE: RJO – MEDITS CODE: RAJA OXY)			
		FEMALES	
STAGE	**PHASE**	**OVARY**	**OVIDUCAL GLAND**
1	IMMATURE VIRGIN	 GSA 11 (H and E)	 GSA 11* (H and E)
2	MATURING	 GSA 11 (H and E)	 GSA 11* (H and E)
3a	MATURE	 GSA 11 (H and E)	 GSA 11* (PAS/AB)
3b	MATURE/ EXTRUDING		 GSA 11* (H and E)
4a/4	RESTING		 GSA 11* (PAS/AB)
4b	REGENERATING	 GSA 11 (H and E)	 GSA 11* (PAS/AB)

* from Marongiu *et al.* (2015).

Dipturus oxyrinchus (FAO CODE: RJO – MEDITS CODE: RAJA OXY)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	
2	**MATURING**	 **GSA 11 (H and E)**
3a	**MATURE**	 **GSA 11 (H and E)**
3b	**MATURE/ ACTIVE**	 **GSA 11 (H and E)**
4	**REGRESSING**	 **GSA 11 (H and E)**

Order: Rajiformes **Family: Rajidae**

***Raja asterias* (Delaroche, 1809)**

Photo by A. Mulas

FAO CODE: JRS

MEDITS CODE: RAJA AST

Common name:
Starry ray (English)
Raie étoilée (French)
Razza stellata (Italian)
Raya estrellada (Spanish)

GEOGRAPHIC DISTRIBUTION

Although it is believed to be common in the entire Mediterranean Sea, it may not be found in the Black Sea (Fischer, Bauchot and Schneider, 1987; Relini *et al.,* 2000). It has been recorded along the Atlantic coast of northern Morocco and in southern Portugal (Whitehead *et al.,* 1984). In general terms, *R. asterias* may be considered a Mediterranean endemic species. It is a benthic species generally found in shallow waters on muddy or sandy soft bottoms, mostly concentrated at depths up to 150 m (Serena, Baino and Righini, 1988).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

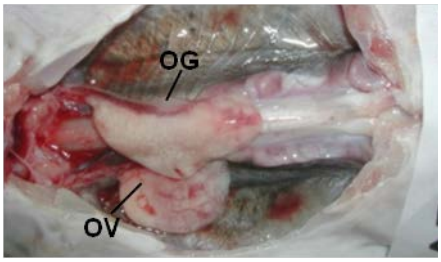
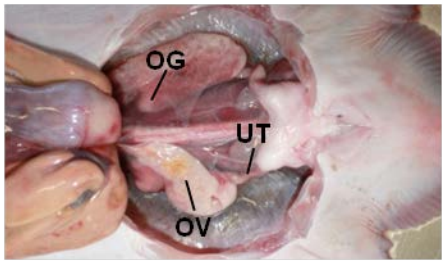
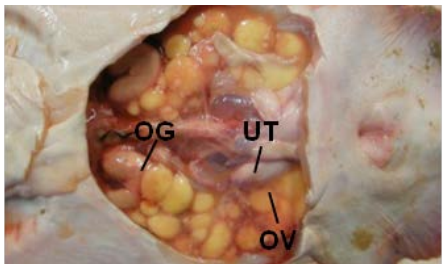
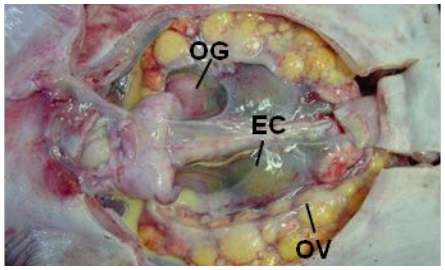
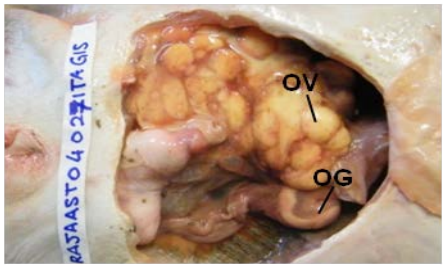
SPAWNING PERIOD

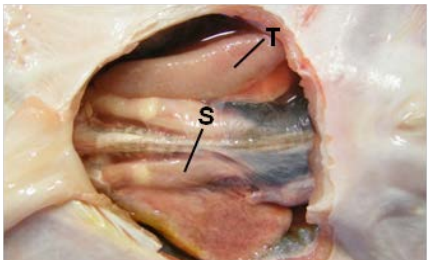
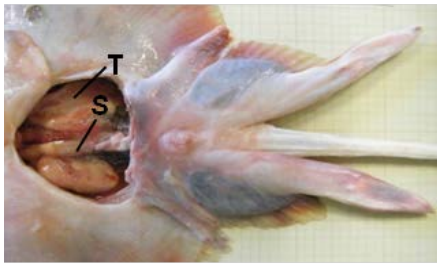
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean Sea	F													Stehmann and Bürkel (1984b)
GSA 9 S. Ligurian Sea	F													Barone *et al.* (2007)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 6 Catalan Sea	F	20.0-62.0	46.0	48.1	Coll, Navarro and Palomera (2013)
	M	9.0-60.0	51.0	50.0	
	F		50.0	50.0-52.0	Navarro *et al.* (2013)
	M		45.0	50.0-52.0	
Italian waters	F			60.0	Tortonese (1956)
GSA 9 S. Ligurian Sea	F		54.0	56.1	Barone *et al.* (2007)
	M		56.0	51.7	
GSAs 12, 13, 14 Tunisian coast	F			60.0	Capapé (1977a)
	M			54.0	
GSA 10 Tyrrhenian Sea	F	22.0-63.0		56.5	Romanelli *et al.* (2007)
	M	21.0-58.0		50.5	
GSAs 17, 18 N. and S. Adriatic Sea	F	8.5-55.9	50.5		Ferrà *et al.* (2016)
	M	9.0-56.0	44.2		
GSA 18 S. Adriatic Sea	F		50.0		Ungaro *et al.* (2005)
	M		45.0		

Raja asterias (FAO CODE: JRS – MEDITS CODE: RAJA AST)		
STAGE	**PHASE**	**FEMALES**
1	**IMMATURE VIRGIN**	 TL 44.7 cm; TW 518 g; ST: January; GSA 11
2	**MATURING**	 TL 56.2 cm; TW 1115 g; ST: November; GSA 10-18
3a	**MATURE**	 TL 61.4 cm; TW 1343.4 g; ST: August; GSA 11
3b	**MATURE/ EXTRUDING**	  ST: June; GSA 9
4a	**RESTING**	 TL 67.5 cm; TW 1834 g; ST: June; GSA 11
4b	**REGENERATING**	 TL 58.8 cm; TW 1360 g; ST: November; GSA 11

Raja asterias (FAO CODE: JRS – MEDITS CODE: RAJA AST)		
STAGE	**PHASE**	**MALES**
1	IMMATURE VIRGIN	 TL 30.5 cm; TW 169 g; ST: October; GSA 10-18
2	MATURING	 TL 45.8 cm; TW 624 g; ST: October; GSA 10-18
3a	MATURE	 TL 54.4 cm; TW 945 g; ST: June; GSA 11 
3b	MATURE/ ACTIVE	 TL 52.6 cm; TW 869 g; ST: November; GSA 11
4	REGRESSING	 TL 55.9 cm; TW 1072 g; ST: June; GSA 11

Order: Rajiformes **Family: Rajidae**

Raja brachyura (Lafont, 1871)

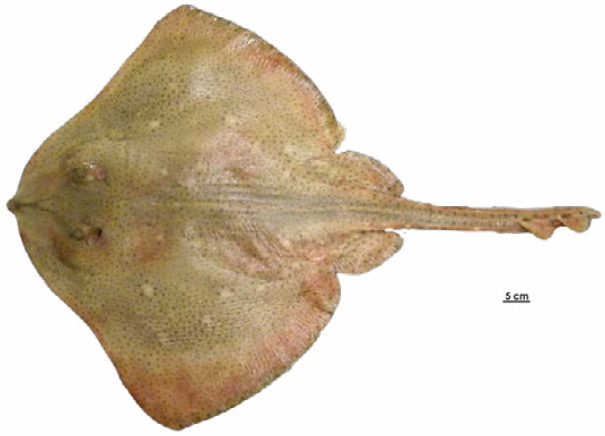


Photo by C. Porcu

MEDITS CODE: RAJA BRA

Common name:
Blonde ray (English)
Raie lisse (French)
Razza a coda corta (Italian)
Raya boca de rosa (Spanish)

GEOGRAPHIC DISTRIBUTION

The blonde ray is a benthic species that shows a clear preference for sandy bottoms on the upper continental shelf (Serena, 2005). It is distributed in the northeast Atlantic from Norway to Morocco and is more common in the western-central than the eastern Mediterranean Sea (Ellis *et al.,* 2010; Serena, Mancusi and Barone, 2010). Generally, it is considered an uncommon species in the Mediterranean (Matallanas, 1974; Serena, 2005), but the most recent observations of Follesa *et al.* (2003, 2010), Ragonese *et al.* (2003) and Catalano *et al.* (2007) indicate that the Sardinian coast and western Sicily represent a zone where *R. brachyura* is relatively abundant.

REPRODUCTION

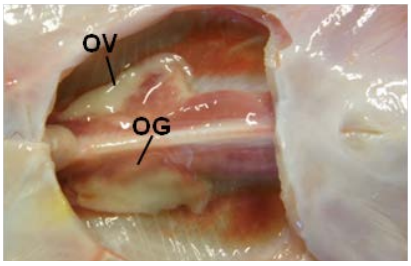
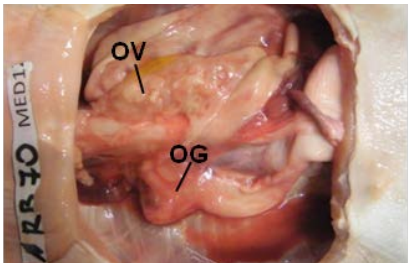
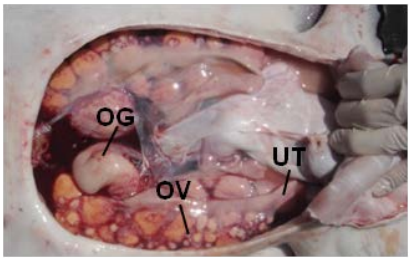
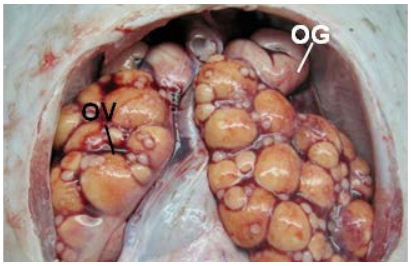
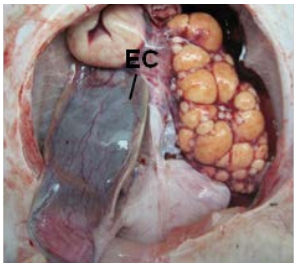
Reproductive strategy: lecithotrophic, single oviparity.

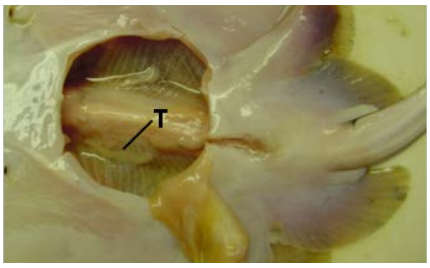
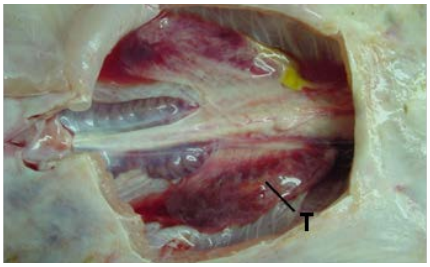
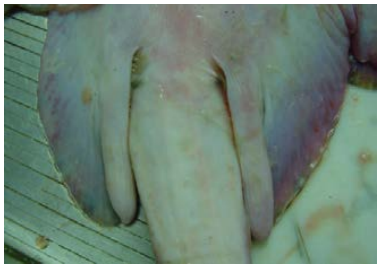
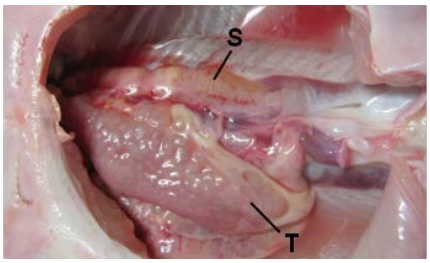
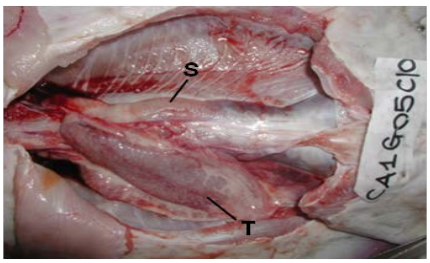
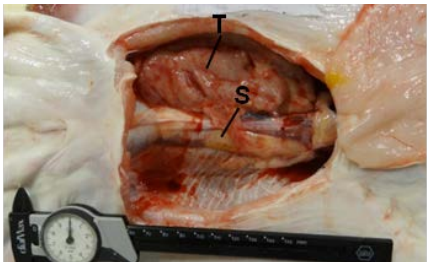
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 11 Sardinian Seas	F					■	■	■	■					Porcu *et al.* (2015)
	M	■	■	■	■	■	■	■	■	■				
N.E. Atlantic Ocean														
IE 9.b.2, 9.a Portuguese waters	F			■										Serra-Pereira *et al.* (2005)
English waters	F		■	■	■	■	■	■						Clark (1922)
IE 7.a Irish Sea	F		■	■	■	■	■	■						Holden, Rout and Humphreys (1971)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 11 Sardinian Seas	F	13.1-105.5	85.0	87.2	Porcu *et al.* (2015)
	M	12.0-96.5	74.6	80.8	
N.E. Atlantic Ocean					
British Isles	F	12.0-102.0	60.0	85.6	McCully, Scott and Ellis (2012)
	M	13.0-100.0	55.0	78.2	
IE 7.a Irish Sea	F	ca 15.0-103.0	81.0	83.6	Gallagher, Nolan and Jeal (2005)
	M		75.0	81.9	
IE 7.e, 7.d English Channel	C	17.0-105.0	100.0		Dorel (1986)

Raja brachyura (FAO CODE: RJH – MEDITS CODE: RAJA BRA)				
STAGE	**PHASE**	**FEMALES**		
1	IMMATURE VIRGIN	 TL 37.7 cm; TW 314 g; ST: June; GSA 11		
2	MATURING	 TL 80.0 cm; TW 3742 g; ST: July; GSA 11		
3a	MATURE	 TL 95.0 cm; TW 6900 g; ST: May; GSA 11		
3b	MATURE/ EXTRUDING	 TL 97.0 cm; TW 7700 g; ST: March; GSA 9		 GSA 11
4a	RESTING			
4b	REGENERATING			

Raja brachyura (FAO CODE: RJH – MEDITS CODE: RAJA BRA)			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE VIRGIN**	 TL 28.0 cm; TW 98 g; ST: April; GSA 9	
2	**MATURING**	 TL 70.5 cm; TW 2250 g; ST: November; GSA 9	
3a	**MATURE**	 TL 87.0 cm; TW 4500 g; ST: March; GSA 9	
3b	**MATURE/ ACTIVE**	 TL 93.4 cm; TW 5945 g; ST: July; GSA 11	
4	**REGRESSING**	 TL 94.7 cm; TW 6567 g; ST: July; GSA 11	

Order: Rajiformes **Family: Rajidae**

***Raja clavata* (Linnaeus, 1758)**

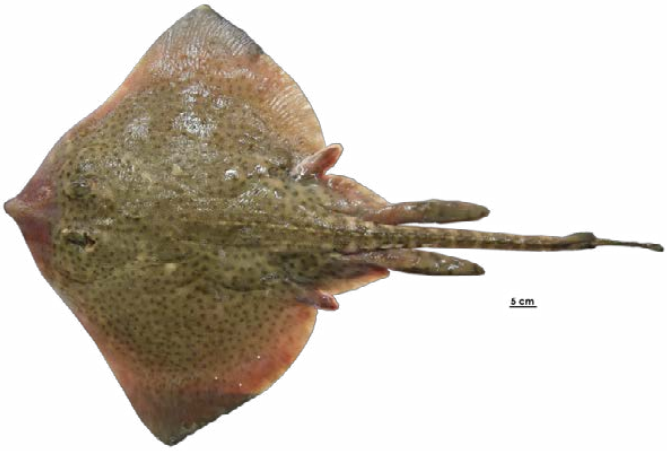


Photo by M.C. Follesa

FAO CODE: RJC

MEDITS CODE: RAJA CLA

Common name:

Thornback skate (English)
Raie bouclée (French)
Razza chiodata (Italian)
Raya de clavos (Spanish)

GEOGRAPHIC DISTRIBUTION

Raja clavata is one of the most abundant rajids in north European coastal waters and may be the predominant rajid in commercial landings and research vessel catches (Rousset, 1990). It is widely distributed from Iceland and Norway (south of the Arctic Circle) to the North Sea (where it is now less abundant in southeastern areas) (Walker, 1999), the Mediterranean Sea, the western Black Sea, Madeira, the Atlantic coast of Africa, and as far south as South Africa and the southwestern Indian Ocean (Stehmann, 1995).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

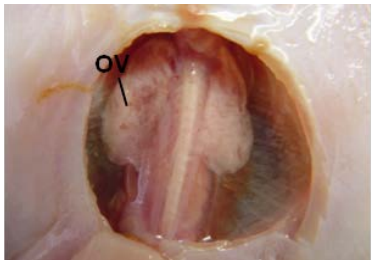
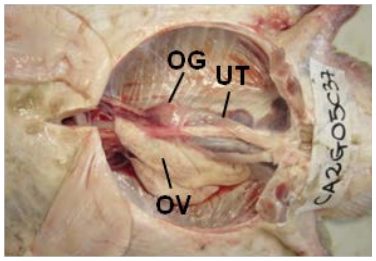
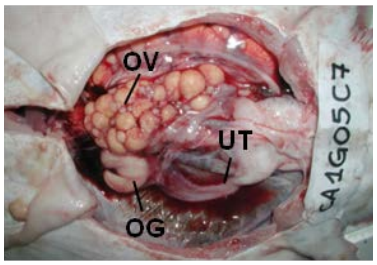
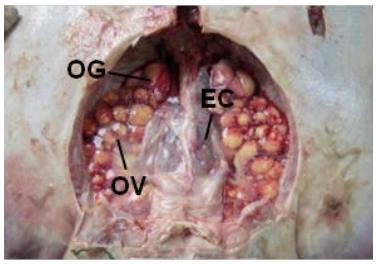
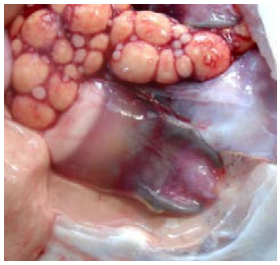
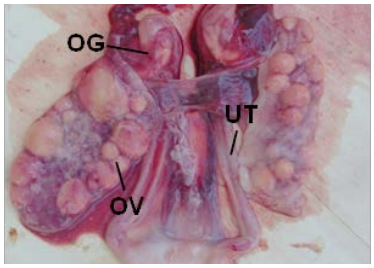
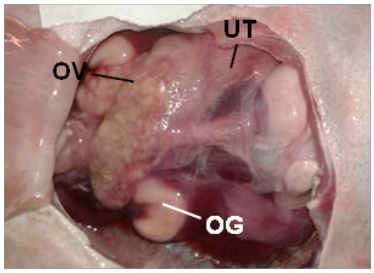
SPAWNING PERIOD

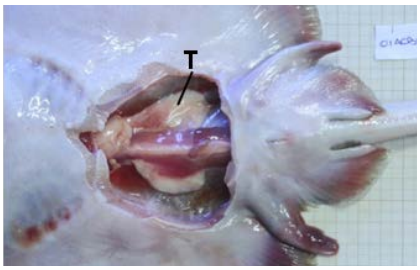
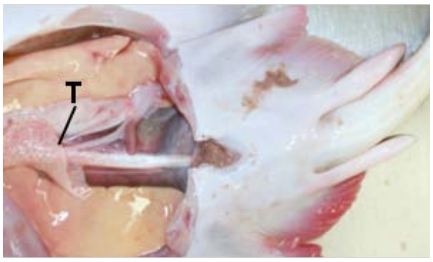
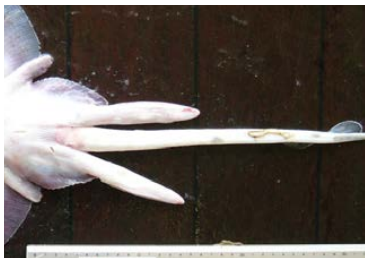
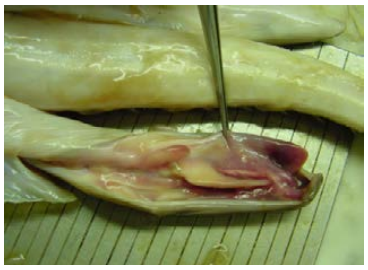
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 7 S. France	C													Capapé *et al.* (2007)
GSA 9 N. Tyrrhenian Sea	C													Barone (2009)
GSA 14 Gulf of Gabès	C													Kadri *et al.* (2014b)
Black Sea														
GSA 29 S.E. Black Sea	C													Saglam and Ak (2011)
														Demirhan *et al.* (2005)
N.E. Atlantic Ocean														
IE 9.b.2, 9.a, Portugal	F													Serra-Pereira, Figueiredo and Gordo (2011)
	M													
IE 7.a Irish Sea	C													Brander and Palmer (1985)
IE 7.f Carmarthen Bay, UK	C													Ryland and Ajayi (1984)
IE 4.b, 4.c E. England	C													Holden, Rout and Humphreys (1971); Holden (1975)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 7 Gulf of Lion	F	max 85.0		75.6	Capapé *et al.* (2007)
	M	max 85.0		59.9	
GSA 9 N. Tyrrhenian Sea	F			78.0	Barone (2009)
	M			66.0	
GSA 11 Sardinian Seas	F	max 98.0		74.0-76.0	Follesa *et al.* (2003)
	M	max 90.0		54.0-56.0	
GSA 10 N. Tyrrhenian Sea	F			60.0	Serena *et al.* (2005)
	M			54.0	
GSA 14 Gulf of Gabès	F	max 104.0	72.4	81.4	Kadri *et al.* (2014b)
	M	max 89.0	55.0	67.4	
GSA 16 Strait of Sicily	F			77.0-79.0	Cannizzaro *et al.* (1995)
	M			57.0-59.0	
GSA 17 N.C. Adriatic Sea	F			73.0	Jardas (1973)
	M			54.0	
	F	max 65.0	47.5	61.2	Krstulović Šifner *et al.* (2009)
	M	max 65.0	47.0	59.3	
GSA 18 S. Adriatic Sea	F		70.0		Ungaro *et al.* (2005)
	M		60.0		
Black Sea					
GSA 29 S.E. Black Sea	F			66.7	Demirhan *et al.* (2005)
	M			64.0	
	F	15.6-93.0	72.0	74.6	Saglam and Ak (2011)
	M	14.3-92.0	68.0	71.8	
N.E. Atlantic Ocean					
IE 9.b.2, 9.a Portuguese waters	F	12.5-105.0	69.9	78.4	Serra-Pereira *et al.* (2011)
	M	13.8-96.5	59.9	67.6	
British Isles	F	10.0-98.0	47.0	75.1	McCully *et al.* (2012)
	M	10.0-94.0	47.0	66.5	
IE 7.a Irish Sea	F	max 104.0	61.0	71.8	Gallagher *et al.* (2005)
	M	max 90.0	58.0	65.7	
	F	18.0-92.0		70.5	Whittamore and McCarthy (2005)
	M	27.0-78.0		58.8	
IE 7.a Solway Firth, United Kingdom	F			62.4	Nottage and Perkins (1983)
	M			61.8	
IE 7.f Carmarthen Bay, United Kingdom	F			59.5	Ryland and Ajayi (1984)
	M			60.5	
IE 7.e, 7.d English Channel	F			91.0	Steven (1934)
	M			71.3	
	F			92.4	Steven (1936)
	M			72.7	
IE 4.a, 4.b, 4.c North Sea	F	ca 20.0-90.0		77.0	Walker (1999)
	M			68.0	

Raja clavata (FAO CODE: RJC – MEDITS CODE: RAJA CLA)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 GSA 9
2	MATURING	 TL 63.5 cm; TW 1522 g; ST: January; GSA 11
3a	MATURE	 TL 74.3 cm; TW 2789 g; ST: January; GSA 11
3b	MATURE/ EXTRUDING	   TL 76.8 cm; TW 4300 g; ST: June; GSA 11
4a	RESTING	 GSA 9
4b	REGENERATING	 TL 86.3 cm; TW 4889 g; ST: June; GSA 11

Raja clavata (FAO CODE: RJC – MEDITS CODE: RAJA CLA)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE VIRGIN	 TL 47.6 cm; TW 485 g; ST: March; GSA 11	
2	MATURING	 TL 51.5 cm; TW 1385 g; ST: December; GSA 10-18	
3a	MATURE	 TL 70.5 cm; TW 1841 g; ST: June; GSA 11	
3b	MATURE/ ACTIVE	 TL 71.0 cm; TW 2135 g; ST: August; GSA 11	 GSA 9
4	REGRESSING	 TL 75.4 cm; TW 2109 g; ST: November; GSA10-18	

Order: Rajiformes **Family: Rajidae**

***Raja miraletus* (Linnaeus, 1758)**

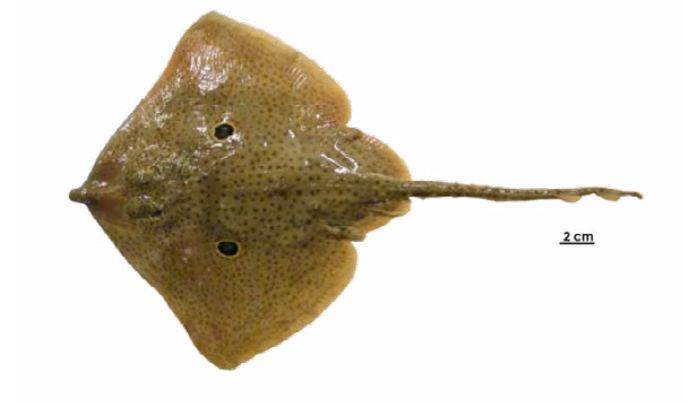


Photo by A. Mulas

FAO CODE: JAI

MEDITS CODE: RAJA MIR

Common name:
Brown ray (English)
Raie miroir (French)
Razza quattrocchi (Italian)
Raya de espejos (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the eastern Atlantic Ocean, the Mediterranean Sea and the western Indian Ocean where it forms distinct subpopulations (McEachran, Seret and Miyake, 1989; Compagno, Ebert and Cowley, 2011).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

SPAWNING PERIOD

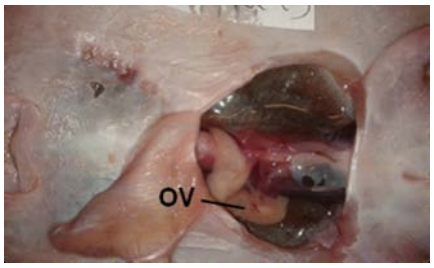
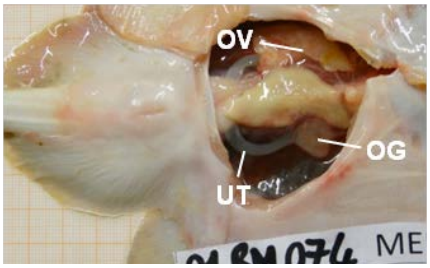
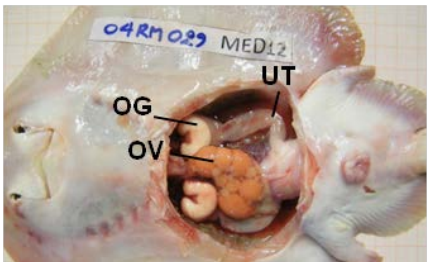
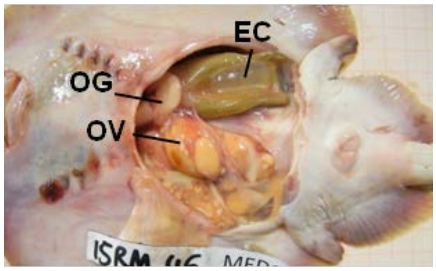
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 12, 13, 14 Tunisian coast	C													Capapé and Quignard (1974)
GSA 14 Gulf of Gabès	F													Kadri *et al.* (2012)
	M													
GSA 18 Adriatic Sea	C													Ungaro (2004)
GSA 26 Egyptian waters	F													Abdel-Aziz, Ezzat and Hussein (1987)

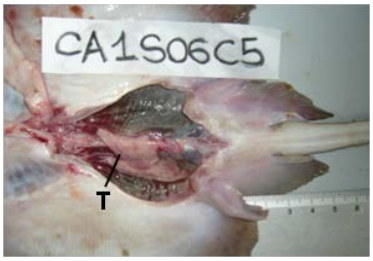
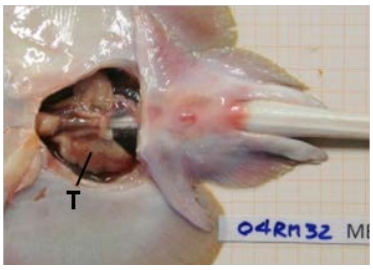
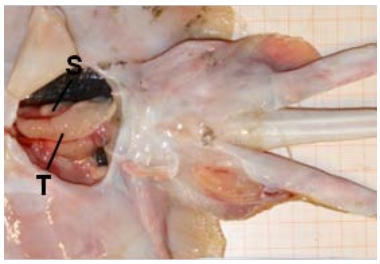
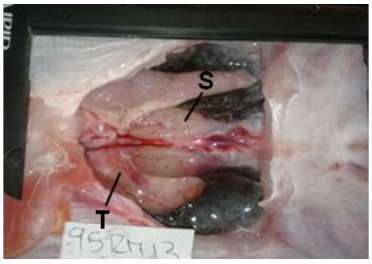
Peak of spawning period

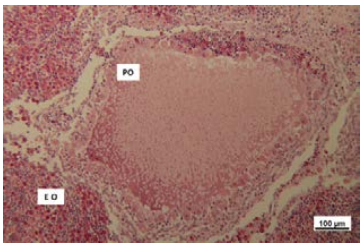
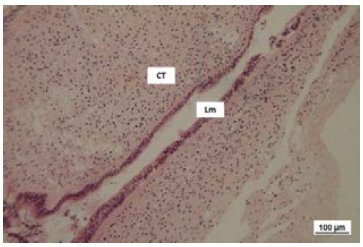
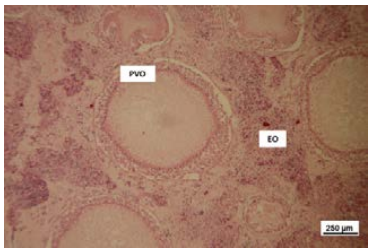
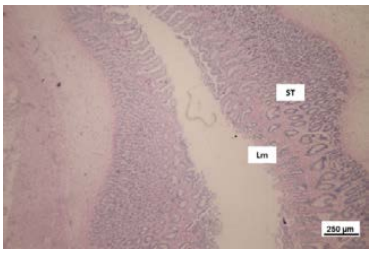
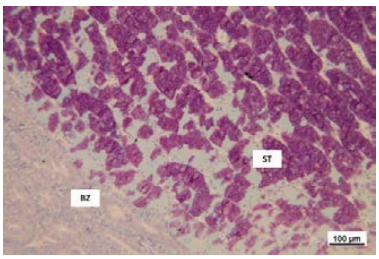
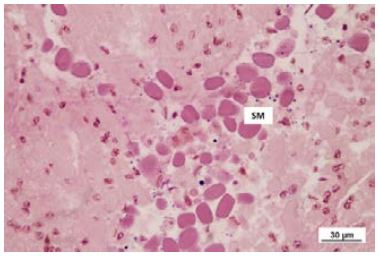
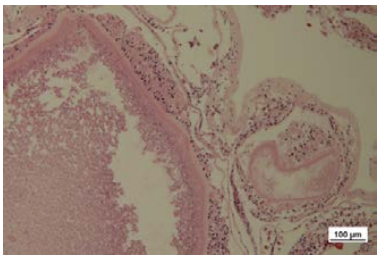
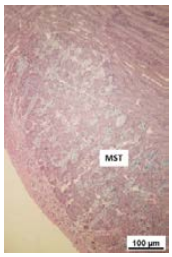
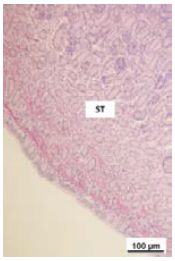
MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSAs 12, 13, 14Tunisian coast	F	max 33.0*			Capapé and Quignard (1974)
	M	max 32.0*			
GSA 14 Gulf of Gabès	F	13.5-56.0	33.0	41.8	Kadri *et al.* (2012)
	M	13.5	28.0	34.3	
GSA 17 Adriatic Sea	F		35.0		Zupanovic (1961)
	C			22.0*	Jardas (1973)
GSA 18 S. Adriatic Sea	F		43.5	42.3	Ungaro (2004)
	M		36.0	36.4	
GSA 26 Egyptian waters	F			30.0*	Abdel-Aziz, Ezzat and Hussein (1987)
	M			28.0*	

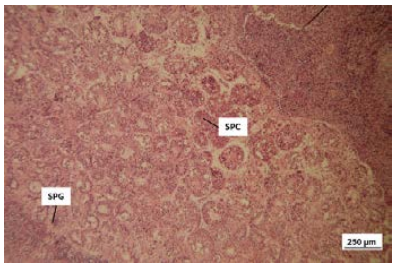
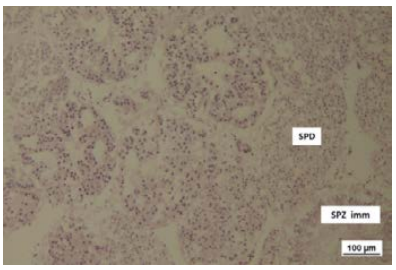
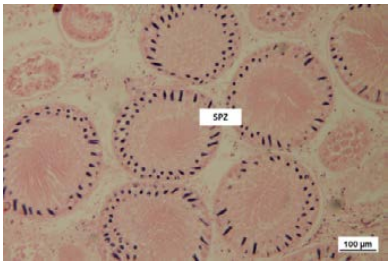
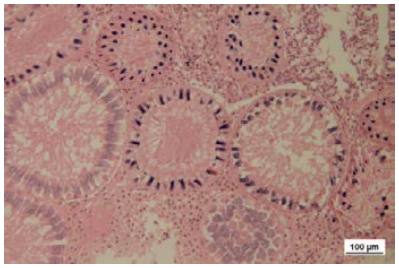
*Disc width.

Raja miraletus (FAO CODE: JAI – MEDITS CODE: RAJA MIR)			
STAGE	**PHASE**	**FEMALES**	
1	**IMMATURE VIRGIN**	 TL 37.8 cm; TW 230 g; ST: June; GSA 11	
2	**MATURING**	 TL 33.8 cm; TW 197 g; ST: July; GSA 11	
3a	**MATURE**	 TL 39.2 cm; TW 301 g; ST: June; GSA 11	
3b	**MATURE/ EXTRUDING**	 TL 39.2 cm; TW 342 g; ST: June; GSA 11	
4a	**RESTING**		
4b	**REGENERATING**		

Raja miraletus (FAO CODE: JAI – MEDITS CODE: RAJA MIR)		
STAGE	**PHASE**	**MALES**
1	IMMATURE VIRGIN	 TL 35.8 cm; TW 181 g; ST: May; GSA 11
2	MATURING	 TL 39.8 cm; TW 254 g; ST: June; GSA 11
3a	MATURE	 TL 37 cm; TW 220 g; ST: July; GSA 11
3b	MATURE/ ACTIVE	 TL 38.2 cm; TW 277 g; ST: July; GSA 11
4	RESTING	 TL 47.6 cm; TW 485 g; ST: March; GSA 11

Raja miraletus (FAO CODE: JAI – MEDITS CODE: RAJA MIR)			
		FEMALES	
STAGE	**PHASE**	**OVARY**	**OVIDUCAL GLAND**
1	**IMMATURE VIRGIN**	 **GSA11 (H and E)**	 **GSA 11* (H and E)**
2	**MATURING**	 **GSA 11 (H and E)**	 **GSA 11* (H and E)**
3a	**MATURE**		 **GSA 11* (PAS/AB)**
3b	**MATURE/ EXTRUDING**		 **GSA11* (H and E)**
4a	**RESTING**	 **GSA11* (H and E)**	 **GSA 11* (PAS/AB)**
4b	**REGENERATING**		 **GSA 11* (PAS/AB)**

* from Marongiu *et al.* (2015).

Raja miraletus (FAO CODE: JAI – MEDITS CODE: RAJA MIR)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE VIRGIN**	 GSA11 (H and E)
2	**MATURING**	 GSA11 (H and E)
3a	**MATURE**	 GSA11 (H and E)
3b	**MATURE/ ACTIVE**	
4	**REGRESSING**	 GSA11 (H and E)

Order: Rajiformes **Family: Rajidae**

***Raja polystigma* (Regan, 1923)**

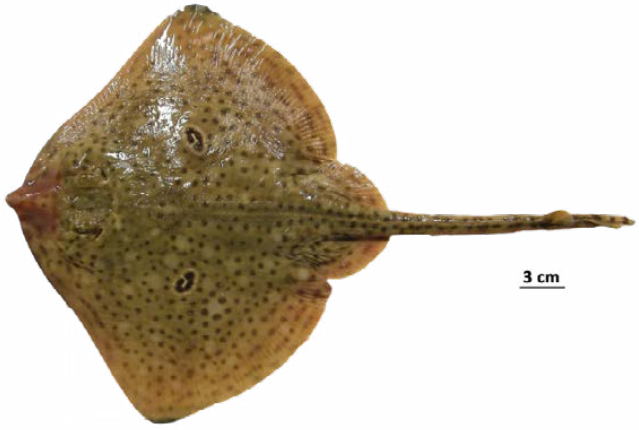


Photo by A. Mulas

FAO CODE: JAY

MEDITS CODE: RAJA POL

Common name:

Speckled ray; Speckled skate (English)

Raie tachetée, Raie douce (French)

Razza polistimma (Italian)

Raya manchada, Raya pintada (Spanish)

GEOGRAPHIC DISTRIBUTION

It is endemic in the Mediterranean Sea (Serena, 2005). Moderately common throughout the Mediterranean Sea, particularly in the western (Morocco, Spain and France) and western central areas (Tyrrhenian, Corsica, Sardinia and Sicily) (Baino *et al.*, 2001; Ragonese *et al.*, 2003; Florio *et al.*, 2003; Follesa *et al.*, 2003; Spedicato, Lembo and Carbonara, 2003; Serena, 2005; Mancusi *et al.*, 2005). It is rare in the Adriatic and Ionian Seas (Notarbartolo di Sciara and Bianchi, 1998), but common along northern African coasts (Stehmann and Bürkel, 1984b) and eastern Algerian coasts (Bertozzi *et al.*, 2003).

REPRODUCTION

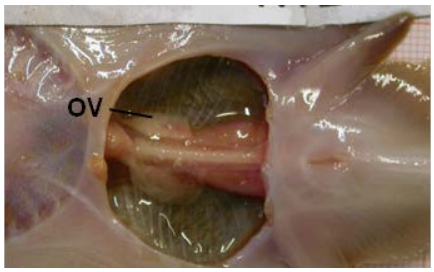
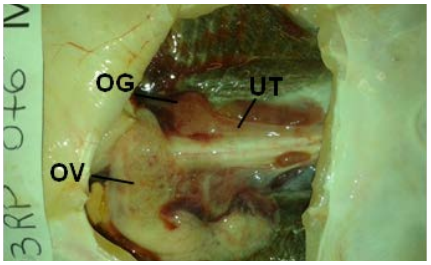
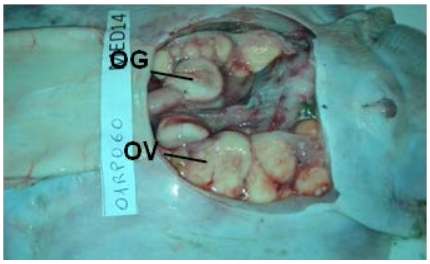
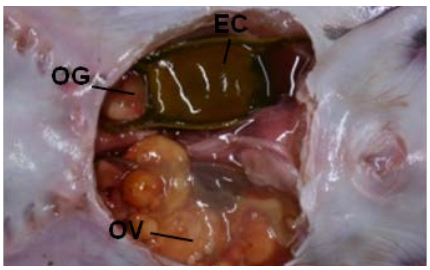
Reproductive strategy: lecithotrophic, single oviparity.

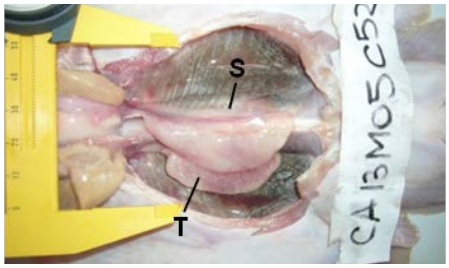
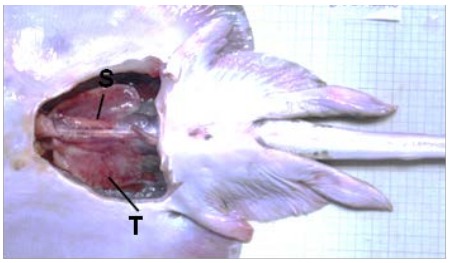
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean Sea	C													Serena (2005)
GSAs 12, 13, 14 Tunisian coast	C													Stehmann and Bürkel (1984b)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSAs 12, 13, 14 Tunisian coasts	F	max 41.0		38.0	Capapé and Quignard (1978)
	M	max 45.0		34.0	

Raja polystigma (FAO CODE: JAY – MEDITS CODE: RAJA POL)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 TL 16.9 cm; TW 16 g; ST: June; GSA 11
2	MATURING	 TL 28.4 cm; TW 91 g; ST: July; GSA 11
3a	MATURE	 TL 48.5 cm; TW 745 g; ST: August; GSA 11
3b	MATURE/ EXTRUDING	  TL 51.6 cm; TW 837 g; ST: June; GSA 11
4a	RESTING	
4b	REGENERATING	 TL 52.5 cm; TW 983 g; ST: November; GSA 11

Raja polystigma (FAO CODE: JAY – MEDITS CODE: RAJA POL)			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE VIRGIN**	 TL 39.2 cm; TW 322 g; ST: July; GSA 11	
2	**MATURING**	 TL 45.1 cm; TW 434 g; ST: July; GSA 11	
3a	**MATURE**	 TL 47.2 cm; TW 538 g; ST: July; GSA 11	
3b	**MATURE/ ACTIVE**	 TL 57 cm; TW 1080 g; ST: May; GSA 11	
4	**REGRESSING**	 TL 51.2 cm; TW 950 g; ST: May; GSA 11	

Order: Carcharhiniformes **Family: Scyliorhinidae**

***Galeus melastomus* (Rafinesque, 1810)**

Photo by M.C. Follesa

FAO CODE: SHO

MEDITS CODE: GALU MEL

Common name:
Blackmouth catshark (English)
Chien espagnol (French)
Gattuccio boccanera (Italian)
Bocanegra (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the northeast and eastern central Atlantic Ocean from the Faeroe Islands and Trondheim, Norway, the northern area of the Mid-Atlantic Ridge, the Reykjanes Ridge and southwest Iceland (Hareide and Garnes, 2001), and southward to Senegal and Azores Islands (Compagno, 1984). It is also distributed throughout the Mediterranean Sea excluding the northern Adriatic Sea. It is not present in the Black Sea (Bauchot, 1987; Serena, 2005).

REPRODUCTION

Reproductive strategy: lecithotrophic, multiple oviparity.

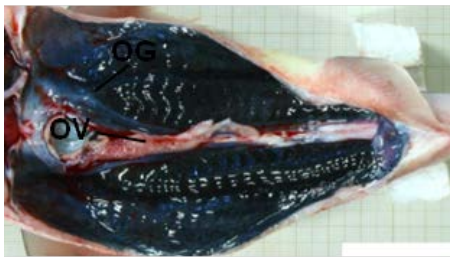
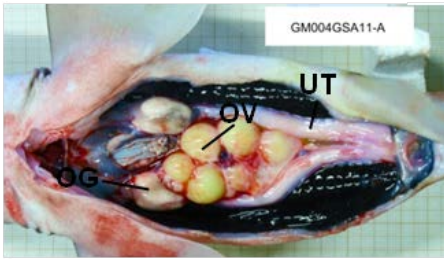
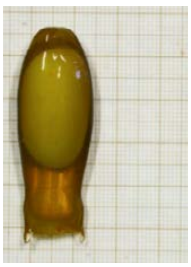
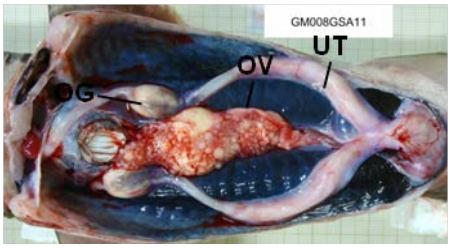
SPAWNING PERIOD

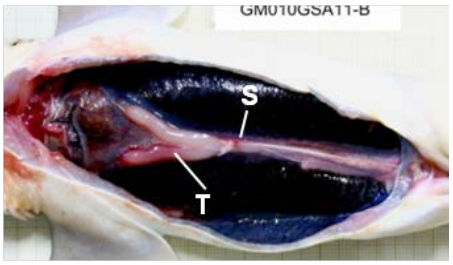
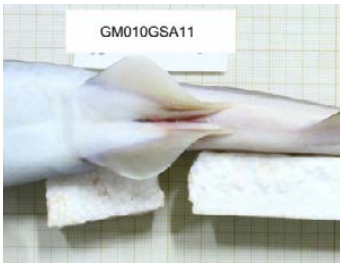
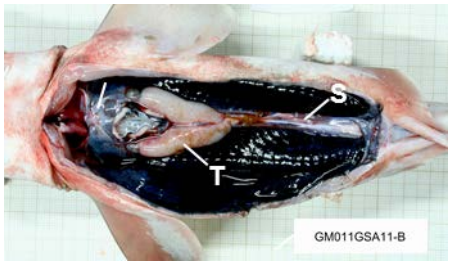
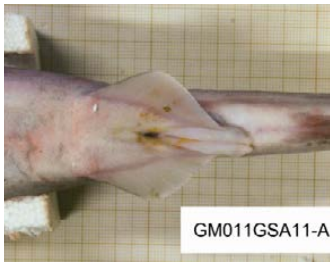
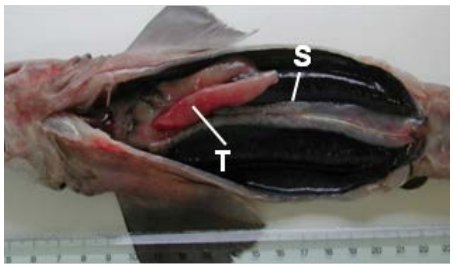
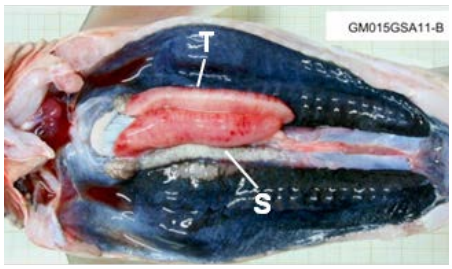
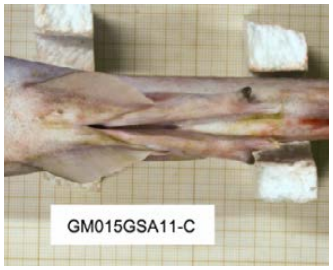
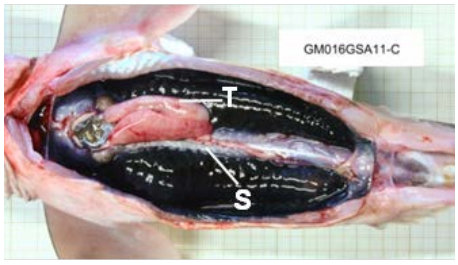
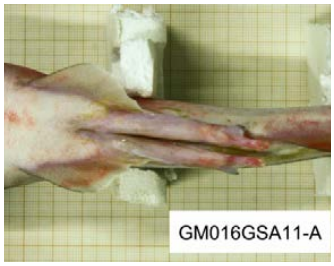
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 1, 2, 3 Alboran Sea	F													Rey, Gil De Sola and Massuti (2005)
	M													
GSA 7 S. France	F													Capapé *et al.* (2008a)
GSA 9 Ligurian Sea	C					■	■	■	■					Relini Orsi and Wurtz (1975)
GSA 11 Sardinian Seas	F	■	■	■		■	■	■	■				■	Marongiu *et al.* (2013)
	M					■	■	■	■					
GSAs 12, 13, 14 Tunisian coast	F	■	■	■							■	■	■	Capapé and Zouali (1977)
GSA 10 S. Tyrrhenian Sea	C													Rinelli *et al.* (2005)
GSA 16 Strait of Sicily	C					■	■	■	■					Ragonese *et al.* (2009)
GSA 18 S. Adriatic Sea	C													Ungaro, Marano and Marsan (1994)
GSA 19 Ionian Sea	F		■											Tursi *et al.* (1993)
	M			■										
N.E. Atlantic Ocean														
IE 9.b.2, 9.a Portuguese waters	C	■	■	■									■	Costa, Erzini and Borges (2005)

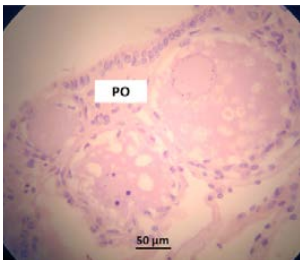
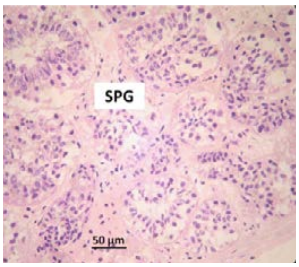
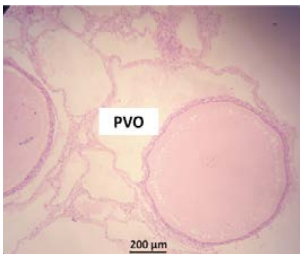
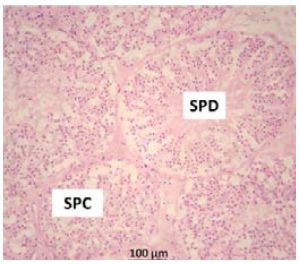
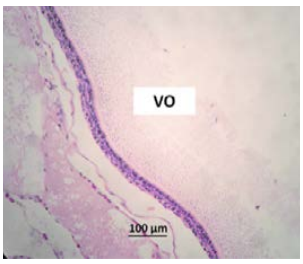
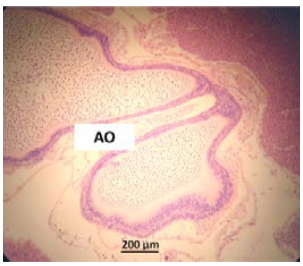
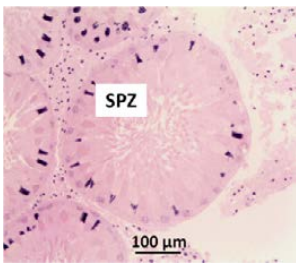
■ Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSAs 1, 2, 3 Alboran Sea	F	10.0-62.0	45.0	48.8	Rey, Gil De Sola and Massuti (2005)
	M	10.0-63.0	42.0	44.3	
GSA 7 S. France	F	max 64.0		52.0-61.0	Capapé *et al.* (2008a)
	M	max 62.0		51.0-55.0	
GSA 9 Ligurian Sea	F		45.0	43.3	Relini Orsi and Wurtz (1975); Cardinale, Raetz and Charef (2011)
	M		45.0	38.0	
GSA 11 Sardinian Seas	F	11.0-53.0	41.0	45.0	Marongiu *et al.* (2013)
	M	11.0-59.0	42.0	42.4	
GSAs 12, 13, 14 Tunisian coast	F			39.0-42.0	Capapè and Zaouali (1977)
	M			<42.0	
GSA 10 C.S. Tyrrhenian	F			42.5	Carbonara *et al.* (2012)
	M			37.0	
GSA 16 Strait of Sicily	F	9.0-51.0		43.3	Ragonese *et al.* (2009)
	M	7.0-59.0		38.0	
GSA 18 S. Adriatic Sea	F		50.8		Ungaro, Marano and Marsan (1994)
	M		44.8		
	F			44.2	Carbonara *et al.* (2012)
	M			38.7	
GSA 19 Ionian Sea	F	7.5-55.0	41.0	49.0	Tursi *et al.* (1993)
	M	7.0-51.0	34.0	45.0	
	F			41.9	Carbonara *et al.* (2012)
	M			38.4	
GSA 20 Ionian Sea	F			44.4	Apostolopoulos *et al.* (2014)
	M			41.2	
GSA 22 Aegean Sea	F	10.6-53.3		48.3	Metochis *et al.* (2016)
	M	13.5-50.1		43.3	
N.E. Atlantic Ocean					
IE 9.b.2, 9.a Portuguese waters	F	9.5-67.0	52.0	56.0-59.0	Costa *et al.* (2005)
	M	9.4-64.3	44.0	49.0	

Galeus melastomus (FAO CODE: SHO – MEDITS CODE: GALU MEL)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 TL 21.1 cm; TW 32 g; ST: March; GSA 11
2	MATURING	 TL 32.8 cm; TW 115 g; ST: June; GSA 19
3a	MATURE	 TL 46.3 cm; TW 321 g; ST: March; GSA 11
3b	MATURE/ EXTRUDING	 TL 49.2 cm; TW 402 g; ST: June; GSA 19 
4a	RESTING	 TL 49.3 cm; TW 336.6 g; ST: August; GSA 11
4b	REGENERATING	

Galeus melastomus (FAO CODE: SHO – MEDITS CODE: GALU MEL)			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE VIRGIN**		
		TL 25 cm; TW 44 g; ST: March; GSA 11	
2	**MATURING**		
		TL 38.7 cm; TW 138 g; ST: March; GSA 11	
3a	**MATURE**		
		TL 42.6 cm; TW 237 g; ST: June; GSA 19	
3b	**MATURE/ ACTIVE**		
		TL 46.2 cm; TW 273 g; ST: March; GSA 11	
4	**REGRESSING**		
		TL 46.6 cm; TW 248 g; ST: July; GSA 11	

Galeus melastomus (FAO CODE: SHO – MEDITS CODE: GALU MEL)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)	 GSA 11 (H and E)
2	MATURING	 GSA 11 (H and E)	 GSA 11 (H and E)
3a	MATURE	 GSA11 (H and E)	 GSA 11 (H and E)
3b	MATURE/ EXTRUDING/ ACTIVE		 GSA 11 (H and E)
4a/4	RESTING/ REGRESSING	 GSA 11 (H and E)	 GSA 11 (H and E)
4b	REGENERATING	 GSA 11 (H and E)	

Order: Carcharhiniformes **Family: Scyliorhinidae**

***Scyliorhinus canicula* (Linnaeus, 1758)**

Photo by C. Porcu

FAO CODE: SYC

MEDITS CODE: SCYO CAN

Common name:
Small spotted catshark, Lesser spotted dogfish (English)
Petite roussette (French)
Gattuccio (Italian)
Pintarroja (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found throughout the northeast and eastern central Atlantic Ocean from the Shetland Islands and Norway in the north, to western Africa (Morocco, Western Sahara and Mauritania to Senegal, possibly along the Ivory Coast) in the south, including the Mediterranean Sea (Compagno, Dando and Fowler, 2005). It is not found in the Black Sea, although there may be occasional records of this species as a vagrant (Compagno, Dando and Fowler, 2005).

REPRODUCTION

Reproductive strategy: lecithotrophic, single oviparity.

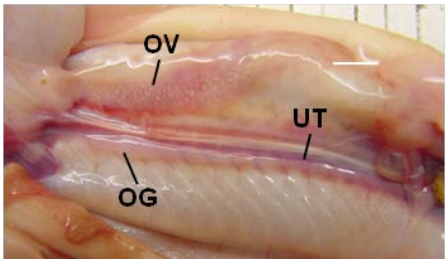
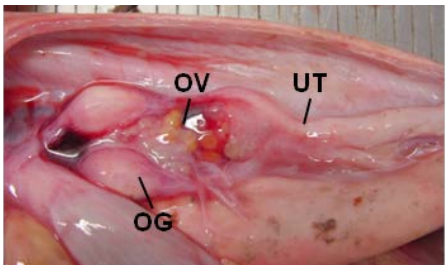
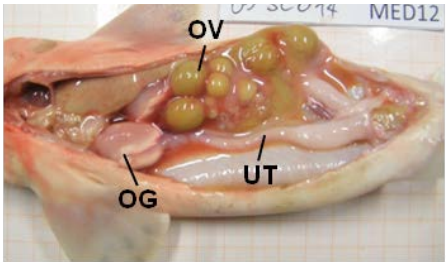
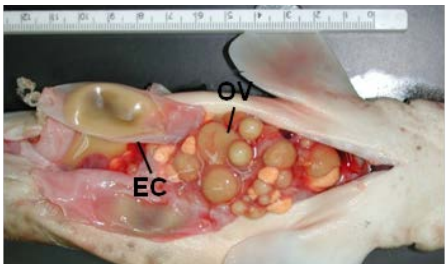
SPAWNING PERIOD

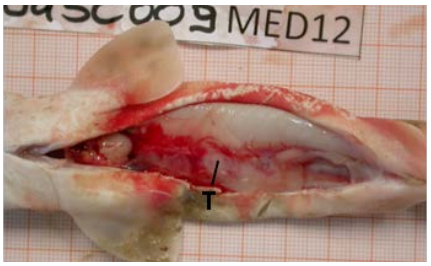
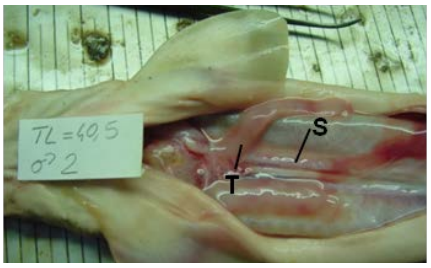
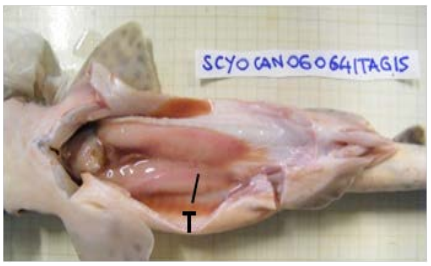
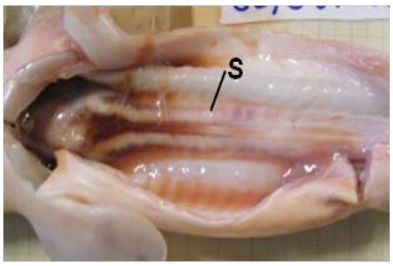
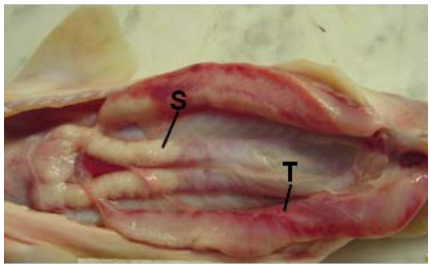
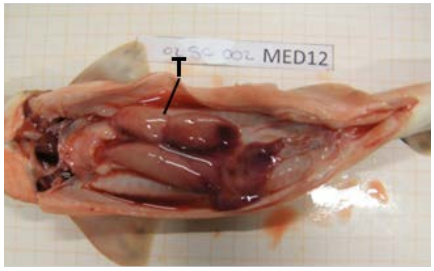
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 4 Algerian Sea	F		■	■			■	■	■	■		■	■	Bendiab, Mouffok and Boutiba (2012)
GSA 7 S. France	F													Leloup and Olivereau (1951)
	F				■	■								Capapé *et al.* (2008b)
	M				■	■	■	■	■					
GSA 10 Tyrrhenian Sea	F				■	■								Lupi (2008)
GSAs 12, 13, 14 Tunisian waters	F					■	■	■	■					Capapé (1977b)
GSA 22 Aegean Sea	F													Kousteni, Kontopoulou and Megalofonou (2010)
N.E. Atlantic Ocean														
IE 7.b, 7.j.2 Irish waters	F					■								Henderson and Casey (2001)
	M										■	■		
IE 8.c, 8.b Cantabrian Sea	F				■	■	■							Rodrìguez-Cabello, Velasco and Olaso (1998)
IE 7.f Bristol Channel	F						■	■						Ellis and Shackley (1997)
IE 7.e Roscoff (France)	F													Fauré-Frémiet (1942)
	F													Leloup and Olivereau (1951)
IE 7.e, 7.d English Channel	F								■					Ford (1921)

■ Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F			37.0-44.0	Leloup and Olivereau (1951)
	M			37.0-44.0	
GSA 4 Algerian Sea	F	20.1-47.4		36.0	Bendiab *et al.* (2012)
GSA 7 Gulf of Lion	F			41.0-47.0	Capapé, Tomasini and Bouchereau (1991)
	M			44.0	
	F	22.0-51.0	41.0		Capapé *et al.* (2008b)
	M	27.0-55.0	43.0		
GSAs 12, 13, 14 Tunisian waters	F			40.0-45.0	Capapé (1977b)
	M			40.0	
GSA 10 Tyrrhenian Sea	F	11.0-49.0	39.5	40.5	Lupi (2008)
	M	12.0-50.5	39.0	40.2	
GSA 16 Strait of Sicily	F	15.5-48.0	34.5	36.8	Finotto *et al.* (2015)
	M	20.5-49.5	33.5	38.5	
GSA 17 N. and E. Adriatic Sea	F		31.5		Jardas (1979)
	M		27.5		
	F	35.5-49	39.0	40.9	Finotto *et al.* (2015)
	M	32.5-50.5	37.0	40.0	
GSA 18 S. Adriatic Sea	F		39.0	44.4	Ungaro, Marano and Marzano (2002)
	M		42		
GSA 22 Aegean Sea	F	23.6-46.7	36.4	39.9	Kousteni *et al.* (2010)
	M	28.2-48.8	37.1	39.6	
N.E. Atlantic Ocean					
IE 7b, 7j2 Irish waters	F		52.0	58.1	Henderson and Casey (2001)
	M		53.0	57.5	
IE 7a, 7g Irish waters	F	10.3-70.0	52.0	57.0	Ivory, Jeal and Noland (2005)
	M	10.4-71.0	49.0	53.5	
IE 8c, 8.b Cantabrian Sea	F		51.0	54.2	Rodrìguez-Cabello, Velasco and Olaso (1998)
IE 7.f Bristol Channel	F	37.9-67.0	52.0	55.0	Ellis and Shackley (1997)
	M	37.2-66.2	49.0	52.0	
IE 7.e Roscoff (France)	F			52.0-60.0	Fauré-Frémiet (1942)
	M			52.0-60.0	
	F			52.0-60.0	Leloup and Olivereau (1951)
	M			52.0-60.0	
IE 7.e, 7.d English Channel	F			57.0-60.0	Ford (1921)
	M			57.0-60.0	

Scyliorhinus canicula (FAO CODE: SYC – MEDITS CODE: SCYO CAN)			
STAGE	**PHASE**	**FEMALES**	
1	IMMATURE VIRGIN	 TL 35.0 cm; ST: March; GSA 9	
2	MATURING	 TL 40.5 cm; ST: August; GSA 9	
3a	MATURE	 TL 43.6 cm; TW 303 g; ST: July; GSA 11	
3b	MATURE/ EXTRUDING	 TL 44.3 cm; TW 315 g; ST: June; GSA 19	
4a	RESTING		
4b	REGENERATING		

Scyliorhinus canicula (FAO CODE: SYC – MEDITS CODE: SCYO CAN)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE VIRGIN	 TL 25.5 cm; TW 55 g; ST: June; GSA 11	 GSA 9
2	MATURING	 TL 40.5 cm; ST: March; GSA 9	
3a	MATURE	 TL 41.1 cm; TW 241 g; ST: July; GSA 11	
3b	MATURE/ ACTIVE	 TL 43 cm; ST: March; GSA 9	
4	REGRESSING	 TL 44.2 cm; TW 290.8 g; ST: July; GSA 11	

Viviparous elasmobranchs

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Order: Torpediniformes **Family: Torpedinidae** ***Torpedo marmorata* (Risso, 1810)**

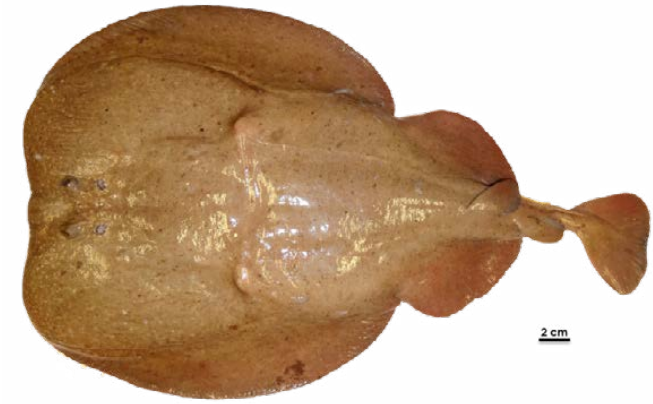


Photo by C. Porcu

FAO CODE: TTR

MEDITS CODE: TORP MAR

Common name:

Spotted torpedo, Marbled electric ray, Marbled torpedo (English)

Torpille marbrée (French)

Torpedine marezzata (Italian)

Tembladera (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in eastern Atlantic Ocean and the Mediterranean Sea, from the northern United Kingdom, south to the Cape of Good Hope, South Africa (Whitehead *et al.,* 1984).

REPRODUCTION

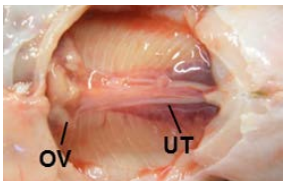
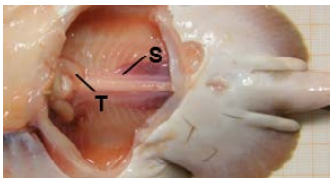
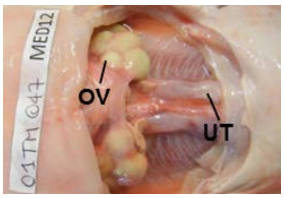
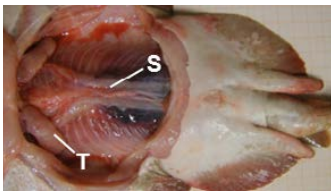
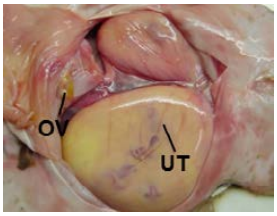
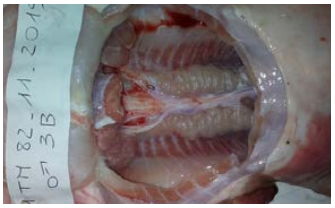
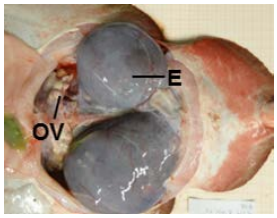
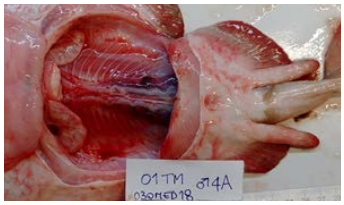
Reproductive strategy: lecithotrophic, yolk sac viviparity.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 9 C. Mediterranean Sea	F													Consalvo *et al.* (2007)
GSA 26 Egyptian waters	F													Abdel-Aziz (1994)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 9 C. Mediterranean Sea	F	max 55.3	26.7	31.2	Consalvo *et al.* (2007)
	M	max 36.4	23.1	25.1	
GSA 26 Egyptian waters	F	max 61.2		35.5	Abdel-Aziz (1994)
	M	max 38.6		25.5	

Torpedo marmorata (FAO CODE: TTR – MEDITS CODE: TORP MAR)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE	 TL 16.2 cm; TW 90 g; ST: June; GSA 11	 TL 20.4 cm; TW 163 g; ST: June; GSA 11
2	DEVELOPING		 TL 20.7 cm; TW 193 g; ST: August; GSA 11
3a	CAPABLE OF REPRODUCING	 TL 43.2 cm; TW 1660 g; ST: June; GSA 11	 TL 31 cm; TW 573 g; ST: May; GSA 11
3b	EARLY PREGNANCY/ ACTIVELY SPAWNING	 TL 36 cm; TW 1700 g; ST: August; GSA 9	 GSA 11
3c	MID PREGNANCY		
3d	LATE PREGNANCY	  TL 51.9 cm; TW 3275 g; ST: November; GSA 11	
4a/4	REGRESSING	 TL 53.0 cm; TW 3204 g; ST: November; GSA 11	 TL 34.1 cm; TW 784 g; ST: July; GSA 11
4b	REGENERATING		

Order: Torpediniformes **Family: Torpedinidae** ***Torpedo torpedo* (Linnaeus, 1758)**

Photo by A. Mulas

FAO CODE: TTV

MEDITS CODE: TORP TOR

Common name:

Ocellate torpedo, Common torpedo (English)

Torpille ocellée (French)

Torpedine occhiuta (Italian)

Tremolina común (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the eastern Atlantic Ocean from the southern Bay of Biscay (records as far north as Belgium are questionable), south to Angola, and also throughout the Mediterranean Sea (Whitehead *et al.,* 1984).

REPRODUCTION

Reproductive strategy: lecithotrophic, yolk sac viviparity.

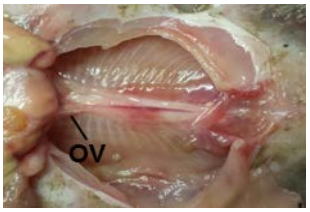
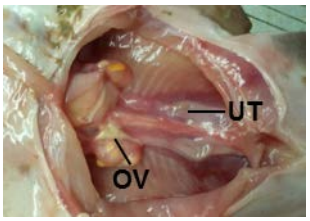
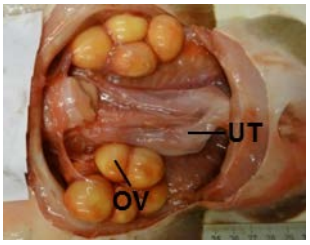
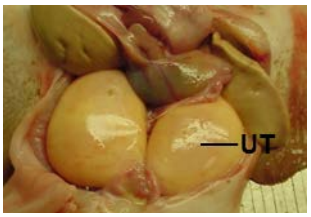
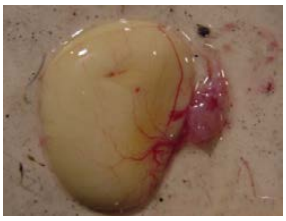
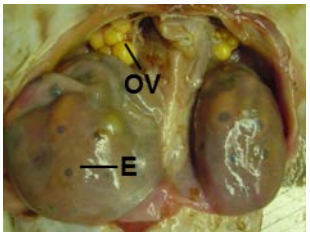
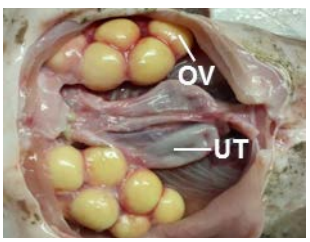
SPAWNING PERIOD

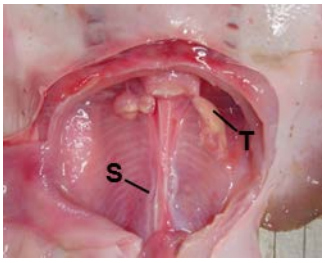
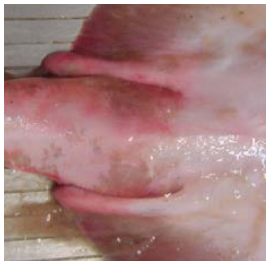
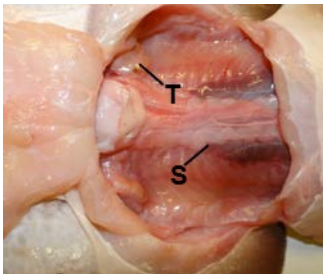
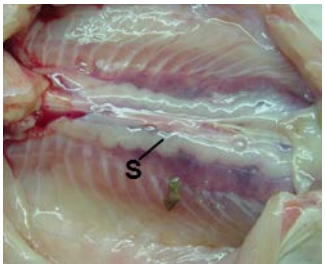
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 9 C. Mediterranean Sea	F				*	*	*	*						Consalvo *et al.* (2007)
GSAs 12, 13, 14 Tunisian waters	F													Quignard and Capapé (1974)
GSA 26 Egyptian waters	F													Abdel-Aziz (1994)

*gestation period.

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 9 C. Mediterranean Sea	F	max 47.7	23.5	25.8	Consalvo *et al.* (2007)
	M	max 44.5	22.7	24.9	
GSA 26 Egyptian waters	F	max 40.8		35.5	Abdel-Aziz (1994)
	M	max 39.1		25.5	

Torpedo torpedo (FAO CODE: TTV – MEDITS CODE: TORP TOR)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE	 TL 19.0 cm; TW 87 g; ST: December; GSA 9
2	DEVELOPING	 TL 28.0 cm; TW 352 g; ST: December; GSA 9
3a	CAPABLE OF REPRODUCING	 TL 39.3 cm; TW 1073 g; ST: November; GSA 11
3b	EARLY PREGNANCY	
3c	MID PREGNANCY	  TL 35.5 cm; TW 725 g; ST: June; GSA 9
3d	LATE PREGNANCY	  TL 35.0 cm; TW 651 g; ST: September; GSA 9
4a	REGRESSING	
4b	REGENERATING	 TL 44.0 cm; ST: December; GSA 9

Torpedo torpedo (FAO CODE: TTV – MEDITS CODE: TORP TOR)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE	 TL 22.0 cm; TW 134 g; ST: October; GSA 9	
2	DEVELOPING	 TL 25.5 cm; TW 199 g; ST: October; GSA 9	
3a	CAPABLE OF REPRODUCING	 TL 38.7 cm; TW 930 g; ST: November; GSA 11	
3b	ACTIVELY SPAWNING	 TL 40.5 cm; TW 994 g; ST: October; GSA 9	
4	REGRESSING		

Order: Squaliformes **Family: Centrophoridae**

Centrophorus granulosus
(Bloch and Schneider, 1801)

Photo by A. Mulas

FAO CODE: GUP

MEDITS CODE: CENT GRA

Common name:
Gulper shark (English)
Squale-chagrin commun (French)
Centroforo (Italian)
Quelvacho (Spanish)

GEOGRAPHIC DISTRIBUTION

It is considered a circumglobal species, in temperate and tropical waters; however, considerable taxonomic confusion of the genus still persists (Guallart *et al.,* 2006). It can be found from southwest England to South Africa, including the Mediterranean Sea. It is also found in the western Atlantic, the Indian Ocean and the western Pacific (Jennings n.d.).

REPRODUCTION

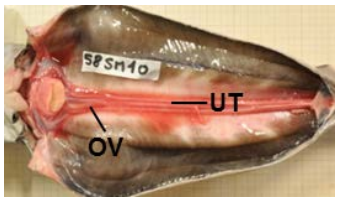
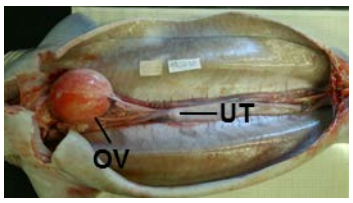
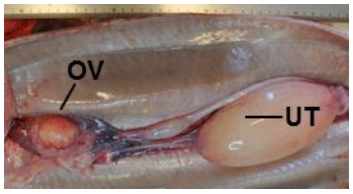
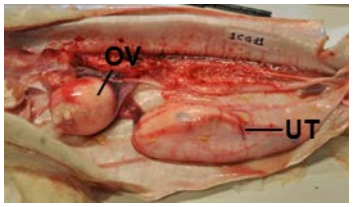
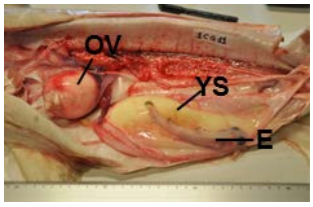
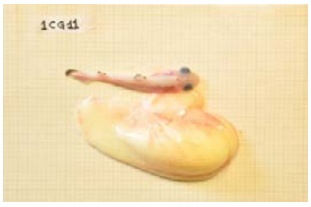
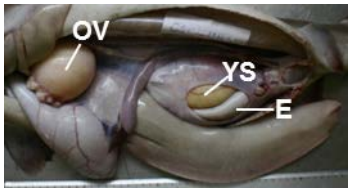
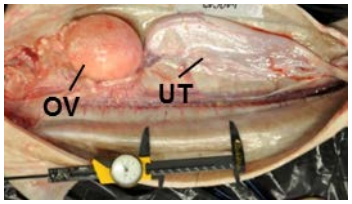
Reproductive strategy: lecithotrophic, yolk sac viviparity.

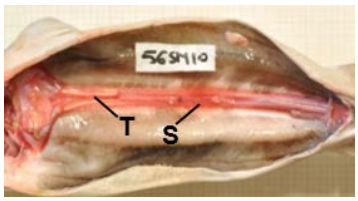
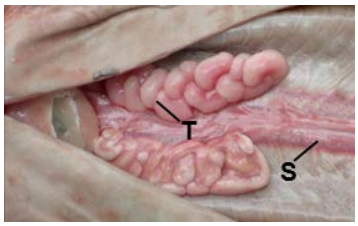
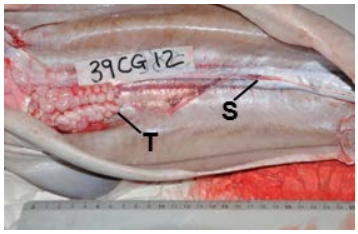
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 12 N. Tunisia	F													Capapè *et al.* (2003)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 5 Balearic Sea	F		89.0	93.0	Guallart (1998)
	M		79.0	80.0	
GSAs 12, 13, 14 Tunisian coast	F			70.0-95.0	Capapé (1985)
	M			70.0-80.0	
GSA 16 Strait of Sicily	F			90.0-95.0	Rizzo *et al.* (1995)
	M			70.0-75.0	
GSA 23 Off Island of Crete	F	60.0-95.0	85.0		Megalofonou and Chatzispyrou (2006)
	M	65.0-83.0	74.5		
N.E. Atlantic Ocean					
IE 9.b.2, 9.a, 8.c E. Atlantic, N.W. Spain	F	44.0-166.0	138.0	147.0	Bañón, Piñeiro and Casas (2008)
	M	73.0-127.0	118.0		

Centrophorus granulosus (FAO CODE: GUP – MEDITS CODE: CENT GRA)			
STAGE	**PHASE**	**FEMALES**	
1	IMMATURE	 TL 50.1 cm; TW 699 g; ST: December; GSA 11	
2	DEVELOPING		
3a	CAPABLE OF REPRODUCING	 TL 96.5 cm; TW 6097 g; ST: March; GSA 11	
3b	EARLY PREGNANCY	 TL 103.5 cm; TW 6542 g; ST: March; GSA 11	
3c	MID PREGNANCY	 TL 97 cm; TW 6289 g; ST: January; GSA 11	 
3d	LATE PREGNANCY	 TL 101 cm; TW 6581 g; ST: May; GSA 11	
4a	REGRESSING	 TL 103.8 cm; TW 7151 g; ST: October; GSA 11	
4b	REGENERATING		

Centrophorus granulosus (FAO CODE: GUP – MEDITS CODE: CENT GRA)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE**	 **TL 58.1 cm; TW 846 g; ST: December; GSA 11**
2	**DEVELOPING**	
3a	**CAPABLE OF REPRODUCING**	 **TL 88 cm; TW 3800 g; ST: July; GSA 9**
3b	**ACTIVELY SPAWNING**	  **TL 90 cm; TW 4812 g; ST: October; GSA 11**
4	**REGRESSING**	

Order: Squaliformes **Family: Dalatiidae** ***Dalatias licha* (Bonaterre, 1788)**

Photo by A. Mulas

FAO CODE: SCK;

MEDITS CODE: SCYM LIC

Common name:

Kitefin shark, Black shark (English);

Squale liche (French);

Zigrino (Italian);

Carocho (Spanish).

GEOGRAPHIC DISTRIBUTION

Dalatias licha is largely distributed off the eastern Atlantic Ocean from both British and Irish waters (Wheeler, 1969) to Morocco (Collignon and Aloncle, 1972). Southward, the species is reported to be found off Madeira and Azores Islands (Perrotta, 2004), and from Senegal (Cadenat and Blache, 1981) to South Africa (Bass, D'Aubrey and Kistnasamy, 1976). Additionally, the species is also known elsewhere off New Zealand, Australia, Japan and Taiwan Province of China (McEachran and Branstetter, 1984). In the Mediterranean, *D. licha* was previously reported in the western basin only, and the coast of Greece was its easternmost range extension (McEachran and Branstetter, 1984). Nevertheless, further reports showed that the species is found in the eastern Levantin Basin: off Turkey (Meriç, 1995; Kabasakal and Kabasakal, 2002), Israel (Golani, 2004) and the Syrian Arab Republic (Saad, Séret and Ali, 2004).

REPRODUCTION

Reproductive strategy: lecithotrophic, yolk sac viviparity.

SPAWNING PERIOD

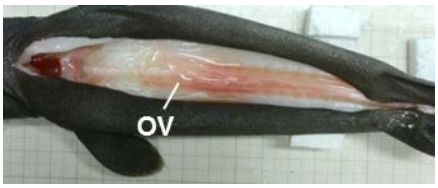
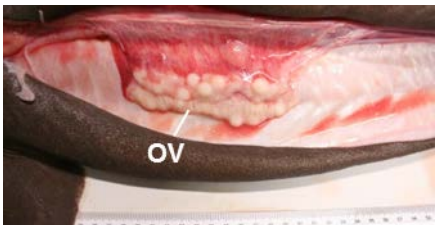
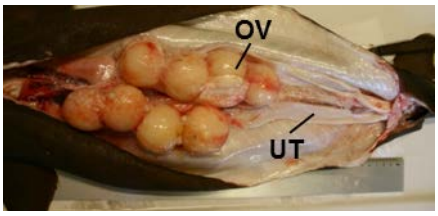
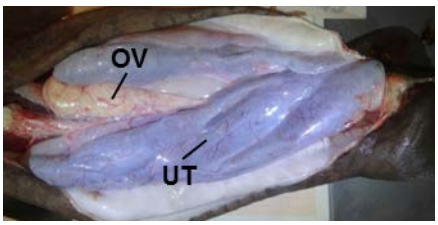
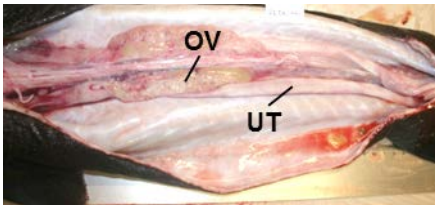
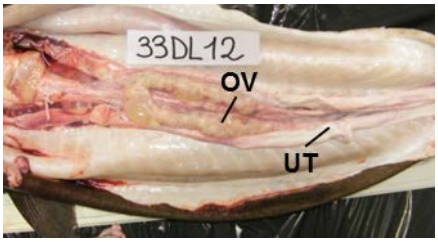
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean Sea	F													Tortonese (1956)
Mediterranean Sea	F													Bini (1976)
GSAs 3, 4, 12 S.W. Mediterranean Sea	F													Capapé *et al.* (2008c)

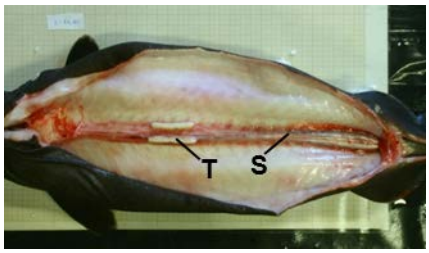
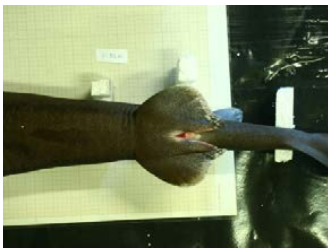
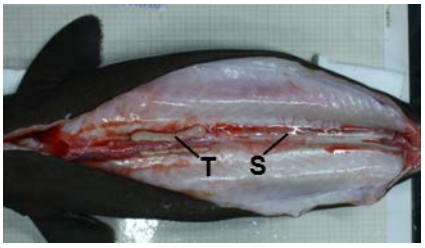
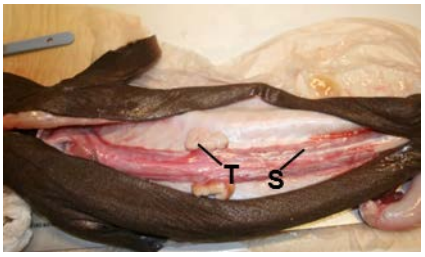
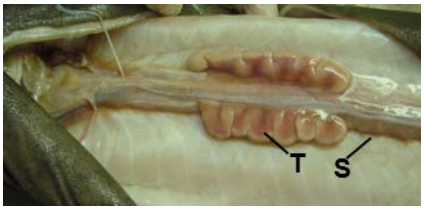
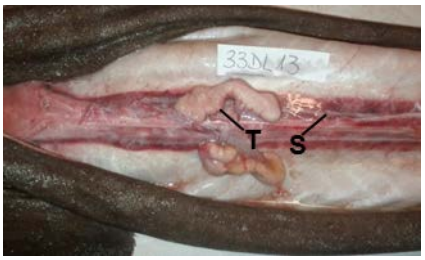
Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F			117.0-159.0	Bauchot (1987)
	M			77.0-121.0	
GSAs 3, 4, 12 S.W. Mediterranean	F	32.0-117.0			Capapé *et al.* (2008c)
	M		74.0		
GSA 18 S. Adriatic Sea	F			96.0	Ungaro pers. obs. *

* in Blasdale *et al.* (2009).

Dalatias licha (FAO CODE: SCK – MEDITS CODE: SCYM LIC)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE	 TL 32.8 cm; TW 140 g; ST: January; GSA 11
2	DEVELOPING	 TL 70.6 cm; TW 1935.8 g; ST: October; GSA 11
3a	CAPABLE OF REPRODUCING	 TL 102.5 cm; TW 6741 g; ST: April; GSA 11
3b	EARLY PREGNANCY	
3c	MID PREGNANCY	
3d	LATE PREGNANCY	  TL 92 cm; TW 6525 g; ST: January; GSA 11
4a	REGRESSING	 TL 101 cm; TW 4047 g; ST: April; GSA 11
4b	REGENERATING	 TL 105 cm; TW 6376 g; ST: October; GSA 11

Dalatias licha (FAO CODE: SCK – MEDITS CODE: SCYM LIC)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE	 TL 74.3 cm; TW 1845 g; ST: March; GSA 11	
2	DEVELOPING	 TL 75.5 cm; TW 1847 g; ST: April; GSA 11	
3a	CAPABLE OF REPRODUCING	 TL 83.9 cm; TW 2425 g; ST: January; GSA 11	
3b	ACTIVELY SPAWNING	 TL 85 cm; TW 2500 g; ST: September; GSA 9	
4	REGRESSING	 TL 86.5 cm; TW 2847 g; ST: June; GSA 11	

Order: Squaliformes **Family: Etmopteridae**

***Etmopterus spinax* (Linnaeus, 1758)**

Photo by C. Porcu

FAO CODE: ETX

MEDITS CODE: ETMO SPI

Common name:

Velvet belly lanternshark (English)

Sagre commun (French)

Sagrì nero (Italian)

Negrito (Spanish)

GEOGRAPHIC DISTRIBUTION

It is usually found in the eastern Atlantic Ocean, from Iceland and Norway (Compagno, Dando and Fowler, 2005), to South Africa (Compagno, 1984) including the Azores Islands (Santos, Porteiro and Barreiros, 1997), the Canary Islands (Brito *et al.,* 2002) and the Cabo Verde Islands (Reiner, 1996). It is also distributed in the Mediterranean Sea (Serena, 2005), including the Ionian, the lower Adriatic and the Aegean Seas (Notarbartolo di Sciara and Bianchi, 1998).

REPRODUCTION

Reproductive strategy: lecithotrophic, yolk sac viviparity.

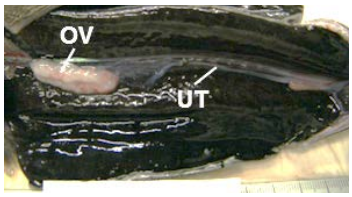
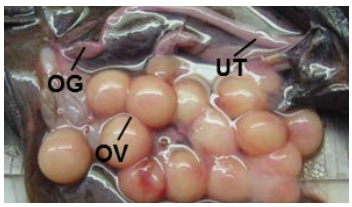
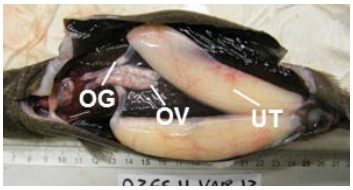
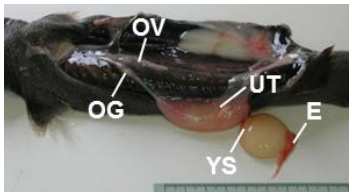
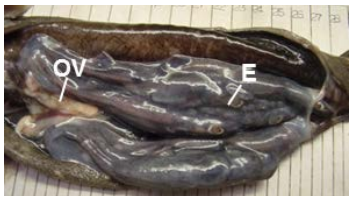
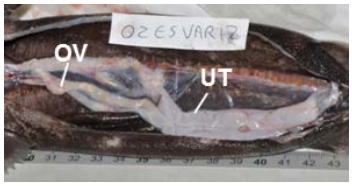
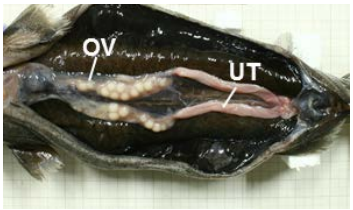
SPAWNING PERIOD

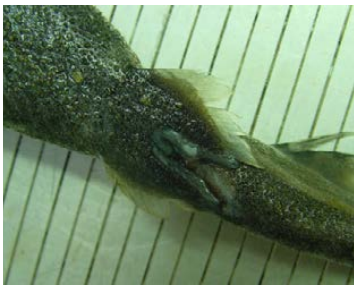
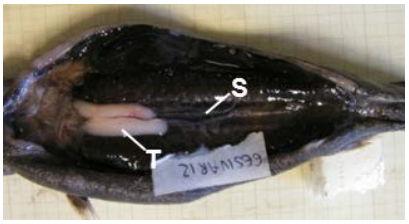
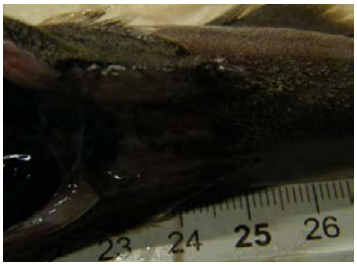
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea	C													
GSA 7 S. France	F													Capapè *et al.* (2001)
GSA 9 Ligurian Sea	F													Vacchi and Orsi-Relini (1979)
GSA 11 Sardinian Seas	C													Porcu *et al.* (2014)
GSAs 12, 13, 14 Tunisian coast	F													Capapè *et al.* (2001)
N.E. Atlantic Ocean														
10.a.2 Azores Islands	F													Aranha, Meneze and Pinho (2009)
9.a S. Portugal	F													Coelho and Erzini (2005, 2008)

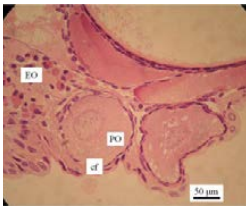
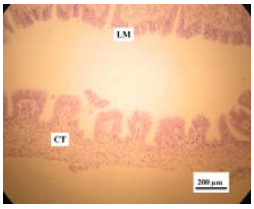
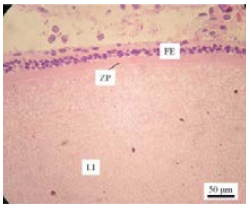
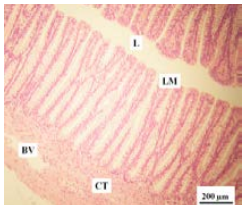
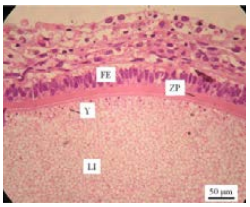
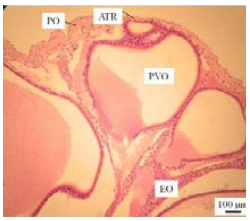
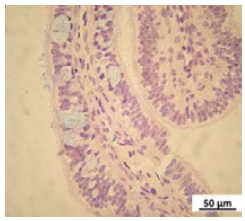
Peak of spawning period

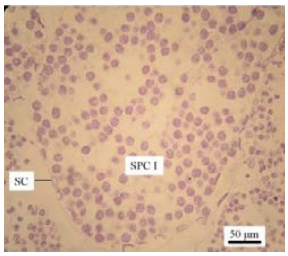
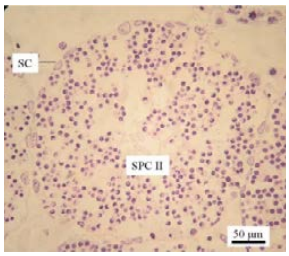
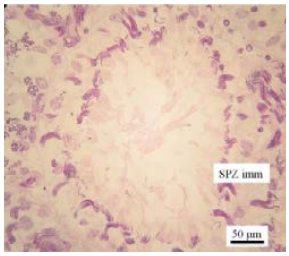
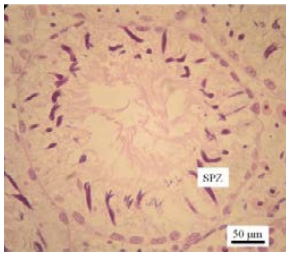
MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 1, 2, 3 Alboran Sea	F	10.1-41.1		34.1	Coelho *et al.* (2010)
	M	10.1-41.1		28.3	
GSA 7 S. France	F	max 46.0		38.0	Capapè *et al.* (2001)
	M	max 46.0		35.0	
GSA 9 Ligurian Sea	F			34.0	Vacchi and Orsi-Relini (1979)
	M			28.0-30.0	
GSA 11 Sardinian Seas	F	10.0-45.7	45.7	36.9	Porcu *et al.* (2014)
	M	9.7-41.8	41.8	33.0	
GSAs 12, 13, 14 Tunisian coast	F	max 46.0		38.0	Capapè *et al.* (2001)
	M	max 46.0		35.0	
N.E. Atlantic Ocean					
IE 10.a.2 Azores Islands	F	17.5-48.0	32.0	34.1	Aranha, Meneze and Pinho (2009)
	M	18.5-45.0	28.0	29.7	
IE 9.a S. Portugal	F	9.1-41.1	30.5	30.8	Coelho and Erzini (2005, 2008)
	M	10.2-33.8	24.2	25.3	

Etmopterus spinax (FAO CODE: ETX – MEDITS CODE: ETMO SPI)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE	 TL 28.3 cm; TW 95 g; ST: January; GSA 11
2	DEVELOPING	 TL 36.0 cm; TW 227 g; ST: November; GSA 11
3a	CAPABLE OF REPRODUCING	 TL 36.5 cm; TW 292 g; ST: January; GSA 9
3b	EARLY PREGNANCY	 TL 38.0 cm; TW 252 g; ST: November; GSA 11
3c	MID PREGNANCY	  TL 36.0 cm; TW 232 g; ST: June; GSA 19
3d	LATE PREGNANCY	  TL 38.0 cm; TW 272 g; ST: January; GSA 9
4a	REGRESSING	 TL 41.1 cm; TW 280 g; ST: November; GSA 11
4b	REGENERATING	 TL 38.5 cm; TW 253 g; ST: November; GSA 11

Etmopterus spinax (FAO CODE: ETX – MEDITS CODE: ETMO SPI)			
STAGE	**PHASE**	**MALES**	
1	IMMATURE	 TL 23.5 cm; ST: January; GSA 9	
2	DEVELOPING	 TL 31.5 cm; TW 129 g; ST: February; GSA 11	
3a	CAPABLE OF REPRODUCING	 TL 33.5 cm; TW 117 g; ST: October; GSA 11	
3b	ACTIVELY SPAWNING	 TL 36.5 cm; TW 151 g; ST: February; GSA 11	
4	REGRESSING		

Etmopterus spinax (FAO CODE: ETX – MEDITS CODE: ETMO SPI)			
		FEMALES	
STAGE	PHASE	OVARY	OVIDUCAL GLAND
1	IMMATURE	 GSA 11* (H and E)	 GSA11* (H and E)
2	DEVELOPING	 GSA 11* (H and E)	 GSA 11* (H and E)
3a	CAPABLE OF REPRODUCING	 GSA 11* (H and E)	
3b	EARLY PREGNANCY	 GSA 11* (H and E)	 GSA 11* (PAS/AB)
3c	MID PREGNANCY		
3d	LATE PREGNANCY		
4a	REGRESSING		
4b	REGENERATING		

Etmopterus spinax (FAO CODE: ETX – MEDITS CODE: ETMO SPI)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE**	 **GSA 11* (H and E)**
2	**DEVELOPING**	 **GSA 11* (H and E)**
3a	**CAPABLE OF REPRODUCING**	 **GSA 11* (H and E)**
3b	**ACTIVELY SPAWNING**	 **GSA 11* (H and E)**
4	**REGRESSING**	

* from Porcu *et al.* (2014).

Order: Squaliformes **Family: Oxynotidae** ***Oxynotus centrina*** **(Linnaeus, 1758)**

Photo by A. Mulas

FAO CODE: OXY

MEDITS CODE: OXYN CEN

Common name:

Angular rough shark (English)
Centrine commune (French)
Pesce porco (Italian)
Cerdo marino (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in eastern Atlantic Ocean and the Mediterranean Sea (entire coast from the Straits of Gibraltar to Israel, but absent from the Black Sea), down to South Africa, and possibly off Mozambique in the Indian Ocean (Bradaï *et al.,* 2007).

REPRODUCTION

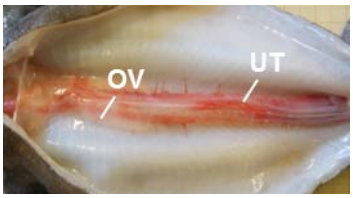
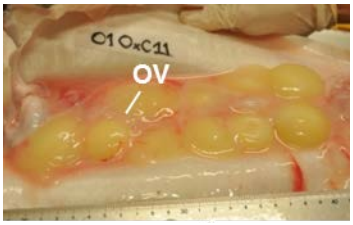
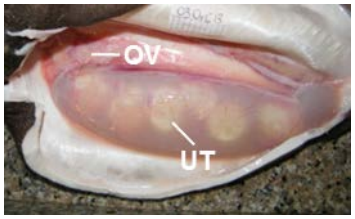
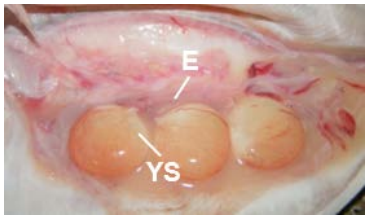
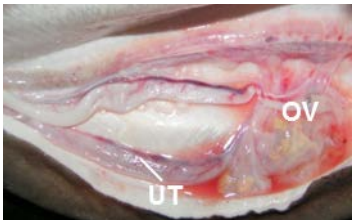
Reproductive strategy: lecithotrophic, single oviparity.

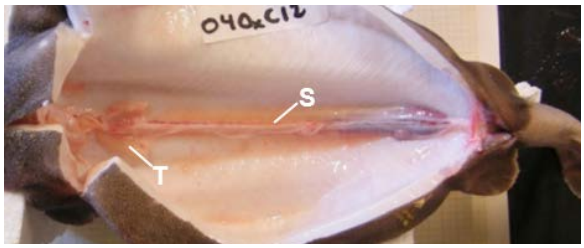
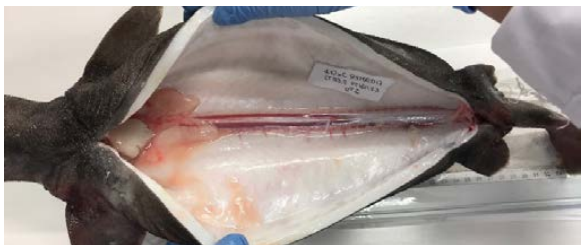
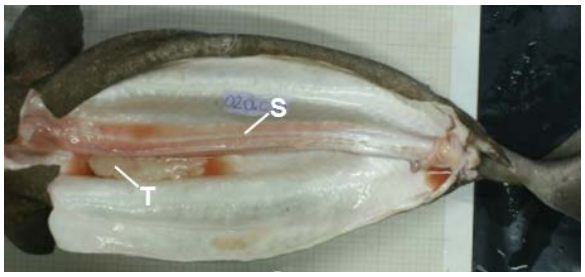
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean Sea	C													Capapè, Seck and Quignard (1999)
GSA 7, 12, 13, 14 Gulf of Lion/Tunisian coast	F													Capapè, Seck and Quignard (1999)
	M													
GSA 11 Sardinian Seas	C													Porcu *et al.* (2017b)
GSA 22 Aegean Sea	C													Kousteni and Megalofonou (2016)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	C			50.0-70.0	Serena (2005)
GSA 7, 12, 13, 14 Gulf of Lion/ Tunisian coast	F	22.0-78.0	64.0		Capapè, Seck and Quignard (1999)
	M	21.0-66.0		60.0-66.0	
GSA 11 Sardinian Seas	F	25.6-78.2	60.8		Porcu *et al.* (2017b)
	M	22.7-64.6	53.5		
GSA 17 Adriatic Sea	F	max 80.0	80.0 (1 ind)		Dragičević, Dulčić and Capapé (2009)
GSA 22 Aegean Sea	F		69.0		Megalofonou and Damalas (2004)

Oxynotus centrina (FAO CODE:OXY – MEDITS CODE: OXYN CEN)				
STAGE	**PHASE**	**FEMALES**		
1	**IMMATURE**	 TL 27.4 cm; TW 154 g; ST: February; GSA 11		
2	**DEVELOPING**			
3a	**CAPABLE OF REPRODUCING**	 TL 65.4 cm; TW 4429 g; ST: February; GSA 11		
3b	**EARLY PREGNANCY**			
3c	**MID PREGNANCY**	 TL 77.1 cm; TW 4682 g; ST: January; GSA 11		
3d	**LATE PREGNANCY**			
4a	**REGRESSING**	 TL 73.1 cm; TW 5287 g; ST: April; GSA 11		
4b	**REGENERATING**			

Oxynotus centrina (FAO CODE:OXY – MEDITS CODE: OXYN CEN)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE**	 TL 51 cm; TW 15087 g; ST: February; GSA 11
2	**DEVELOPING**	 TL 53.3 cm; TW 1611 g; ST: November; GSA 11
3a	**CAPABLE OF REPRODUCING**	
3b	**ACTIVELY SPAWNING**	 TL 74.6 cm; TW 1970 g; ST: January; GSA 11
4	**REGRESSING**	

Order: Squaliformes **Family: Squalidae**

Squalus blainville (Risso, 1827)

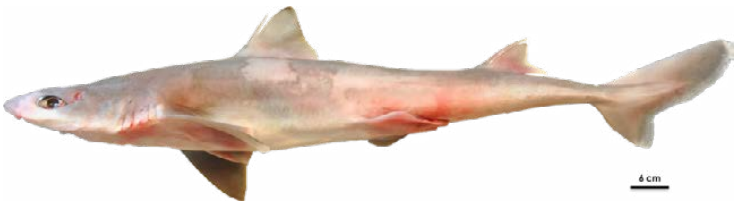


Photo by A. Mulas

FAO CODE: QUB

MEDITS CODE: SQUA BLA

Common name:

Longnose spurdog (English)

Aiguillat galludo, Aiguillat coq (French)

Spinarolo bruno (Italian)

Galludo (Spanish)

GEOGRAPHIC DISTRIBUTION

This species is found in tropical and temperate waters, and inhabits depths to around 700 m in the Atlantic, Pacific and Indian Oceans, including the Mediterranean and Black Seas (Compagno, Dando and Fowler, 2005; Serena, 2005).

REPRODUCTION

Reproductive strategy: lecithotrophic, yolk sac viviparity.

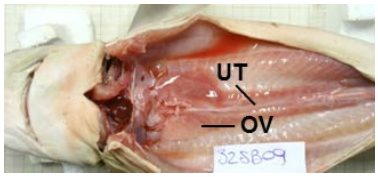
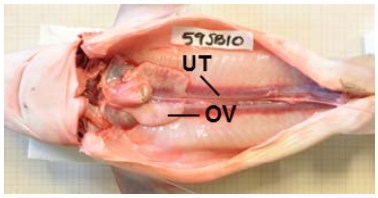
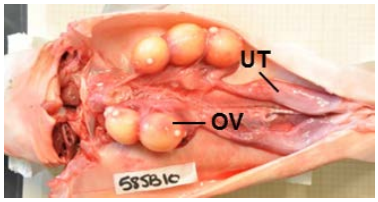
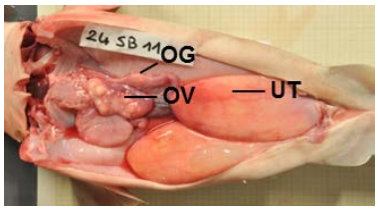
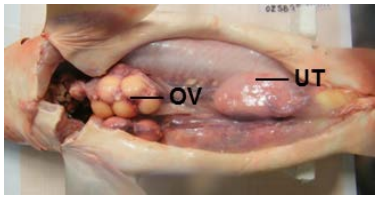
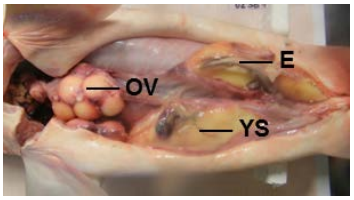
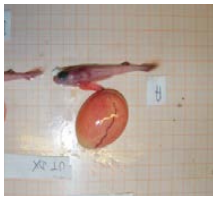
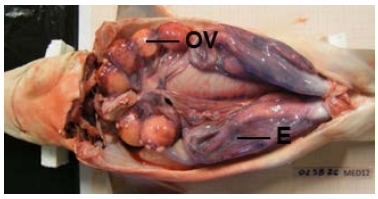
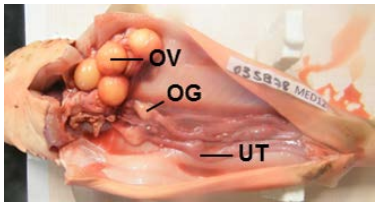
SPAWNING PERIOD

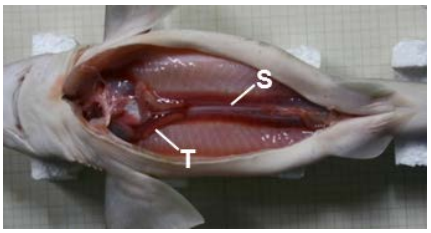
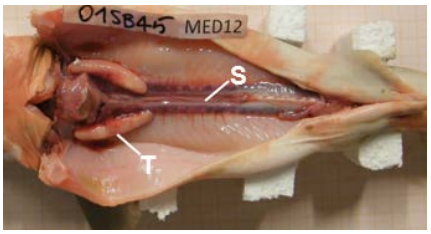
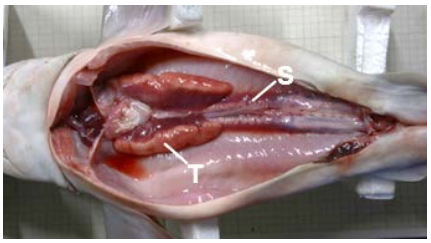
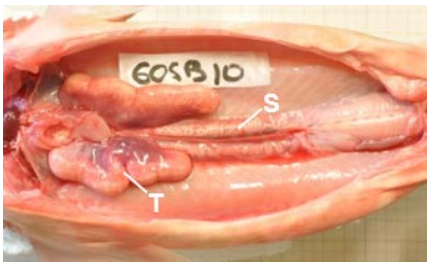
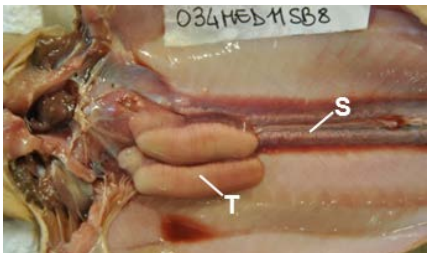
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 16 Strait of Sicily	F													Cannizzaro *et al.* (1995)
	M													
GSA 20 E. Ionian Sea	C													Sion, d'Onghia and Tursi (2003)
GSA 20 E. Ionian Sea	C													Anastasopoulou *et al.* (2018)
GSA 22 E. Mediterranean Sea	F													Kousteni and Megalofonou (2011)
	M													

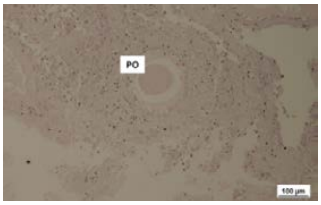
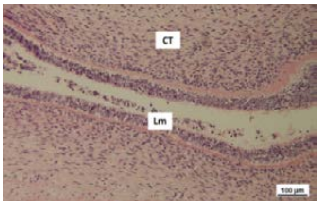
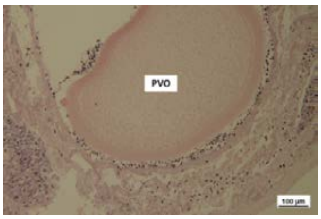
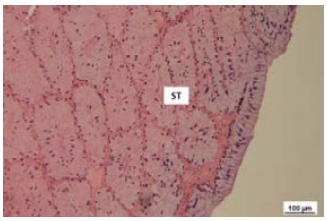
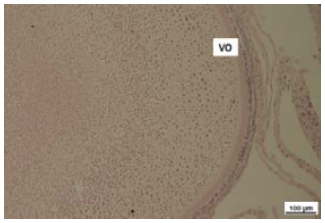
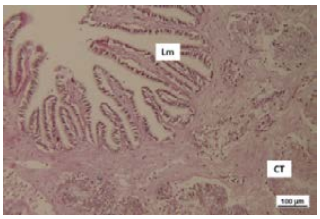
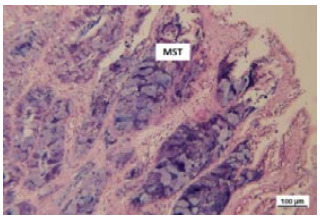
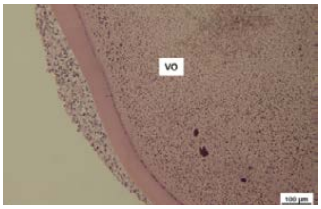
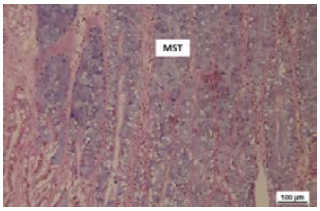
Peak of spawning period

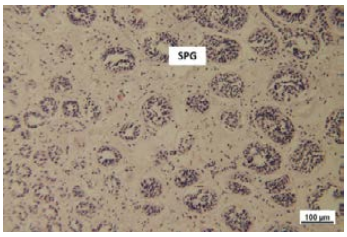
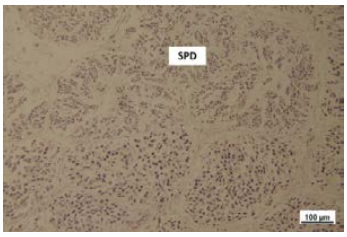
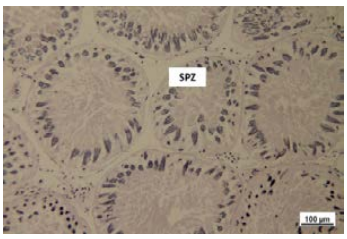
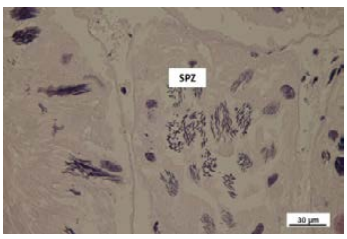
MATURITY

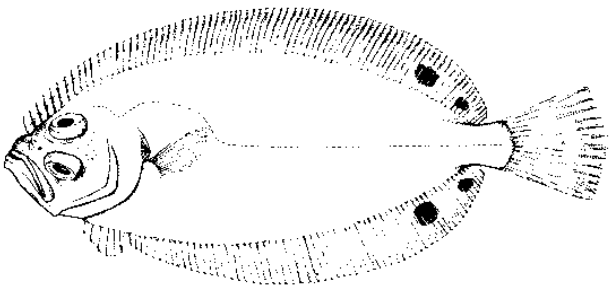
Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F			50.0-65.0	Bauchot (1987)
	M			45.0-50.0	
GSA 14 Gulf of Gabès	F	24.7-100.0	56.0	62.5	Marouani *et al.* (2012)
	M	23.2-83.4	44.0	52.3	
GSA 16 Strait of Sicily	F	max 92.0		57.0-58.0	Cannizzaro *et al.* (1995)
	M	max 73.5		45.0-46.0	
GSA 20 E. Ionian Sea	F	19.0-78.5	58.0	60.1	Sion, d'Onghia and Tursi (2003)
	M	19.0-66.4	45.0		
GSA 20 E. Ionian Sea	F	13.5-95.0	58.5	60.3	Anastasopoulou *et al.* (2018)
	M	19.0-100.0	36.5	41.3	
GSAs 20, 22, 23 E. Mediterranean Sea	F	18.2-79.0	52.3	56.8	Kousteni and Megalofonou (2015)
	M	18.0-79.9	42.0	46.0	
GSA 22 Aegean Sea	F	18.2-77.9	52.3	56.4	Kousteni and Megalofonou (2011)
	M	18.0-79.9	42.5	45.7	

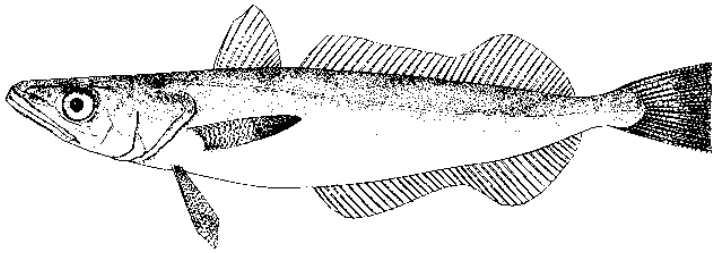
Squalus blainville (FAO CODE: QUB – MEDITS CODE: SQUA BLA)				
STAGE	**PHASE**	**FEMALES**		
1	IMMATURE	 TL 38.4 cm; TW 254 g; ST: May; GSA 11		
2	DEVELOPING	 TL 60.1 cm; TW 1004 g; ST: December; GSA 11		
3a	CAPABLE OF REPRODUCING	 TL 59.3 cm; TW 1313 g; ST: December; GSA 11		
3b	EARLY PREGNANCY	 TL 68.3 cm; TW 1524 g; ST: February; GSA 11		
3c	MID PREGNANCY	 TL 79.9 cm; TW 2967 g; ST: July; GSA 11		
3d	LATE PREGNANCY	 TL 77.2 cm; TW 2300 g; ST: June; GSA 11		
4a	REGRESSING	 TL 69.3 cm; TW 1760 g; ST: July; GSA 11		
4b	REGENERATING			

Squalus blainville (FAO CODE: QUB – MEDITS CODE: SQUA BLA)			
STAGE	**PHASE**	**MALES**	
1	**IMMATURE**	 **TL 44 cm; TW 395 g; ST: June; GSA 11**	
2	**DEVELOPING**	 **TL 48 cm; TW 419 g; ST: June; GSA 11**	
3a	**CAPABLE OF REPRODUCING**	 **TL 60 cm; TW 1018 g; ST: June; GSA 11**	
3b	**ACTIVELY SPAWNING**	 **TL 58.5 cm; TW 857 g; ST: December; GSA 11**	
4	**REGRESSING**	 **TL 58.6 cm; TW 896 g; ST: October; GSA 11**	

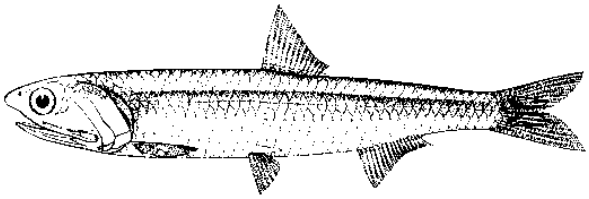
Squalus blainville (FAO CODE: QUB – MEDITS CODE: SQUA BLA)			
		FEMALES	
STAGE	PHASE	OVARY	OVIDUCAL GLAND
1	IMMATURE	 GSA 11 (H and E)	 GSA 11 (H and E)
2	DEVELOPING	 GSA 11 (H and E)	 GSA 11 (H and E)
3a	CAPABLE OF REPRODUCING	 GSA 11 (H and E)	 GSA 11 (PAS/AB)
3b	EARLY PREGNANCY		
3c	MID PREGNANCY		 GSA 11 (PAS/AB)
3d	LATE PREGNANCY	 GSA 11 (H and E)	 GSA 11 (PAS/AB)
4a	REGRESSING		
4b	REGENERATING		

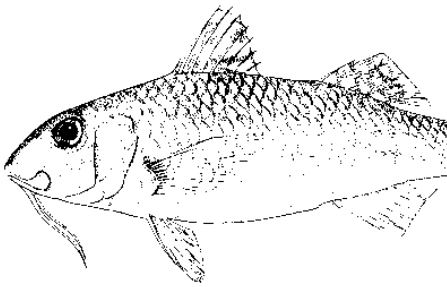
Squalus blainville (FAO CODE: QUB – MEDITS CODE: SQUA BLA)		
STAGE	**PHASE**	**MALES**
1	**IMMATURE**	 **GSA 11 (H and E)**
2	**DEVELOPING**	 **GSA 11 (H and E)**
3a	**CAPABLE OF REPRODUCING**	 **GSA 11 (H and E)**
3b	**ACTIVELY SPAWNING**	
4	**REGRESSING**	 **GSA 11 (H and E)**

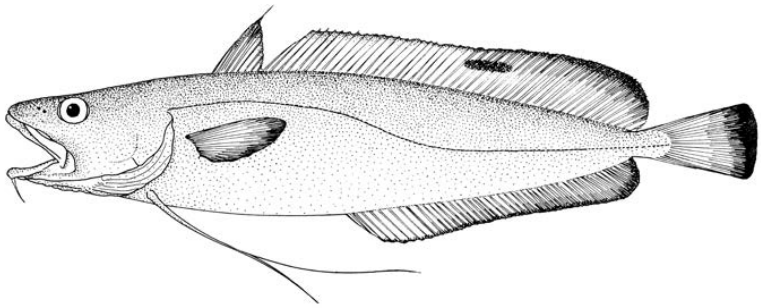


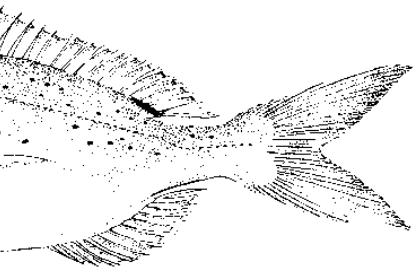


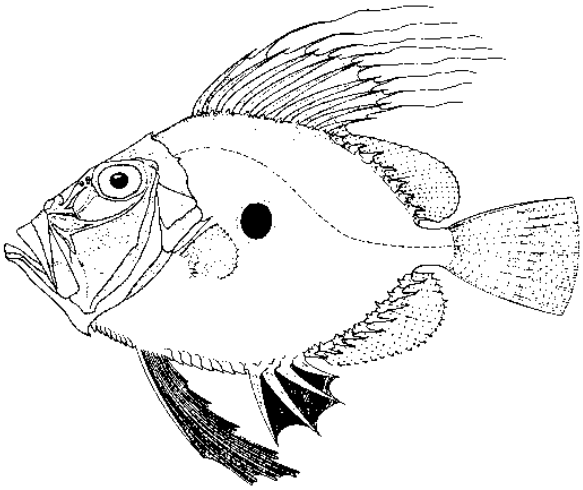
BONY FISH

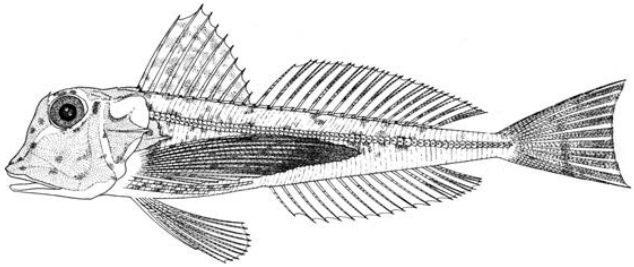












Bony fish

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Order: Clupeiformes **Family: Engraulidae**

Engraulis encrasicolus (Linnaeus, 1758)

Photo by E. Beccornia

FAO CODE: ANE

MEDITS CODE: ENGR ENC

Common name:
European anchovy (English)
Anchois commun (French)
Acciuga (Italian)
Anchoa (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed throughout the Mediterranean, Black and Azov Seas, with stray individuals in the Suez Canal and the Gulf of Suez. It is found in the eastern Atlantic from Bergen, Norway to east London and in the Indian Ocean, South Africa (possibly reaching Durban) (Whitehead, 1990). It is reported to be present in Estonia (Anonymous, 1999).

REPRODUCTION

Reproductive strategy: dioic, pelagic spawner with continuous gametogenesis and multiple spawning.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSAs 1, 2, 3 Alboran Sea	C					■	■	■	■	■	■			García and Perez Rubín (1986)
	C			■	■	■	■	■	■	■	■			Giráldez and Abad (1995)
	C				■	■	■	■	■	■				Giráldez (2009)
	C				■	■	■	■	■	■				Giráldez and Torres (2009)
GSA 3 Morocco	C							■	■	■	■	■		Kada *et al.* (2009)
GSA 4 Algerian coast	C						■	■	■	■				Hemida (1987)
	C					■	■	■	■	■	■	■		Bacha and Amara (2012)
	C				■	■	■	■	■	■	■			Mezedjiri, Kerfouf and Tahar (2013)
GSA 6 Catalan coast	C				■	■	■	■	■	■	■			Palomera (1992)
GSA 7 Gulf of Lion	C					■	■	■	■	■				Chavance (1980)
GSA 9 Ligurian Sea	C					■	■	■	■	■				Albertelli *et al.* (1988)
	C				■	■	■	■	■	■				Petrillo *et al.* (1998)
GSA 12 Gulf of Tunis	C		■	■	■	■	■	■	■	■	■			Zarrad *et al.* (2006)
	C					■	■	■	■	■				Khemiri and Gaamour (2009)
GSA 16 Strait of Sicily	C						■	■	■	■				Cuttitta *et al.* (1999)
GSA 16 Strait of Sicily	C			■	■	■	■	■	■	■	■			Basilone *et al.* (2006)
GSA 17 Gulf of Trieste	C					■	■	■	■	■				Specchi *et al.* (1998)
GSA 17 N. Adriatic Sea	C				■	■	■	■	■	■	■			Orlandi *et al.* (1994)
GSA 17 N. Adriatic Sea	C				■	■	■	■	■	■	■			Pacetti *et al.* (2013)

Table continues next page ➜

SPAWNING PERIOD (continued)

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSA 17 C.N. Adriatic Sea	C				■	■	■	■	■	■	■			Regner (1996)
GSA 17 N.E. Adriatic Sea	C				■	■	■	■	■	■				Zorica *et al.* (2013)
GSA 17 Croatian waters	C			■	■	■	■	■	■	■				Sinovčić (2000)
	C				■	■	■	■	■	■				Sinovčić and Zorica (2006)
GSA 18 S.W. Adriatic Sea	C					■	■	■	■	■				Casavola, Marano and Rizzi (1996)
	C					■	■	■	■					Zupa *et al.* (2013)
GSA 18 Lesina lagoon	C				■	■	■	■	■	■				Manzo *et al.* (2013)

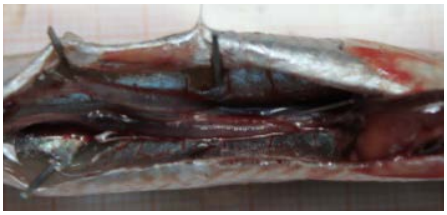
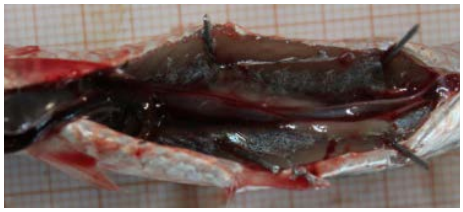
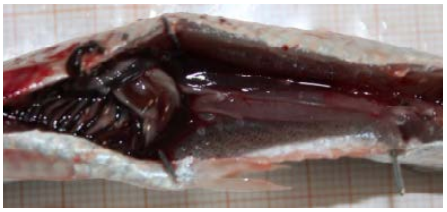
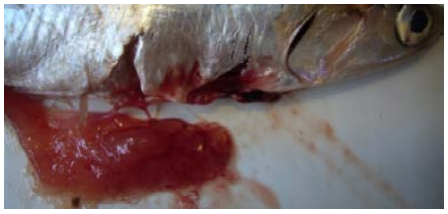
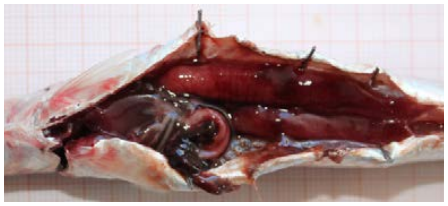
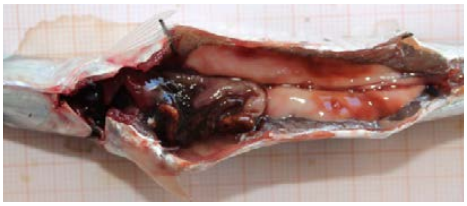
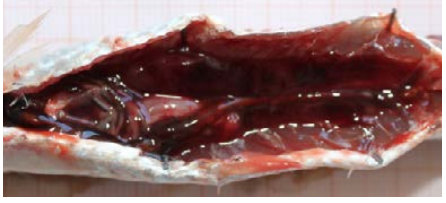
MATURITY

Geographic area	Sex	Size range TL, cm	Minimum lsize Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 1 Malaga	F			11.1	Giráldez and Abad (1995)
	M			11.4	
	C			11.3	
	F			10.8	
	M			10.3	
	C			10.5	
GSA 1 N. Alboran Sea	F			11.4	Giráldez (2009)
	M			10.7	
	C			11.4	
GSA 4 Algerian coast	F			11.6	Djabali, Mouloud and Hemida (1988)
	M			11.2	
	C			11.4	
	C			11.3	Bouaziz and Bennoui (2004)
GSA 4 E. Algeria	C			12.5	Mezedjiri, Kerfouf and Tahar (2013)
GSA 6 Catalan coast	F			12.5	Pertierra (1992)
	M			12.7	
	C			11.6	
	C			12.5	Ochoa-Báez (1998)
GSA 6 Tarragona	F			11.08	Palomera, Tejeir and Aleman (2003)
GSA 7 Gulf of Lion	C			13.0	Dorel (1986)
	F			12.78	Palomera, Tejeir and Aleman (2003)
	C			11.0	Bigot and Roos (2009)
GSA 12 N. Tunisia	C			8.3	Gaamour *et al.* (2004)
	C			7.3	MedSudMed (2004)
	F			8.3	Khemiri and Gaamour (2009)
	M			8.2	Khemiri and Gaamour (2009)
GSA 12 Gulf of Tunisia	F			6.9	
	M			7.1	Khemiri and Gaamour (2009)
GSA 12 E. Tunisia	F			7.5	Khemiri and Gaamour (2009)
	M			7.7	
GSA 12 S. Tunisia	F			6.1	Khemiri and Gaamour (2009)
	M			6.3	
GSA 13 Gulf of Hammamet	C			8.5	MedSudMed (2004)
GSA 14 Gulf of Gabès	C			7.5	MedSudMed (2004)

Table continues next page ➜

MATURITY (continued)

Geographic area	Sex	Size range TL, cm	Minimum lsize Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
	F			11.24	
GSA 16 Strait of Sicily	M			11.26	Basilone *et al.* (2006)
	C			11.27	
GSA 17 Adriatic Sea	C			9.0	Sinovčić (1998,1999)
GSA 17 N.C. Adriatic	F			8.14	Rampa *et al.* (2005)
GSA 17 Croatian waters	C			8.2	Sinovčić and Zorica (2006)
GSA 22 Aegean Sea	C			11.0	Somarakis and Machias (2000)
GSA 22 Aegean Sea	C			10.4	Somarakis *et al.* (2005)
GSA 20 E. Ionian Sea	C			10.5	Somarakis *et al.* (2005)
NE Atlantic Ocean					
	F	9.0-18.0		11.2	Millán (1999)(1989-1990 data)
	F	9.0-18.0		10.6	Millán (1999)(1991 data)
	F	9.0-18.0		10.7	Millán (1999)(1992 data)
IE 9.a Gulf of Cádiz	M	9.0-18.0		11.4	Millán (1999)(1989 data)
	M	9.0-18.0		11.2	Millán (1999)(1990 data)
	M	9.0-18.0		10.6	Millán (1999)(1991 data)
	M	9.0-18.0		10.7	Millán (1999)(1992 data)

Engraulis encrasicolus (FAO CODE: ANE – MEDITS CODE: ENGR ENC)			
STAGE	**MATURATION STATE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 15.4 cm; TW 21 g; ST: November; GSA 16	 TL 13.2 cm; TW 11 g; ST: November; GSA 16
2a	DEVELOPING VIRGIN	 TL 13.9 cm; TW 15 g; ST: November; GSA 16	 TL 12.9 cm; TW 14 g; ST: November; GSA 16
2b	RECOVERING	 TL13.0 cm; ST: February; GSA 17	 TL14.0 cm; TW 17 g; ST: October; GSA 16
2c	MATURING	 TL 15 cm; ST: May; GSA 17	 TL 15.6 cm; TW 25 g; ST: October; GSA 16
3	MATURE/ SPAWNER	 TL 14 cm; ST: April; GSA 17	 TL 12 cm; ST: May; GSA 17
4a	SPENT	 TL 16.2 cm; TW 29 g; ST: October; GSA 16	 TL 15.6 cm; TW 25 g; ST: October; GSA 16
4b	RESTING	 TL 16.9 cm; TW 30 g; ST: October; GSA 16	 TL 13 cm; ST: January; GSA 17

Order: Gadiformes **Family: Merlucciidae**

***Merluccius merluccius* (Linnaeus, 1758)**

Photo by S.Vittori

FAO CODE: HKE

MEDITS CODE: MERL MER

Common name:
European hake (English)
Merlu (French)
Nasello (Italian)
Merluza (Spanish)

GEOGRAPHIC DISTRIBUTION

European hake is geographically distributed throughout the northeast Atlantic from Norway in the north (around 70° north latitude) to the Guinea Gulf in the south (around 40° south latitude) (Casey and Pereiro, 1995; FAO-MiPAF, 2006). Longitudinally, the European hake can be found as far west as Iceland (around 27° west), and as far east as the Black Sea (40° east), having first colonized the whole Mediterranean Sea.

REPRODUCTION

Reproductive strategy: dioic. It is a partial batch-spawner (Pérez and Pereiro, 1985; Sarano, 1986) with indeterminate fecundity (Murua, Motos and Lucio, 1998) characterized by:

a) a continuum of oocyte sizes in the ovary of mature females during the whole reproductive season (no gap between immature and vitellogenic oocytes);
b) high asynchrony;
c) a steady level of total fecundity during the spawning cycle.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 4 Algeria	C													Bouaziz (1992)
	C													Bouaziz *et al.* (1998)
	C													Belhoucine (2012)
GSA 5 Balearic Sea	C													Oliver (1991)
	C													Reñones *et al.* (1995b)
GSA 6 Catalan Sea	F													Garcia-Rodriguez and Esteban (1995)
	M													
	C													Morales-Nin and Moranta (2004)
	F													Recasens, Chiericoni and Belcari (2008)
GSA 7 Gulf of Lion	C													Recasens (1992)
	F													Ferrer-Maza *et al.* (2014)
GSA 9 N. Tyrrhenian Sea	C													Biagi *et al.* (1995)
	C													Belcari, Ligas and Viva (2006)
	F													Recasens, Chiericoni and Belcari (2008)

Table continues next page ➜

SPAWNING PERIOD (continued)

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSAs 12, 13, 14 Tunisia	C													Heldt (1952)
	C													Bouhlal (1973)
GSA 10 C.S. Tyrrhenian Sea	C													Donnaloia (2008)
GSA 17 N.C. Adriatic Sea	C													Zupanovic and Jardas (1986)
	C													Arneri and Morales-Nin (2000)
	C													Dulčić, Soldo and Jardas (2005)
GSA 18 S. Adriatic Sea	C													Ungaro, Rizzi and Marano (1993)
	C													Donnaloia *et al.* (2012)
GSA 19 W. Ionian Sea	C													Donnaloia (2008)
GSA 20 E. Ionian Sea	C													Mytilenou and Vassipoulou (1988)
GSA 22 Aegean Sea	C													Papaconstantonou, Petrakis and Vassipoulou (1986)
GSA 26 Egypt	F													Al -Absawy (2010)
Black Sea														
GSA 29 Turkey	C													Slastenenko (1956)
N.E. Atlantic Ocean														
Ireland	C													Lannin (2006)
IEs 7, 6, 4, 2	C													ICES (2007)
IEs 7.h, 7.g Celtic Sea	C													Fives *et al.* (2001)
IE 8 Bay of Biscay	C													Meriel-Bussy (1966)
	C													Sarano (1986)
	C													ICES(1990)
	C													Martin(1991)
	F													Murua, Motos and Lucio (1998)
	C													Lucio, Murua and Santurtun (2000)
	C													Alvarez *et al.* (2004)
	F													Murua and Motos (2006)
IE 9.a Portuguese coast	F													Costa (2013)
IE 9.a Gulf of Cádiz														Silva *et al.* (2007)
IEs 9.a, 8.c Iberian waters	F													Monteiro and Lima Dias (1965)
	C													Perez and Pereiro (1981; 1985)
	C													ICES (1982)
	C													Alcazar *et al.* (1983)
	F													
	M													ICES(1983)#
	C													
	F													Piñeiro and Sainza (2003)
	M													
	C													Domínguez-Petit (2007)

Peak of spawning period

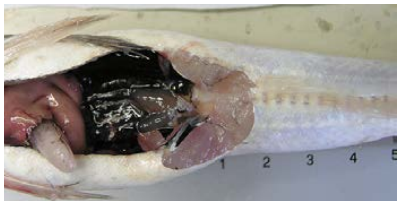
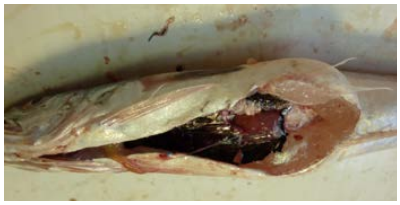
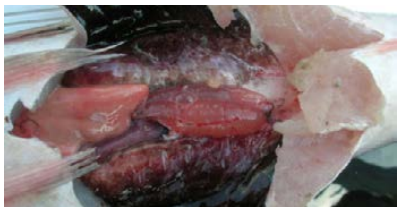
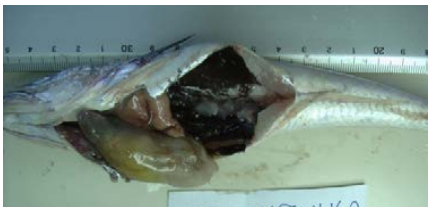
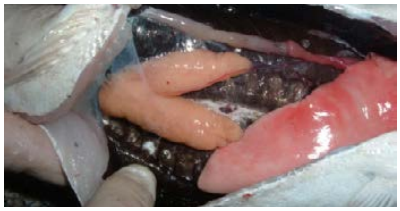
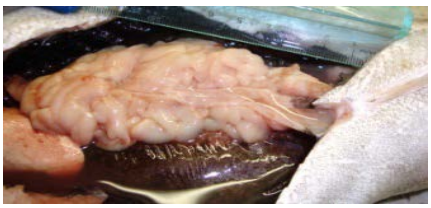
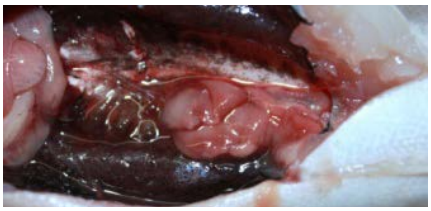
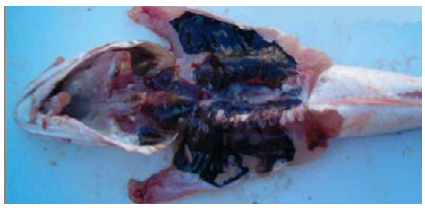
MATURITY

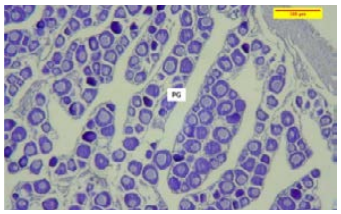
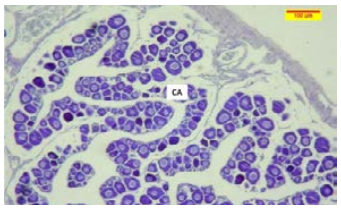
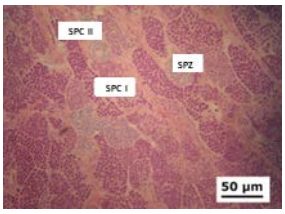
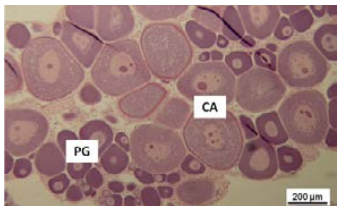
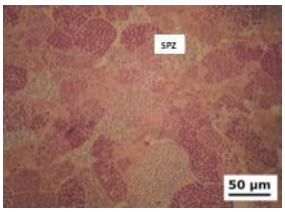
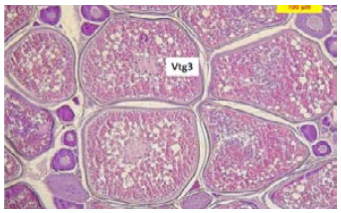
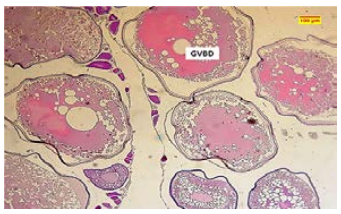
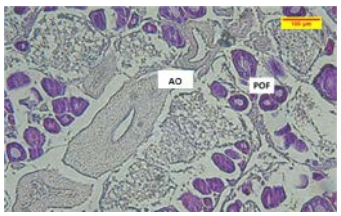
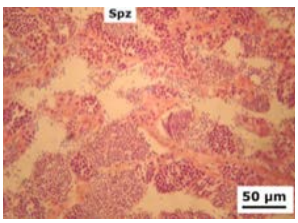
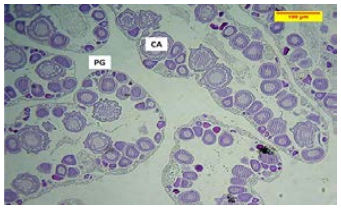
Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
W. Mediterranean Sea	F			18.0-41	Alheit and Pticher (1995)
	M			18-35	
GSA 3 Morocco	C	11.0-66.0		33.6	Zoubi (2001)
GSA 4 Algeria	F			30.6	Bouaziz *et al.* (1998)
	M			21.5	
	F	7.5-65.5		30.5	Bouaziz, Bennoui and Brahmi (2001)
	F			33.5	Belhoucine (2012)
	M			20.5	
GSA 5 Balearic Sea	F			36.3	Oliver (1991)
	M			27.6	
	F	25.0-60.0		36.3	Reñones *et al.* (1995b)
	M	15.0-45.0		27.0	
	F			36.0	Bruno *et al.* (2006)
	M			27.0	
GSA 6 Catalan Sea	F			39.0	Sànchez and Martìn (1985)
	M			32.0	
	F	11.5-68		31.0	Garcia-Rodriguez and Esteban (1995)
	M	13.5-62.5		25.0	
	F			35.8	Recasens, Chiericoni and Belcari (2008)
GSA 7 Gulf of Lion	F			43.0	Aldebert and Carries (1989)
	F			42.0	Campillo (1992b)
	F			38.0	Recasens *et al.* (1998)
	M			28.8	
	F			38.6	SAMED (2003)
GSA 9 N. Tyrrhenian Sea	F			42.5	Biagi *et al.* (1995)
	M			27.0	
	F			35.1	Sbrana *et al.* (2007)
	F			35.1	Recasens, Chiericoni and Belcari (2008)
GSAs 12, 13, 14 Tunisian waters	F			29.0	MedSudMed (2008)
	M			21.5	
GSA 10 C.S. Tyrrhenian Sea	F			33.8	Donnaloia (2008)
GSA 16 Strait of Sicily	F			33.5	SAMED(2003)
	F			33.5	Ragonese *et al.* (2004a)
	M			24.7	
GSA 17 N.C. Adriatic Sea	M	9.0-60.0		29.5	Jukic and Piccinetti (1981)
	C			25.0-30.0	Flamigni (1982)
	F			23.0-33.0	Zupanovic and Jardas (1986)
	M			20.0-28.0	
	C			24.0	Cetinić (1999)
	F			34.7	SAMED (2003)
GSA 18 S. Adriatic Sea	F			33.7	Donnaloia (2008)
GSA 19 W. Ionian Sea	F			34.6	Donnaloia (2008)
GSA 21 Libya	F	14.0-44.0		26.5	Mugahid and Hashem (1982)
	M	13.0-41.0		29.0	
E. Mediterranean Sea	F			30.0-39.0	Alheit and Pticher (1995)
	M			22.0-32.0	

Table continues next page ➜

MATURITY (continued)

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
GSAs 20, 22, 23 Greek waters	F			36.0	Stergiou *et al.* (1997)
GSA 26 Egypt	F	25.0-43.0		32.5	Al-Absawy (2010)
N.E. Atlantic Ocean					
N. Atlantic Ocean	F			41.0	Domínguez-Petit *et al.* (2008)
IE 9.a Portuguese coast	F			>38.0	Costa (2013)
IEs 9.a, 8.c. Iberian waters	F	40.0-86.0		57.7	Monteiro and Lima Dias (1965)
	F			32.2	Larrañeta (1970)
	M			24.3	
	F			49.0	ICES (1982) (data of March-June 1981)
	M			33.0	
	F			56.0	ICES (1982) (data of Jan-Dec1981)
	M			39.0	
	F			54.0	Alcazar *et al.* (1983)
	M			40.0-44.0	
	F			49.0	ICES (1983)
	M			32.0	
	F	25.0-75.0		47.0-58.0	Pérez and Pereiro (1985)
	M	25.0-65.0		36.5-39.5	
	F			58.0	ICES (1986) (data of Apr-Dec1980)
	M			39.5	
	F			49.5	ICES (1986) (data of Jan-Sep1981)
	F			47.0	ICES (1986) (data of Jan-Jun 1982)
	F			46.0	
	F			55.5	ICES (1986) (data of June 1983)
	F			45.0	ICES (1986) (data of Jan-June 1984)
	F			47.0	ICES (1986) (data of Jan-June 1985)
	F			58.0	ICES (1986) (data of -June 1984)
	M			31.6	ICES (1986) (data of -June 1983)
	M			28.6	ICES (1986) (data of -June 1984)
	M			37.0	ICES (1986) (data of Jan-Sep1981)
	M			36.5	ICES (1986) (data of Jan-June 1982)
	M			37.0	ICES (1986) (data of Jan-June 1984)
	C			39.0	ICES (1987)
	F	15.0-78.0		45.4	Piñeiro and Sainza (2003)
	M	15.0-60.0		32.8	
	C	6.0-78.0		37.9	
	F			46.0	Domínguez-Petit *et al.* (2008)
IE 8 Bay of Biscay	F			54.0-57.0	Meriel-Bussy (1966)
	M			36.0-37.0	
	F	12.0-85.0		50.4	Anonymous (1986)
	M	12.0-85.0		38.4	ICES (1986)
	F			59.2	ICES (1990)
	M			33.1	
	F	20.0-75.0		50.5	Martin (1991)
	M	20.0-62.0		37.7	
	F			48.8	Lucio, Murua and Santurtun (2000)
	M			37.8	
	C			42.0	

Merluccius merluccius (FAO CODE: HKE – MEDITS CODE: MERL MER)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 19.4 cm; TW 55 g; ST: February; GSA 11	 TL 18.0 cm; TW 50 g; ST: February ; GSA 11
2a	DEVELOPING VIRGIN	 TL 26.0 cm; TW 117 g; ST: December; GSA 17	 TL 22.5 cm; TW 135 g; ST: February; GSA 11
2b	RECOVERING	 TL 50.5 cm; TW 1000 g; ST: September; GSA 9	 TL 27.7 cm; TW 159; ST: February; GSA 11
2c	MATURING	 TL 60.7 cm; TW 1550g; ST: October; GSA 11	 TL 29.5 cm; TW 195 g; ST: June; GSA 17
3	MATURE/ SPAWNER	 TL 25.0/40.5 cm; TW 127/508 g; ST: July/ September; GSA 10-18	 TL 45.0 cm; TW 658 g; ST: September; GSA 10-18
4a	SPENT	 TL 61.5 cm; TW 1820 g; ST: July; GSA 10-18	 TL 28.5 cm; TW 175 g; ST: December; GSA 10-18
4b	RESTING	 GSA 9	 TL 28.0 cm, GSA 9

Merluccius merluccius (FAO CODE: HKE – MEDITS CODE: MERL MER)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**	 GSA 10-18 (H and E)	
2a	**DEVELOPING VIRGIN**	 GSA 10-18 (H and E)	 GSA 11 (H and E)
2b	**RECOVERING**	 GSA 11 (H and E)	 GSA 11 (H and E)
2c	**MATURING**	 GSA 10-18 (H and E)	
3	**MATURE/ SPAWNER**	 GSA 10-18 (H and E)	
4a	**SPENT**	 GSA 10-18 (H and E)	 GSA 11 (H and E)
4b	**RESTING**	 GSA 10-18 (H and E)	

Order: Gadiformes **Family: Gadidae**

Micromesistius poutassou **(Risso, 1827)**

Photo by E. Beccornia

FAO CODE: WHB

MEDITS CODE: MICM POU

Common name:
Blue whiting (English)
Merlan bleu (French)
Melù (Italian)
Bacaladilla (Spanish)

GEOGRAPHIC DISTRIBUTION

It is concentrated in the northeast Atlantic Ocean (south of Barents Sea through the eastern Norwegian Sea, around Iceland), and in the western Mediterranean, and south along the African coast to Cape Bojador. In the Northwest Atlantic Ocean, it is present in the southern Greenland and off southeast Canada and the northeastern coast of the United States of America.

REPRODUCTION

Reproductive strategy: dioic, external fertilization. Batch spawner.

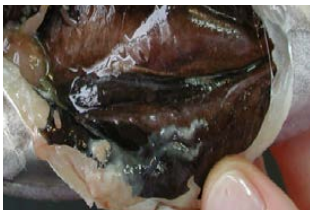
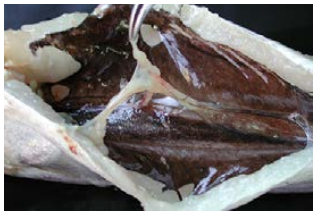
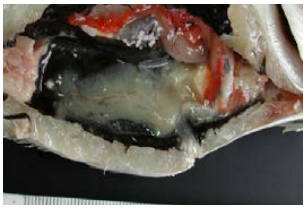
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 9 Ligurian Sea	C													Gualini (1938)
	C													Orsi Relini and Peirano (1982, 1985)
GSA 9 Tyrrhenian Sea	F													Chiericoni, De Ranieri and Sartor (1996)
	M													
	C													Sbrana, Chiericoni Biagi (1998)
GSA 17 C. Adriatic Sea	C													Froglia and Gramitto (1981b)
GSA18 S. Adriatic Sea	C													Martino *et al.* (2001)
GSA 19 W. Ionian Sea	C													Matarrese *et al.* (1998)
	C													Giovanardi Romanelli and Fanelli (1989)
N.E. Atlantic Ocean														
Ireland	C													Hickling (1927)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F			19.4	Matta (1959)
	M			19.2	
GSA 9 Ligurian Sea	C			22.0	Orsi Relini and Peirano (1982; 1985)
GSA 17 C. Adriatic Sea	C			21.0	Froglia and Gramitto (1981b)
GSA 19 W. Ionian Sea	F			26.0-28.0	Matarrese *et al.* (1998)
	M			22.0-24.0	
N.E. Atlantic Ocean					
IE 7.b W. Ireland	C			20.0	Polonsky (1966)
IE 7.a Scottish waters	C			20.0	Raitt (1966)

Micromesistius poutassou (FAO CODE: WHB – MEDITS CODE: MICM POU)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		 TL 14.1 cm; TW 18 g; ST: June; GSA 19
2a	DEVELOPING VIRGIN	 TL 13.5 cm; TW 17 g; ST: July; GSA 19	 TL 23.8 cm; TW 98 g; ST: June; GSA 19
2b	RECOVERING	 TL 30.0 cm; TW 170 g; ST: September; GSA 9	
2c	MATURING	 TL 33.0 cm; ST: January; GSA 10-18	 TL 24.4 cm; TW 116 g; ST: June; GSA 19
3	MATURE/ SPAWNER	 TL 33.0 cm; ST: January; GSA 10-18	 TL 28.5 cm; ST: January; GSA 10-18
4a	SPENT	 TL 30.5 cm; TW 205 g; ST: June; GSA 19	 TL 28 cm; TW 143 g; ST: December; GSA 9
4b	RESTING	 GSA 19	

Order: Gadiformes **Family: Gadidae**

Phycis blennoides (Brünnich, 1768)

Photo by A. Mannini

FAO CODE: GFB

MEDITS CODE: PHYI BLE

Common name:
Greater forkbeard (English)
Moustelle blanche (French)
Musdea (Italian)
Bacaladilla (Spanish)

GEOGRAPHIC DISTRIBUTION

The greater forkbeard is a common gadoid found in the Mediterranean and in the northeastern Atlantic Ocean, from Iceland to Morocco (Fischer, Bauchot and Schneider, 1987; Whitehead, 1985).

REPRODUCTION

Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 4 W. Algeria	F													Benghali *et al.* (2014)
GSA 5 Balearic Sea	F													Rotllant *et al.* (2002)
	M													
GSA 6 Catalan Sea	C													Massutí, Morales-Nin and Lloris (1996)
GSA 9 S.E. Ligurian Sea	F													Rustighi, Casotti and Voliani (2004)
	M													
GSA 9 N. Tyrrhenian Sea	F													Farnocchia Nannini and De Ranieri (2001)
GSA 19 Ionian Sea	F													Tursi *et al.* (1995)
GSA 19 N.W. Ionian Sea	F													Matarrese *et al.* (1998)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 4 W. Algeria	F			24.73	Benghali *et al.* (2014)
GSA 5 Balearic Sea	F		20.0		Rotllant *et al.* (2002)
	M		19.0		
GSA 19 N.W. Ionian Sea	F		61.3		Matarrese *et al.* (1998)
	M		19.0		
N.E. Atlantic Ocean					
N. Atlantic Ocean	F			33.0	Cohen *et al.* (1990)
	M			18.0	

Phycis blennoides (FAO CODE: GFB – MEDITS CODE: PHYI BLE)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 18.4 cm; TW 33.1 g; ST: January; GSA 11	
2a	DEVELOPING VIRGIN	 TL 21.7 cm; TW 54 g; ST: September; GSA 11	
2b	RECOVERING	 TL 56.0 cm; TW 1500 g; ST: September; GSA 9	 GSA 19
2c	MATURING		 TL 20.0 cm; TW 60 g; ST: September; GSA 9
3	MATURE/ SPAWNER	 TL 48.3 cm; TW 1201 g; ST: June; GSA 19	 TL 18.5 cm; TW 48 g; ST: September; GSA 9
4a	SPENT		
4b	RESTING		

Order: Lophiiformes **Family: Lophiidae**

Lophius budegassa (Spinola, 1807)

Photo by A. Mulas

FAO CODE: ANK

MEDITS CODE: LOPH BUD

Common name:
Black anglerfish (English)
Baudroie rousse (French)
Budego (Italian)
Rape negro (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the northeastern Atlantic, from the British Isles to Senegal and throughout the Mediterranean Sea (Knudsen, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization. Group-synchronous oocyte development, determinate fecundity.

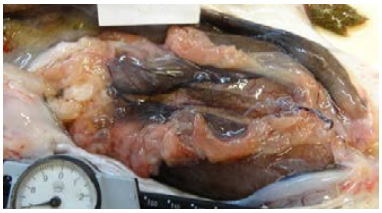
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 6 Catalan coast	F													Colmenero *et al.* (2013)
	M													
GSA 10 C.S. Tyrrhenian Sea	F													Carbonara *et al.* (2005)
	M													
GSA 17 Adriatic Sea	C													La Mesa and De Rossi (2008)
GSA 19 N.W. Ionian Sea	C													Carlucci *et al.* (2009)
GSA 20 Greek waters	F													Maravelias, Haralabous and Papaconstantinou (2003)
GSA 22 Aegean Sea	F													Tsimenidis (1980)
	F													Yigin, Ismenand Arslan (2015)
	M													
N.E. Atlantic Ocean														
N.E. Atlantic	C													Landa *et al.* (2014)
IEs 9.a, 8.c Iberian coast	C													Azevedo (1996)
	F													Duarte *et al.* (2001)
IE 8 Bay of Biscay	F													Quincoces, Santurtun and Lucio (1998)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F	1.0-95.0		66.2	Ungaro *et al.* (2002)
GSA 6 N.W. Mediterranean	F	20.0-72.5		48.2	Colmenero *et al.* (2013)
	M	20.0-72.5		33.4	
GSA 19 N.W. Ionian Sea	F	8.0-114.0	30.5		Carlucci *et al.* (2009)
	M	10.0-93.0	17.0		
GSA 22 Aegean Sea	F			34.0	Tsimenidis (1980)
	M			24.0	
	F	17.1-107.0		58.8	Yigin, Ismenand Arslan (2015)
	M	15.7-75.7		42.5	
NE Atlantic Ocean					
N.E. Atlantic	F			53.0	Landa *et al.* (2014)
	M			36.0	
	C	4.0-99.0		38.2	
IEs 9.a, 8.c Iberian coast	F			56.2	Azevedo (1996)
	M			37.6	
	F	13.0-89.0		53.6	Duarte *et al.* (2001)
	M	14.0-67.0		38.6	
	C	13.0-89.0		44.7	
IE 8 Bay of Biscay	F			65.4	Quincoces, Santurtun and Lucio (1998)
	M			36.0	
	F			58.7	Quincoces (2002)
	M			41.0	
IE 6.a Scottish waters	F			70.4	Laurenson, Dobby and Mclay (2008)
	M			49.4	

Lophius budegassa (FAO CODE: ANK – MEDITS CODE: LOPH BUD)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 28.0 cm; TW 297 g; ST: August; GSA 10-18	 TL 17.5 cm; TW 66 g; ST: July; GSA 11
2a	DEVELOPING VIRGIN	 TL 32.0 cm; ST: August; GSA 10-18	 TL 16 cm; TW 59 g; ST: November; GSA 19
2b	RECOVERING	 TL 59.0 cm; ST: July; GSA 10-18	 TL 21.0 cm; TW 107 g; ST: July; GSA 10-18
2c	MATURING	 TL 28.8 cm; TW 352 g; ST: June; GSA 19	 TL 30.0 cm; TW 358 g; ST: August; GSA 11
3	MATURE/ SPAWNER	 TL 48.5 cm; TW 1912 g; ST: January; GSA 10-18	 TL 48.2 cm; TW 1491 g; ST: November; GSA 11
4a	SPENT	 TL 50.8 cm; TW 2038 g; ST: June; GSA 11	 TL 31.0 cm; TW 360 g; ST: July; GSA 11
4b	RESTING	 TL 61.0 cm; TW 2786 g; ST: November; GSA 11	

Order: Perciformes **Family: Carangidae**

***Trachurus mediterraneus* (Steindachner, 1868)**

Photo by C. Porcu

FAO CODE: HMM

MEDITS CODE: TRAC MED

Common name:
Mediterranean horse mackerel (English);
Chinchard à queue jaune (French);
Sugarello maggiore (Italian);
Jurel mediterráneo (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the eastern Atlantic Ocean from the Bay of Biscay to Mauritania including the Mediterranean Sea. The subspecies *Trachurus mediterraneus ponticus* is found in the Sea of Marmara and the Black Sea, and the southern and western parts of the Azov Sea (Smith-Vaniz, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization, multiple spawner, asynchronous oocyte development, indeterminate fecundity.

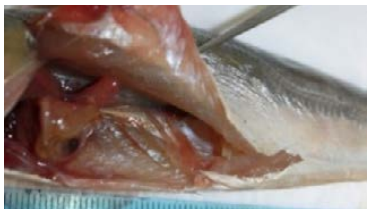
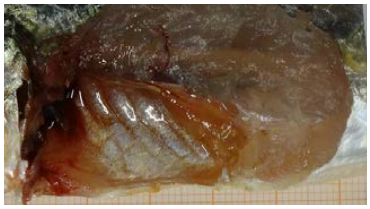
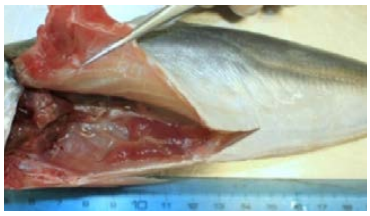
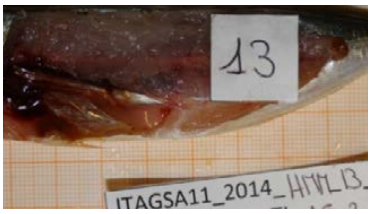
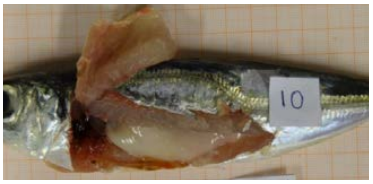
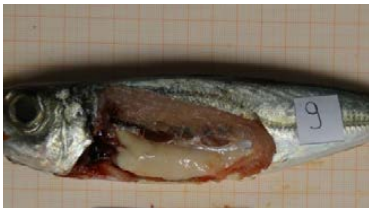
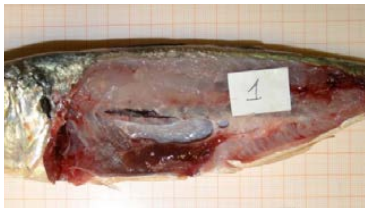
SPAWNING PERIOD

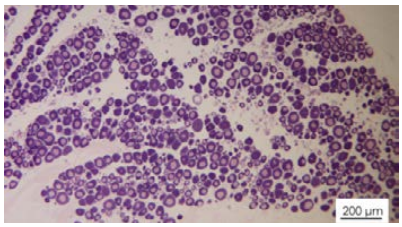
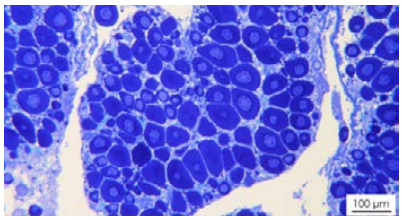
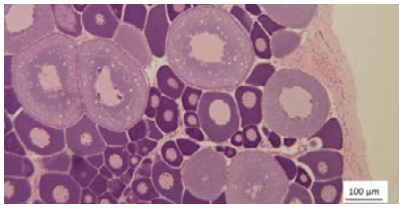
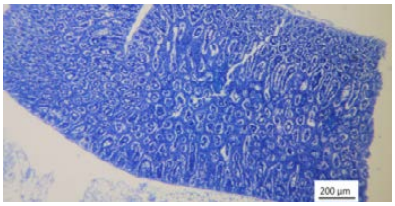
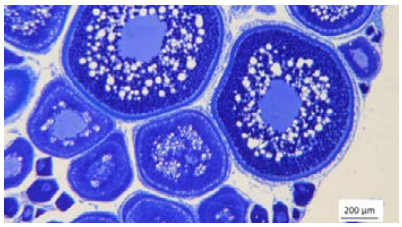
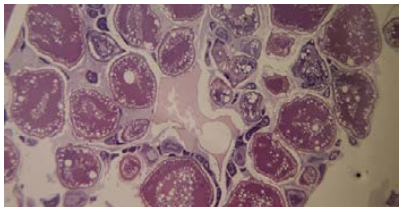
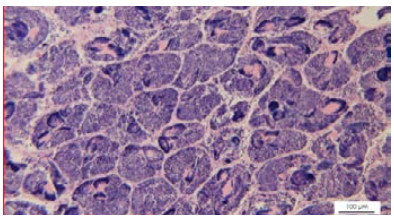
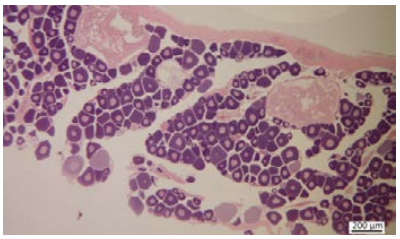
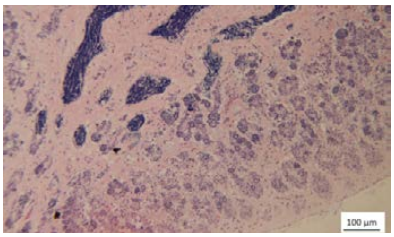
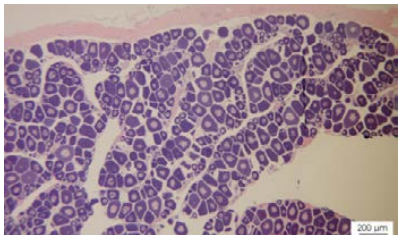
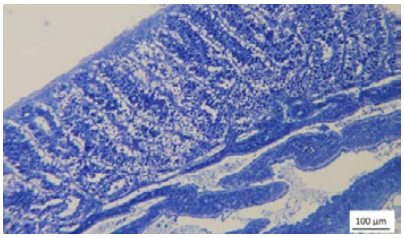
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
	C													Carrillo (1978)
GSA 6 Catalan coast	C													Sabatés (1990)
	C													Casaponsa (1993)
GSA 9 N. Tyrrhenian Sea	C													Nannini , Sbrana and Ranieri (1997)
GSA 17 Gulf of Trieste	C													Viette *et al.* (1997)
GSA 17 E. Adriatic	C													Santic, Pallaoro and Jardas (2006)
GSA 22 Saronikos Gulf	C													Karlou-Riga (2000)
GSA 28 Sea of Marmara	F													Demirel and Yüksek (2013)
	M													
GSA 29 E. Black Sea	C													Şahin *et al.* (2009)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 6 Spanish waters	C			16.0	IEO (2009) Internal report
	F			15.0	MEDISEH (2013)
GSA 7 Gulf of Lion	F			16.5	MEDISEH (2013)
GSA 8 Corsica	F			15.5	MEDISEH (2013)
GSA 9 Ligurian Sea	F			16.0	MEDISEH (2013)
GSA 9, 10 Tyrrhenian Sea	F			16.0	SAMED (2002)
GSA 10 C.S. Tyrrhenian	F			16.0	MEDISEH (2013)
GSA 11 Sardinian Seas	F			15.5	MEDISEH (2013)
GSAs 15, 16 Strait of Sicily and Malta	F			14.5	MEDISEH (2013)
GSA 16 Strait of Sicily	F			16.0	SAMED (2002)
GSA 17 N. Adriatic	F			15.0	MEDISEH (2013)
GSA 18 S. Adriatic	F			15.5	MEDISEH (2013)
GSA 20 E. Ionian	F			14.0	MEDISEH (2013)
GSA 22 Aegean Sea	F			20.0	Stergiou *et al.* (1997)
	F			13.3	SAMED (2002)
GSA 22, 23 Aegean and Crete	F			16.0	MEDISEH (2013)
GSA 28 Sea of Marmara	F			12.2	Demirel and Yüksek (2013)
	M			12.5	

Trachurus mediterraneus (FAO CODE: HMM – MEDITS CODE: TRAC MED)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 16.0 cm; TW 30 g; ST: August; GSA 10-18	
2a	DEVELOPING VIRGIN	 TL 15.2 cm; TW 26 g; ST: October; GSA 11	 TL 15.3 cm; TW 29 g; ST: July; GSA 11
2b	RECOVERING	 TL 30.0 cm; TW 191 g; ST: December; GSA 10-18	 TL 15.2 cm; TW 30 g; ST: July; GSA 11
2c	MATURING	 TL 24.5 cm; ST: August; GSA 10-18	 TL 19.2 cm; TW 55 g; ST: May; GSA 11
3	MATURE/ SPAWNER	 TL 31.5 cm; ST: August; GSA 10-18	 TL 23.5 cm; TW 87 g; ST: July; GSA 11
4a	SPENT	 TL 24.5 cm; ST: August; GSA 10-18	 TL 29.5 cm; TW 199 g; ST: August; GSA 10-18
4b	RESTING	 TL 29.0 cm; TW 196 g; ST: July; GSA 11	 TL 24.0 cm; TW 103 g; ST: July; GSA 11

Trachurus mediterraneus (FAO CODE: HMM – MEDITS CODE: TRAC MED)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)	
2a	DEVELOPING VIRGIN	 GSA 11 (BT)	
2b	RECOVERING	 GSA 11 (H and E)	 GSA 11 (BT)
2c	MATURING	 GSA 11 (BT)	
3	MATURE/ SPAWNER	 GSA 11 (H and E)	 GSA 11 (H and E)
4a	SPENT	 GSA 11 (H and E)	 GSA 11 (H and E)
4b	RESTING	 GSA 11 (H and E)	 GSA 11 (BT)

Order: Perciformes **Family: Carangidae** ***Trachurus trachurus* (Linnaeus 1758)**

Photo by C. Porcu

FAO CODE: HOM

MEDITS CODE: TRACTRA

Common name:
Atlantic horse mackerel (English)
Chinchard d'Europe (French)
Sugarello (Italian)
Jurel (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the northeast Atlantic Ocean and adjacent areas, and commonly on the continental shelf, from the West African Cabo Verde Islands (Crawford, 1987), northward to the Norwegian Sea and North Sea (Knijn *et al.*, 1993), including Iceland, as well as in the Mediterranean Sea (Fischer, 1973) and the Black Sea (Shiganova, 1998).

REPRODUCTION

Reproductive strategy: dioic, external fertilization, multiple spawner.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 3 Moroccan waters	F													Gail (1954)
GSA 4 Algerian waters	C													Korichi (1988)
GSA 6 Catalan coast	C													Carrillo (1978)
	C													Casaponsa (1993)
GSA 9 Tuscan coast	C													Nannini, Sbrana and Ranieri (1997)
GSA 12 Tunisian waters	C													Ben Salem and Ktari (1980)
GSA 17 N.C. Adriatic Sea	C													Alegría-Hernández (1994)
GSA 18 S. Adriatic Sea	C													Carbonara *et al.* (2012)
GSA 22 Gulf of Saronikos	C													Karlou-Riga and Economidis (1996)
Black Sea														
GSA 29 Ordu	C													Aydin and Karadurmus (2012)
N.E. Atlantic Ocean														
IE 9 Portugal	F													Barraca (1964)
	F													Borges and Gordo (1991)
	F													Borges, Dinis and Monteiro (1977)
IE 8 Bay of Biscay	F													Arbault and Lacroix-Boutin (1969)
	F													Nazarov and Dobrusin (1977)
	F													Lucio and Martín (1989)

Table continues next page ➜

SPAWNING PERIOD (continued)

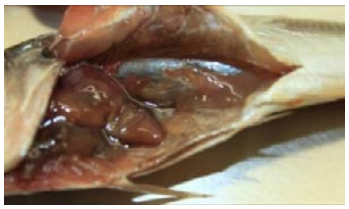
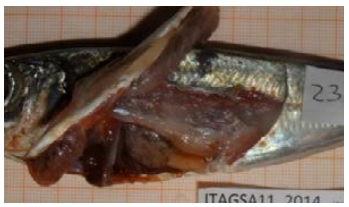
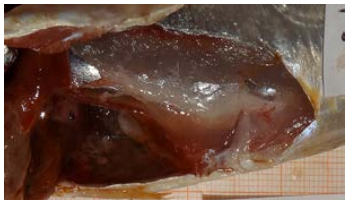
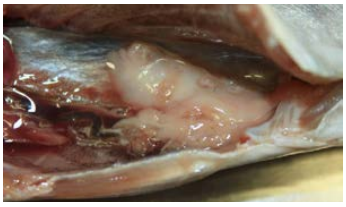
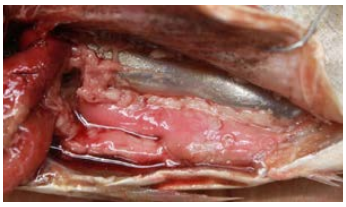
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
IE 8.c N. Spain	F													Anadón (1960)
	F													Solá *et al.* (1990)
IE 7.e, 7.d English Channel, IE 4 North Sea	F													Polonsky and Tormosova (1969)
	F													Sahrhage (1970)
	F													Macer (1974)
	F													Eltink (1991;1992)
IE 4.c Belgian coast	F													Letaconnoux (1951)

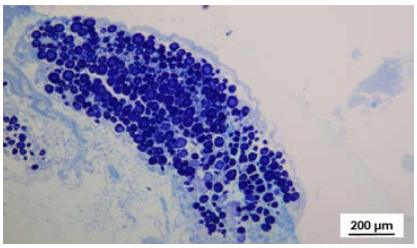
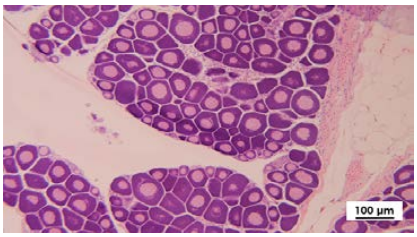
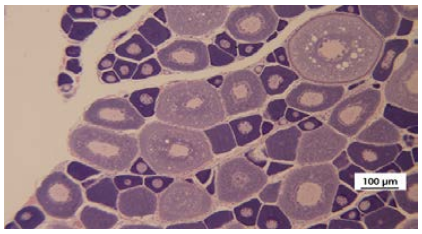
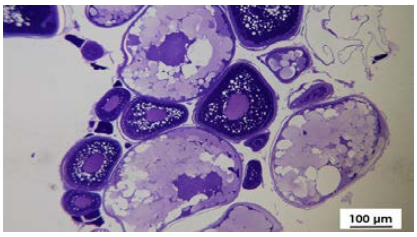
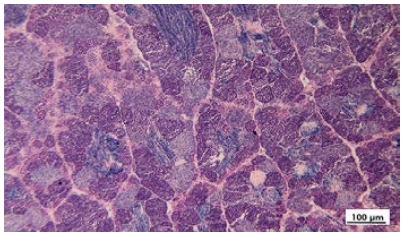
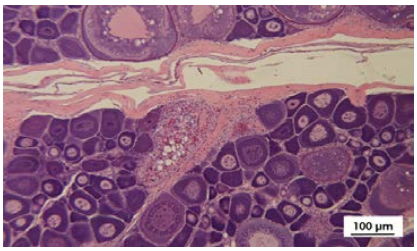
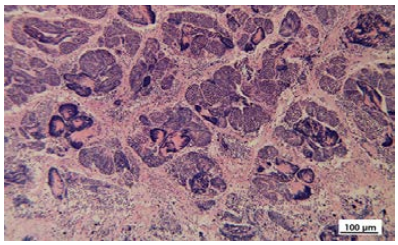
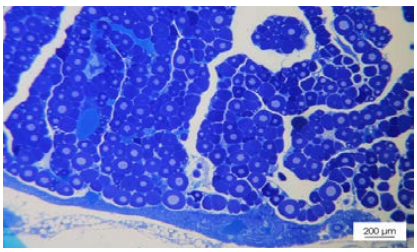
Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 6 N.W. Spanish coast	F			19.5	SAMED (2002)
GSA 6 Spanish coast	F			16.8	MEDISEH (2013)
GSA 7 Gulf of Lion	F			18.5	MEDISEH (2013)
GSA 8 Corsica	F			17.9	MEDISEH (2013)
GSA 9 Ligurian Sea	F			18.6	MEDISEH (2013)
GSA 10 C.S. Tyrrhenian Sea	F			18.9	Carbonara *et al.* (2012)
	M			17.8	
	F			18.5	MEDISEH (2013)
GSA 11 Sardinia Seas	F			18.0	MEDISEH (2013)
GSAs 15, 16 Malta – Strait of Sicily	F			18.0	MEDISEH (2013)
GSA 17 N. Adriatic Sea	F			15.0	MEDISEH (2013)
GSA 18 S. Adriatic Sea	F			18.1	SAMED (2002)
	F			20.0	Carbonara *et al.* (2012)
	M			17.7	
	F			18.5	MEDISEH (2013)
GSA 19 W. Ionian Sea	F			20.6	Carbonara *et al.* (2012)
	M			17.6	
GSA 20 E. Ionian Sea	F			16.0	MEDISEH (2013)
GSA 22 Gulf of Saronikós	F			22.0	Karlou-Riga and Economidis (1996)
GSA 22 Aegean Sea	F			21.0	Stergiou *et al.* (1997)
GSAs 22, 23 Aegean Sea and Crete	F			16.0	MEDISEH (2013)
N.E. Atlantic Ocean					
IE 9 Portugal	C			19.0*	Barraca (1964)
	C			22.5	Borges and Gordo (1991)
IE 8 Bay of Biscay	F			20.6	Lucio and Martín (1989)
	M			20.1	
IE 8.c N. Spain	C			25.0	Anadòn (1960)
	F			21.9	Abaunza, Fariña and Carrera (1995)
	M			20.9	
IEs 7.h, 7.g, 7.a Irish and Celtic Seas	F			25.4	Kerstan (1985)
	M			22.3	
IEs 7.e, 7.d English Channel, IE 4 North Sea	C			20.0-24.0*	Polonsky and Tormosova (1969)
	C			18.0-19.0	Sahrhage (1970)
	C			20.0-24.0	Macer (1974)
IE 4.c Belgian coast	C			19.0-23.0	Letaconnoux (1951)

*Fork length.

Trachurus trachurus (FAO CODE: HOM – MEDITS CODE: TRAC TRA)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 14.2 cm; TW 22 g; ST: December; GSA 10-18	
2a	DEVELOPING VIRGIN	 TL 18.6 cm; TW 48 g; ST: November; GSA 11	 TL 12.5 cm; TW 16 g; ST: June; GSA 19
2b	RECOVERING	 TL 20.5 cm; TW 63 g; ST: November; GSA 11	
2c	MATURING		 TL 27.0 cm; TW 149 g; ST: December; GSA 10-18
3	MATURE/ SPAWNER	 TL 21.0 cm; TW 80 g; ST: March; GSA 11	 TL 21.6 cm; TW 96 g; ST: June; GSA 19
4a	SPENT	 TL 24.5 cm; TW 130 g; ST: March; GSA 11	 TL 26.5 cm; TW 154 g; ST: November; GSA10-18
4b	RESTING	 TL 28.0 cm; TW 156 g; ST: November; GSA 10-18	 TL 23.6 cm; TW 92 g; ST: August; GSA 11

Trachurus trachurus (FAO CODE: HOM – MEDITS CODE: TRAC TRA)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 GSA 11 (BT)	
2a	DEVELOPING VIRGIN	 GSA 11 (H and E)	
2b	RECOVERING	 GSA 11 (H and E)	
2c	MATURING		
3	MATURE/ SPAWNER	 GSA 11 (BT)	 GSA 11 (H and E)
4a	SPENT	 GSA 11 (H and E)	 GSA 11 (H and E)
4b	RESTING	 GSA 11 (BT)	

Order: Perciformes **Family: Centracanthidae** ***Spicara flexuosa* (Rafinesque, 1810)**

Photo by A. Mulas

FAO CODE: SPF

MEDITS CODE: SPIC FLE

Common name:
Picarel (English)
Gerle (French)
Garizzo (Italian)
Picarel (Spanish)

GEOGRAPHIC DISTRIBUTION

It occurs in all areas of the Italian waters (Relini and Lanteri, 2010), in the Mediterranean basin and in the Black Sea, and off-shore Portugal (Fischer, Bauchot and Schneider, 1987).

REPRODUCTION

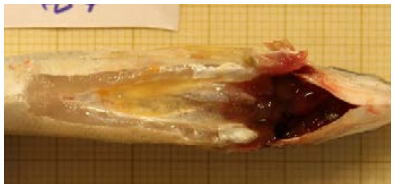
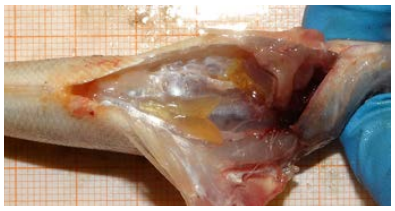
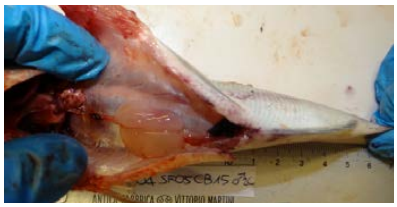
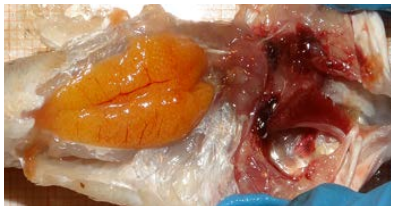
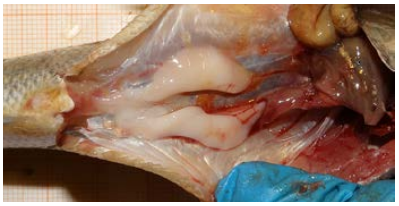
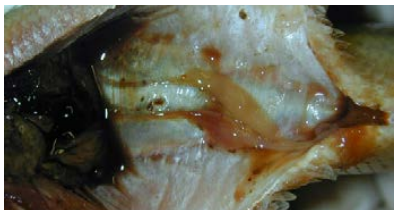
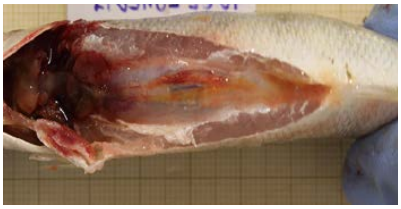
Reproductive strategy: sequential protogynous hermaphrodite species.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 9 Ligurian Sea	F													Zamboni and Relini (1986)
GSA 11 Sardinian Seas	F													Cau *et al.* (1994)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 9 Ligurian Sea	F			12.0	Zamboni and Relini (1986)
GSA 9 Ligurian Sea, N. Tyrrhenian Sea	F			11.4	Ragonese *et al.* (2004b)
GSA 10 S. Tyrrhenian Sea	F			15.3	
GSA 11 Sardinian Seas	F			13.4	Cau *et al.* (1994)
GSA 19 W. Ionian Sea	F			12.0	Ragonese *et al.* (2004)

Spicara flexuosa (FAO CODE: SPF – MEDITS CODE: SPIC FLE)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN	 TL 9.9 cm; TW 8 g; ST: November; GSA 11	 TL 10.9 cm; TW 9 g; ST: March; GSA 11
2b	RECOVERING	 TL 10.2 cm; TW 11.3 g; ST: May; GSA 11	 TL 11.0 cm; TW 13.5 g; ST: May; GSA 11
2c	MATURING	 TL 11.5 cm; TW 15.3 g; ST: May; GSA 11	 TL 11.9 cm; TW 14.8 g.; ST: June GSA 11
3	MATURE/ SPAWNER	 TL 12.7 cm; TW 20.6 g; ST: May; GSA 11	 TL 13.5 cm; TW 20.9 g; ST: May; GSA 11
4a	SPENT	 TL 14.3 cm; TW 28 g; ST: June; GSA 10-18	 GSA 10-18
4b	RESTING	 TL 16.3 cm; TW 38 g; ST: November; GSA 11	 TL 17.5 cm; TW 45 g; ST: March; GSA 11

ORDER: Perciformes **FAMILY: Mullidae**

Mullus barbatus (Linnaeus, 1758)

Photo by A. Mulas

FAO CODE: MUT

MEDITS CODE: MULL BAR

Common name:
Red mullet (English)
Rouget barbet (French)
Triglia di fango (Italian)
Roger (Spanish)

GEOGRAPHIC DISTRIBUTION:

It is common throughout the eastern Atlantic Oceanand the Mediterranean basin, including the Black Sea. It is also found in the Azores Islands (Carpenter *et al.*, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 2 Alboran Sea	C													Del Arbol, Rey and Gil De Sola (2004)
GSA 3 Morocco	C													Aguirre Villaseñor (2000)
	F													Slimani, Elouamari and Hamdi (2003)
	C													Layachi *et al.* (2007)
GSA 4 Algeria	F													Lalami (1971)
GSA 6 Castello (Spain)	F													Larraneta and Rodriguez-Roda (1956)
GSA 6 N. Spain	F													Ferrer-Maza *et al.* (2015)
GSA 7 Gulf of Lion	F													Bougis (1952)
GSA 9 N. Tyrrhenian Sea	F													De Ranieri (1979)
GSA 9 Ligurian Sea	F													Orsi Relini and Arnaldi (1986)
GSA 9 Tuscan coast	C													Voliani, Abella and Serena (1998)
GSA 9 Tyrrhenian Sea	F													Fiorentino *et al.* (1998)
GSA 9 Tuscan archipelago	F													Menini *et al.* (2001)
GSA 10 S. Tyrrhenian Sea	F													Micale *et al.* (2007)
GSA 11 Sardinian Seas	F													Pesci (2006)
GSAs 12, 13, 14 Tunisia	F													Gharbi and Ktari (1981)
GSA 12 Tunisia	F													Cherif *et al.* (2007)
	M													
GSA 16 N.W. Sicily	F													Sieli *et al.* (2011)

Table continues next page ➜

SPAWNING PERIOD (continued)

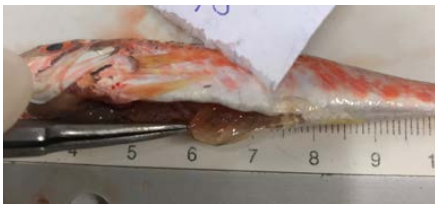
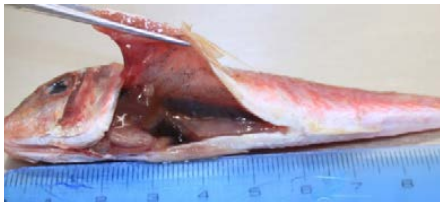
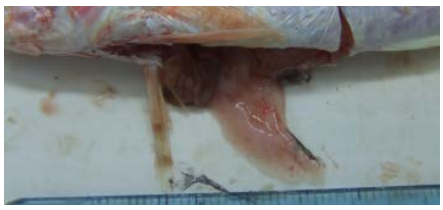
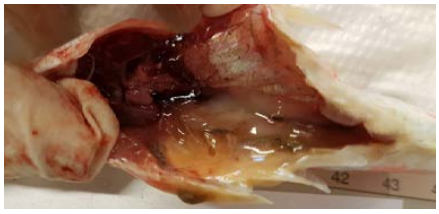
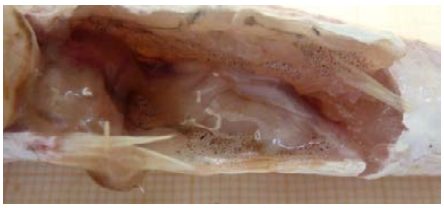
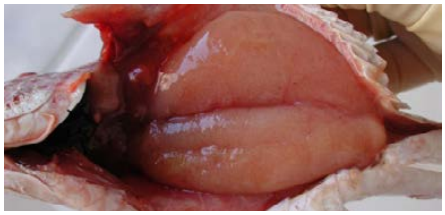
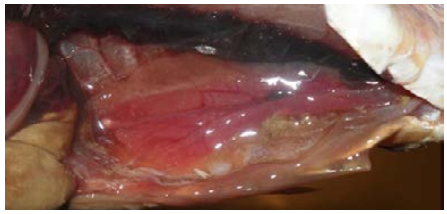
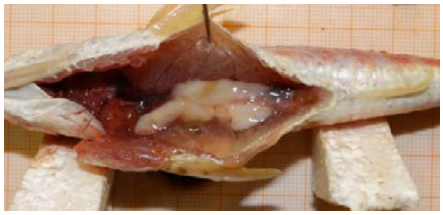
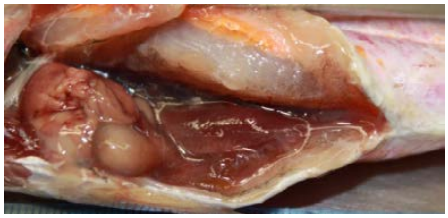
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSA 17 E. Adriatic Sea	F													Haidar (1958; 1970)
GSA 17 Adriatic Sea	C													Jukic and Piccinetti (1981)
	F													Guescini, Piccinetti Manfrin and Piccinetti (1983)
GSA 18 S. Adriatic Sea	F													Carbonara *et al.* (2015)
GSA 19 Ionian Sea	F													Tursi *et al.* (1994)
GSA 22 N. Aegean Sea	F													Papaconstantinou *et al.* (1981)
	F													Celik and Torcu (2000)
	F													Kokokiris *et al.* (2014)
	F													Arslan and Ismen (2014)
GSA 22 Aegean Sea	F													Vassilopoulou and Papacostantinou (1991)
	F													Vassilopoulou (1992)
	C													Vrantzas, Kalagia and Karlou (1992)
GSA 22 Izmir Bay	F													Metin (2005)
GSA 24 Turkey	F													Akyuz (1957)
GSA 24 Gulf of Antalya	C													Balci *et al.* (2005)
GSA 25 Cyprus	F													Livadas (1989a)
GSA 26 Egypt	C													Ezzat, Hosny and Osman (1997)
GSA 26 Egypt	F													Hashem (1973a)
GSA 27 Israel	F													Wirszubsky (1953)

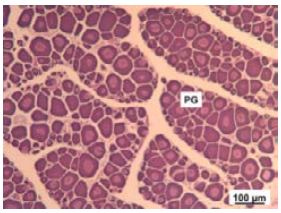
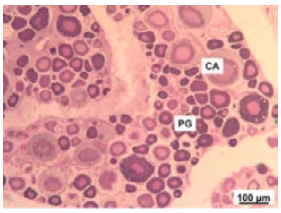
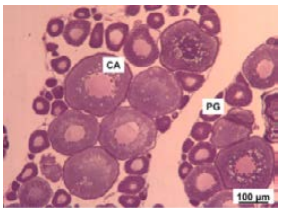
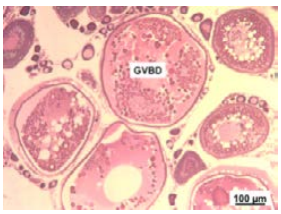
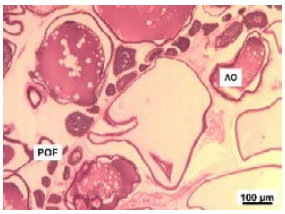
Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 2 Alboran Sea	F	max 23.0		12.2	Del Arbol, Rey and Gil De Sola (2004)
	M			11.7	
GSA 3 Morocco	C	13.6-24.6		14.3	Zoubi (2001)
	F	max 23.0		11.0	Slimani, Elouamari and Hamdi (2003)
	F			13.8	Layachi *et al.* (2007)
	M			10.3	
GSA 7 Gulf of Lion	F			13.0-14.0	Bougis (1952)
GSA 9 Tuscan coast	C			12.0	Voliani, Abella and Serena (1998)
GSA 10 S. Tyrrhenian Sea	F			13.0	Micale *et al.* (2007)
	M			11.15	
GSA 12 Tunisia	F	9.7-25.1		13.94	Cherif *et al.* (2007)
	M	10.6-21.2		13.87	
GSAs 12, 13, 14 Tunisia	F			13.0-14.4 (FL)	Gharbi and Ktari (1981)
GSA 16 Strait of Sicily	F			12.2	Ragonese *et al.* (2004a)
	M			10.1	
GSA 17 N.E. Adriatic Sea	F			12.0	Haïdar (1970)
	M			10.5	
GSA 17 Adriatic Sea	F	12.3-18.0		10.5	Jukic and Piccinetti (1981)
	M	10.0-15.4		10.5	
GSA 18 Montenegrin coast	C			13.5	Joksimovic (2005)
GSA 18 S. Adriatic Sea	F			12.2	Intini (2013)
	M			10.1	
GSA 18 S. Adriatic Sea	F			12.2	Carbonara *et al.* (2015)
	M			10.1	
GSA 19 Ionian Sea	F			13.5	Tursi *et al.* (1994)
GSA 20 E. Ionian Sea	F	max 26.0		14.0	Vassipoulou (1987)
	M	max 20.4		15.5	
	F	max 22.6		12.9	
	M	max 20.4		15.2	
	F	max 24.9		12.2	
	M	max 20.4		14.9	
GSA 22 N. Aegean Sea	F			12.0-13.0 (FL)	Papacostantinou *et al.* (1981)
	F			11.4	Kokokiris *et al.* (2014)
	F	9.2-23.6		11.9	Arslan and Ismen (2014)
	M	8.8-24.1		12.1	
GSA 22 Aegean Sea	F			10.4	Vassipoulou (1989)
	M			9.4	
	F	6.8-26.0		11.8	Vassipoulou and Papacostantinou (1991)
	M	6.8-22.6		10.6	
GSA 22 C. Aegean Sea	F			11.2 (FL)	Vassipoulou (1992)
GSA 22 İzmir Bay	F			14.2	Metin (2005)
	M			12.4	

FL, Fork length.

Mullus barbatus (FAO CODE: MUT – MEDITS CODE: MULL BAR)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 9.0 cm; TW 10 g; ST: November; GSA 11	 TL 9.0 cm; TW 9 g; ST: November; GSA 11
2a	DEVELOPING VIRGIN	 TL 12.0 cm; TW 18 g; ST: November; GSA 10-18	 TL 11.1 cm; TW 13 g; ST: May; GSA 17
2b	RECOVERING	 TL 16.5 cm; TW 49 g; ST: February; GSA 11	 TL 12.2 cm; TW 19 g; ST: November; GSA 11
2c	MATURING	 TL 15.5 cm; TW 43 g; ST: May; GSA 10-18	 TL 11.1 cm; TW 13 g; ST: February; GSA 17
3	MATURE/ SPAWNER	 TL 14.4 cm; TW 31 g; ST: June; GSA 19	 TL 13.7 cm; TW 28 g; ST: June; GSA 19
4a	SPENT	 TL 15.0 cm; TW 41 g; ST: August; GSA 10-18	 TL 15.8cm; TW 38 g; ST: July; GSA 11
4b	RESTING	 TL 17.0 cm; TW 50 g; ST: October; GSA 10-18	 TL 15.3 cm; TW 37 g; ST: July; GSA 11

Mullus barbatus (FAO CODE: MUT – MEDITS CODE: MULL BAR)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)
2a	DEVELOPING VIRGIN	 GSA 11 (H and E)
2b	RECOVERING	 GSA 11 (H and E)
2c	MATURING	 GSA 11 (H and E)
3	MATURE/ SPAWNER	 GSA 11 (H and E)
4a	SPENT	 GSA 11 (H and E)
4b	RESTING	

Order: Perciformes **Family: Mullidae**

***Mullus surmuletus* (Linnaeus, 1758)**

Photo by C. Porcu

FAO CODE: MUR

MEDITS CODE: MULL SUR

Common name:
Red mullet (English)
Rouget de roche (French)
Triglia rossa (Italian)
Salmonete de roche (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed throughout the entire Mediterranean and in the Black Sea, and from Norway and the English Channel to Dakar, Senegal, including Madeira and the Canary islands (Carpenter *et al.*, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization.

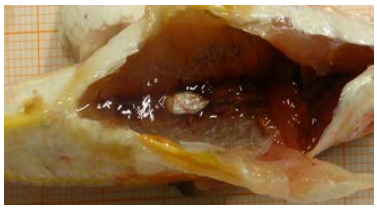
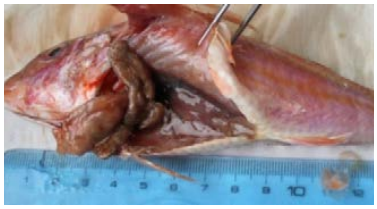
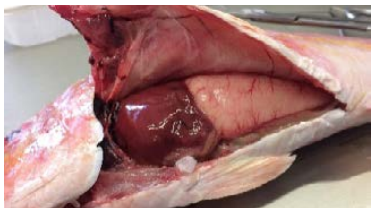
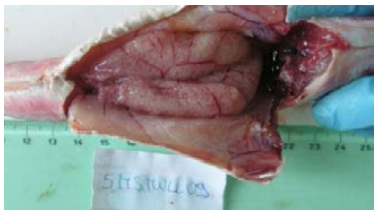
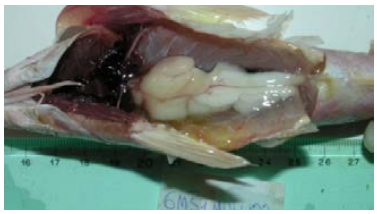
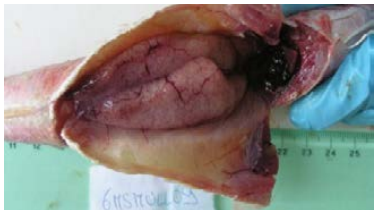
SPAWNING PERIOD

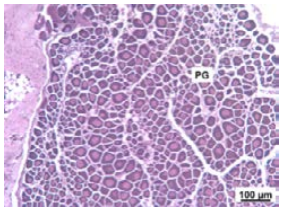
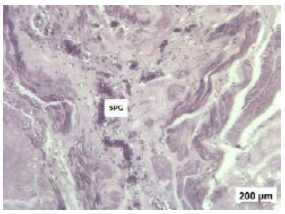
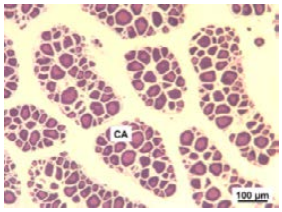
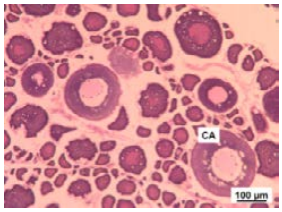
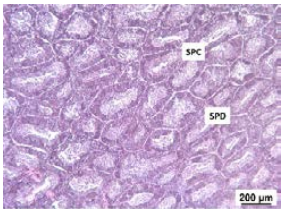
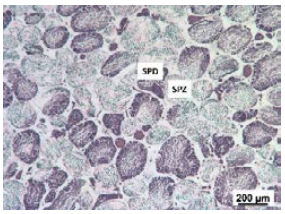
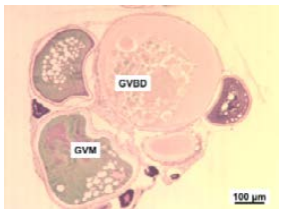
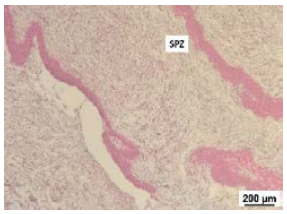
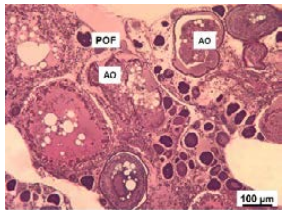
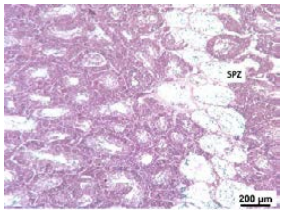
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 3 N.W. Morocco	C													El Bakali, Talbaoui and Bendriss (2010)
GSA 3 Morocco	C													Lamrini (2010)
GSA 4 Algerian coast	C													Lalami (1971)
GSA 5 Balearic Sea	C													Morales-Nin (1992)
	C													Reñones, Massuti and Morales-Nin (1995a)
GSA 7 Gulf of Lion	C													Lloret, Lleonart and Solé (2000)
GSAs 12, 13, 14 Tunisia	C													Gharbi and Ktari (1981)
GSA 12 Gulf of Tunis	C													Chérif *et al.* (2007)
GSA 16 Strait of Sicily	C													Ragonese *et al.* (2004a)
GSA 17 Adriatic Sea	C													Jardas (1996)
	C													Grubišic (1962)
GSA 22 Izmir Bay	C													Ak and Hossucu (2001)
	C													İlhan *et al.* (2009)
GSA 22 Edremit Bay	C													Üstün, Torcu-Koç and Zerdoğan (2010)
GSA 22 N.E. Aegean Sea	C													Arslan and Ismen (2014)
GSA 26 Egyptian waters	C													Hashem (1973b)
	C													Mehana (2009)
GSA 27 Israel	C													Golani (1994)
N.E. Atlantic Ocean														
IE 8 Bay of Biscay	C													N'Da (1992)+
IE 7.e, 7.d English Channel	C													Mahé *et al.* (2013)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 3 N.W. Marocco	F			16.5	El Bakali, Talbaoui and Bendriss (2010)
	M			15.3	
	C			16.3	
GSA 3 Morocco	F			17.8	Lamrini (2010)
	M			16.7	
GSA 5 Balearic Sea	C			15.0	Oliver and Morillas (1992)
	F			15.0	Morales-Nin (1992)
	M			17.0	
	C	9.5-27.0		15.5	
	F			16.8	Reñones, Massuti and Morales-Nin (1995a)
	M			15.0	
	C			14.0	Massutí *et al.* (2005)
GSAs 12, 13, 14 Tunisian coast	F	8.0 -23.0		15.5	Gharbi and Ktari (1981)+
	M	8.0 -23.0		13.0	
GSA 12 Gulf of Tunis	F			16.4	Chérif *et al.* (2007)
	M			16.0	
GSA 16 Strait of Sicily	F			19.5	Ragonese *et al.* (2004a)
GSA 22 Aegean Sea	F			15.5	Vassilopoulou and Papaconstantinou (1995)
	M			11.9	
	F			15.7	Stergiou *et al.* (1997)
GSA 22 N.E. Aegean Sea	F			13.7	Arslan and Ismen (2014)
	M			13.2	
GSA 26 Egyptian waters	F			15.0	Hashem (1973b)
	M			13.0	
	C		11.6	15.1	Mehana (2009)
	F			11.5	Alsayes *et al.* (2010)
	M			12.5	
N.E. Atlantic Ocean					
IE 8 Bay of Biscay	C	16.6-43.5		15.5	N'Da (1992)
IE 7.e, 7.d English Channel	F	15.5-18.9		16.9	Mahé *et al.* (2013)
	M	14.7-17.1		16.2	

Mullus surmuletus (FAO CODE: MUR – MEDITS CODE: MULL SUR)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN	 TL 14.2 cm; TW 31 g; ST: June; GSA 11	 TL 15.5 cm; TW 49 g; ST: October; GSA 9
2b	RECOVERING	 TL 18.0 cm; TW 78 g; ST: October; GSA 10-18	 TL 18.0 cm; TW 91 g; ST: October; GSA 9
2c	MATURING	 TL 17.0 cm; TW 62 g; ST: March; GSA 18	
3	MATURE/ SPAWNER	 TL 24.0 cm; TW 145 g; ST: April; GSA 11	 TL 21.0 cm; TW 94 g; ST: April; GSA 11
4a	SPENT	 TL 23.5 cm; TW 153 g; ST: April; GSA 11	 TL 19.0 cm; TW 79 g; ST: April; GSA 11
4b	RESTING	 TL 19.5 cm; TW 88 g; ST: October; GSA 10-18	 TL 19.5 cm; TW 98 g; ST: October; GSA 10-18

Mullus surmuletus (FAO CODE: MUR – MEDITS CODE: MULL SUR)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 GSA 11 (H and E)	 GSA 11 (H and E)
2a	DEVELOPING VIRGIN	 GSA 11 (H and E)	
2b	RECOVERING	 GSA 11 (H and E)	 GSA 11 (H and E)
2c	MATURING	 GSA 11 (H and E)	 GSA 11 (TM)
3	MATURE/ SPAWNER	 GSA 11 (TM)	 GSA 11 (H and E)
4a	SPENT	 GSA 11 (H and E)	 GSA 11 (H and E)
4b	RESTING		

Order: Perciformes **Family: Scombridae**

Scomber colias (Gmelin, 1789)

Photo by A. Mulas

FAO CODE: MAZ

MEDITS CODE: SCOM PNE

Common name:
Atlantic chub mackerel (English)
Maquereau blanc (French)
Sgombro (Italian)
Estornino del Atlántico (Spanish)

GEOGRAPHIC DISTRIBUTION

This species is present in the Atlantic Ocean and the Mediterranean and Black Sea; it is replaced by *Scomber japonicus* in the Indo-Pacific. In the Atlantic, the range of this species is not continuous between the east and west, and the north and south. Atlantic species should be considered separate stocks or populations (Collette *et al.*, 2011).

REPRODUCTION

Reproductive strategy: Dioic, external fertilization.

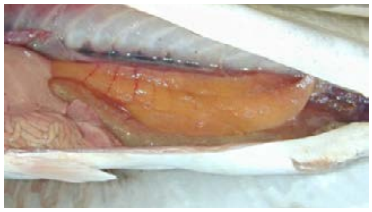
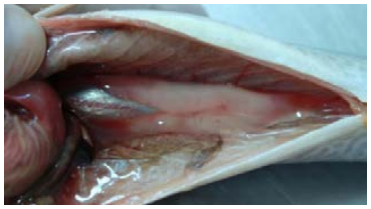
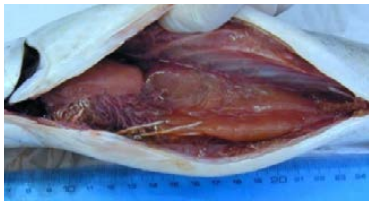
SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 17 N. Adriatic Sea	C													Mužinić (1979)
GSA 17 E. Adriatic Sea	C													Cikeš Keč and Zorica (2012)
GSA 22 N. Aegean Sea	C													Cengiz (2012)
GSA 28 Marmara Sea	C													Tuggac (1957)
Black Sea														
GSA 29 Turkey	C													Atli (1962)
Atlantic Ocean														
IE 10 Azorean waters	C													Westhaus-Ekau and Ekau (1982)
	C													Carvalho, Perrotta and Isidro (2002)
IE 9.a Portugal	C													Martins, Jorge and Gordo (1983)
	C													Martins (1996)
IE 8 Bay of Biscay	C													Lucio (1993; 1997)

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 17 N. Adriatic Sea	C			26 (FL)	Mužinić (1979)
GSA 17 E. Adriatic Sea	C			18.3	Cikeš Keč and Zorica (2012)
GSA 22 N. Aegean Sea	C			18	Cengiz (2012)
N.E. Atlantic Ocean					
IE 10 Azores Archipelago	C			27.8	Carvalho, Perrotta and Isidro (2002)
IE 9.a Portugal	C			27	Martins (1996)
IE 8 Bay of Biscay	F			29.9	Lucio (1997)
	M			30.8	

Scomber colias (FAO CODE: MAZ – MEDITS CODE: SCOM PNE)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN		
2b	RECOVERING	 TL 30.6 cm; TW 255 g; ST: November; GSA 11	 TL 26.0 cm; TW 154 g; ST: March; GSA 18
2c	MATURING	 TL 40 cm; TW 665 g; ST: March; GSA 10-18	 TL 24 cm; TW 127 g; ST: August; GSA 10-18
3	MATURE/ SPAWNER	 TL 35.5 cm; TW 383 g; ST: August; GSA 10-18	 TL 34 cm; TW 370 g; ST: July; GSA 9
4a	SPENT	 TL 42 cm; TW 670 g; ST: March; GSA 10-18	 TL 30.5 cm; TW 241 g; ST: August; GSA 10-18
4b	RESTING	 TL 28.5 cm; TW 193 g; ST: August; GSA 10-18	 TL 28.8 cm; TW 195 g; ST: October; GSA 11

Order: Perciformes **Family: Sparidae**

Boops boops (Linnaeus 1758)

Photo by A. Mulas

FAO CODE: BOG

MEDITS CODE: BOOP BOO

Common name:
Bogue (English)
Bogue (French)
Boga (Italian)
Boga (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the eastern Atlantic Ocean from southern Norway and the British Isles southward to Angola, including the Azores, Madeira, Canary Islands, Cabo Verde Islands, and Sao Tome and Principe. It is common throughout the Mediterranean and Black Seas (Russell, Carpenter and Pollard, 2014a).

REPRODUCTION

Reproductive strategy: gonochoric species as protogynous hermaphroditism.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
W. Mediterranean Sea	C													Whitehead *et al.* (1986)
GSA 3 Strait of Gibraltar (Morocco)	C													Lamrini (1998)*
GSA 1 Spain (Murcia)	C													Cano Fortuna and Sanchez Lizaso (1996)
GSA 4 Algerian coast	C													Dieuzede, Novella and Roland (1955)
	C													Chali-Chabane (1988)
	C													Bensahla Talet, Belaouda and Matoub (1990)
	F													Kerraz (2010)
GSA 6 Spain	C													Zuniga (1967)
GSA 7 Gulf of Lion	C													Girardin (1981)*
	C													Campillo (1992b)*
Italy	C													Bini (1968)
GSA 9 Tuscany (Italy)	C													Matta (1958)*
GSA 10 Italy (Gulf of Naples)	C													Lo Bianco (1909)
GSA 10 S. Tyrrhenian Sea	C													Bottari *et al.* (2014)
GSA 12, 13, 14 Tunisian coast	C													Anato and Ktari (1988)
GSA 17 Adriatic Sea (Croatia)	C													Alegria-Hernandez (1990)*
E. Mediterranean Sea	C													Whitehead *et al.* (1986)
Greek waters	C													Vidalis (1950)*
GSA 25 Cyprus	C													Livadas (1989b)*
GSA 26 Egypt (Alexandria)	C													El-Agamy *et al.* (2004)*
GSA 27 Lebanese coast	C													Mouneimne (1978)

Table continues next page ➜

SPAWNING PERIOD (continued)

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Black Sea														
GSA 29 Black Sea	C													Whitehead *et al.* (1986)
	C													Bauchot (1987)*
N.E. Atlantic Ocean														
Atlantic Ocean	C													Whitehead *et al.* (1986)
IE 9.a Peniche (Portugal)	C													Gordo(1995)*
IE 9.a Algarve (Portugal)	C													Gordo (1995)*
	C													Monteiro *et al.* (2006)*
C. E. Atlantic Ocean	C													Bauchot, Hureau and Miquel (1981)
E. Atlantic Ocean	C													Lloris *et al.* (1977)
E. Atlantic Ocean	C													Whitehead *et al.* (1986)

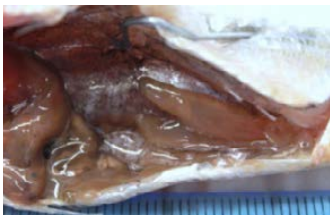
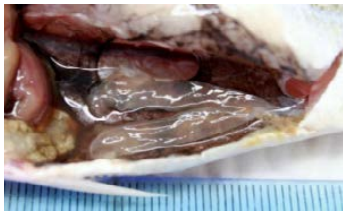
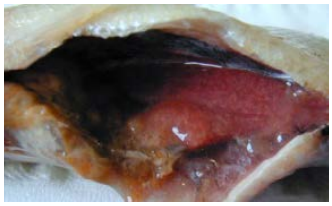
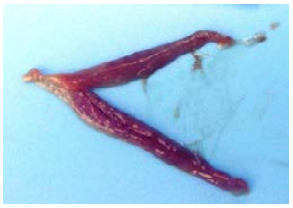
Peak of spawning period

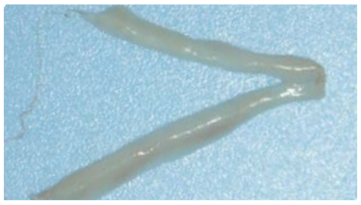
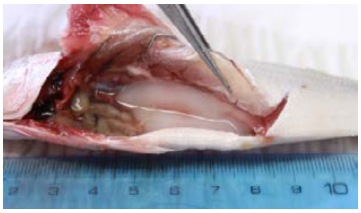
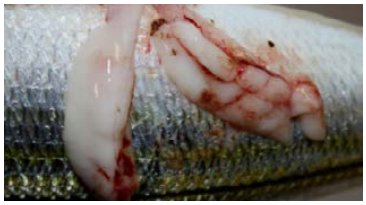
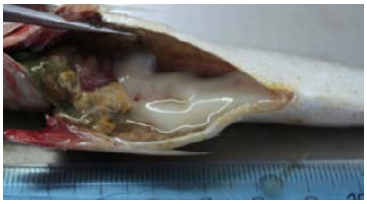
* in Bottari *et al.* (2014).

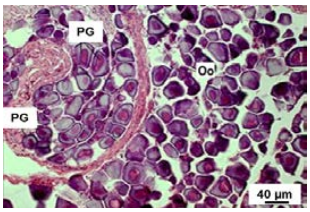
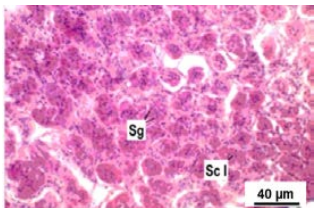
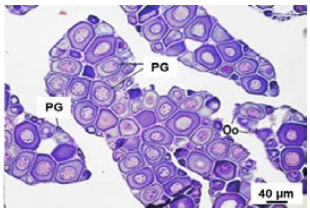
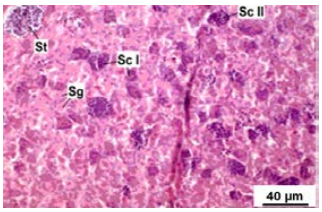
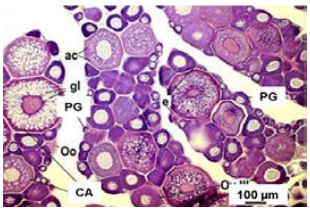
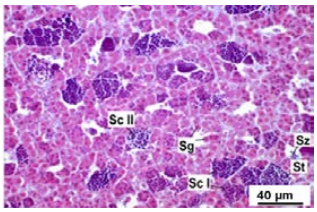
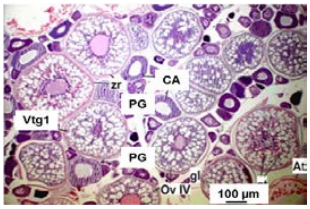
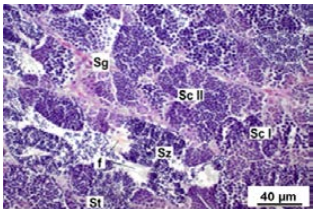
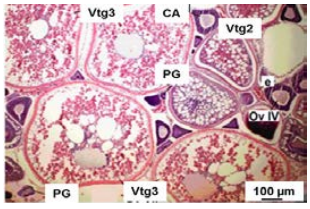
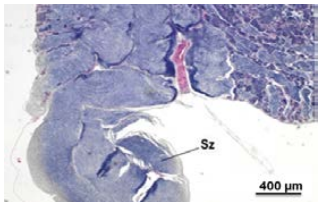
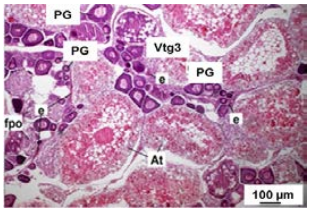
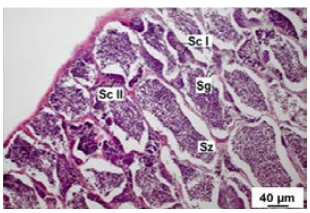
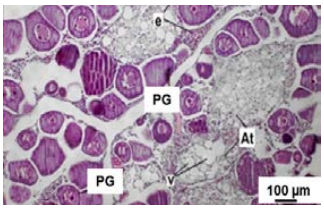
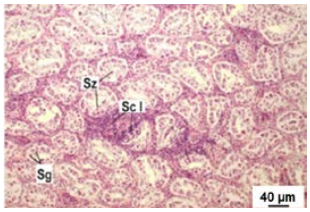
MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 1 Spain (Murcia)	F		10.0	10.2	Cano Fortuna and Sánchez Lizaso (1996)
GSA 3 Strait of Gilbraltar (Morocco)	C			15.3	Lamrini (1998)*
GSA 3 Marocco	C	12.2-25.6		17.1	Zoubi (2001)+
GSA 4 Algerian coast	F			13.0	Bouhniol and Pron (1916)*
	F	9.5-23.5		13.5	Chali-Chabane (1988)+
	F	13.3-27.0		14.1	Bensahla Talet, Belaouda and Matoub (1990)+
	F		11.6	17.1	Kerraz (2010)
GSA 7 Gulf of Lion	C		11.0	13.0-15.0	Girardin (1978)
	F			13.0	Girardin (1981)
	C			13.0	Campillo (1992b)*
GSA 9 Tuscany	F			13.5	Matta (1958)
GSA 10 S. Tyrrhenian Sea	F	7.9-33.0		13.1	Bottari *et al.* (2014)
	M	8.1-30.9		14.2	
	C	7.9-33.0		13.8	
GSA 17 Adriatic Sea (Croatia)	F	10.0-23.0		14.5	Alegria-Hernandez (1990)+
	M	9.0-20.0		13.2	
Greek waters	F			15.0	Vidalis (1950)*
	M			13.0	
GSA 23 Cretan Sea	F	11.0-18.0		13.8	Kallianiotis (1992)+
	M	9.5-18.0		13.3	
	F	10.0-18.0		12.0	
	M	9.0-18.0		11.9	
GSA 25 Cyprus	F			15.0	Livadas (1989b)*
	M			13.0	
GSA 26 Egypt(Alexandria)	F			12.0	El-Agamy *et al.* (2004)*
	M			13.0	
GSA 27 Lebanese coast	F			12.0	Mouneimne (1978)*
N.E. Atlantic Ocean					
IE 9.a Peniche (Portugal)	F			~15.0	Gordo (1995)*
	M			~14.0	
IE 9.a Algarve (Portugal)	F			~14.0	Gordo (1995)*
	M			~13.0	
	F			~15.8	Monteiro *et al.* (2006)*
	M			~15.5	

* in Bottari *et al.* (2014).

Boops boops (FAO CODE: BOG – MEDITS CODE: BOOP BOO)			
STAGE	**PHASE**	**FEMALES**	
1	IMMATURE VIRGIN	 TL 12.6 cm; TW 16 g; ST: December; GSA 10	
2a	DEVELOPING VIRGIN	 TL 14.5 cm; TW 25 g; ST: December; GSA 10-18	 TL 12.2 cm; TW 14 g; ST: December; GSA 10
2b	RECOVERING	 TL 15.5 cm; TW 33 g; ST: December; GSA 10-18	 TL 18.1 cm; TW 47 g; ST: December; GSA 10
2c	MATURING	 TL 15.5 cm; TW 36 g; ST: December; GSA 11	 TL 18.1 cm; TW 43 g; ST: March; GSA 10
3	MATURE/ SPAWNER	 TL 17.5 cm; TW 59 g; ST: March; GSA 11	 TL 19.4 cm; TW 67 g; ST: March; GSA 10
4a	SPENT	 TL 16.0 cm; TW 41 g; ST: March; GSA 10-18	 TL 14.4 cm; TW 30 g; ST: April; GSA 10
4b	RESTING	 TL 15.3 cm; TW 42 g; ST: December; GSA10	

Boops boops (FAO CODE: BOG – MEDITS CODE: BOOP BOO)		
STAGE	**PHASE**	**MALES**
1	IMMATURE VIRGIN	 TL 12.6 cm; TW 12 g; ST: December; GSA 10
2a	DEVELOPING VIRGIN	 TL 14.5 cm; TW 28 g; ST: October; GSA 10
2b	RECOVERING	 TL 14.5 cm; TW 26 g; ST: December; GSA 10
2c	MATURING	 TL 16.5 cm; TW 41 g; ST: December; GSA 10-18
3	MATURE/ SPAWNER	 TL 15.2 cm; TW 38 g; ST: April; GSA 10  TL 19.2 cm; TW 67 g; ST: March; GSA 10
4a	SPENT	 TL 15.5 cm; TW 30 g; ST: March; GSA 10-18
4b	RESTING	 TL 16.7 cm; TW 46 g; ST: August; GSA 10

Boops boops (FAO CODE: BOG – MEDITS CODE: BOOP BOO)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
2a	**VIRGIN DEVELOPING**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
2b	**RECOVERING**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
2c	**MATURING**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
3	**MATURE/ SPAWNER**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
4a	**SPENT**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**
4b	**RESTING**	 **GSA 10* (H and E)**	 **GSA 10* (H and E)**

*from Bottari *et al.* (2014).

Order: Perciformes **Family: Sparidae**

Pagellus acarne (Risso, 1827)

Photo by E. Beccornia

FAO CODE: SBA

MEDITS CODE: PAGE ACA

Common name:
Axillary seabream (English)
Pageot blanch (French)
Pagello bastardo (Italian)
Aligote (Spanish)

GEOGRAPHIC DISTRIBUTION

Pagellus acarne is present throughout the Mediterranean Sea and the Sea of Marmara, but not in the Black Sea. It is widely distributed in the eastern Atlantic Ocean and is found in the Straits of Gibraltar to northern Senegal including Madeira, the Canary Islands and the Cabo Verde islands. *P. acarne* is also recorded as being present in the Azores Islands and off the British Isles, where it is rare, and occasionally northward as far as Denmark and Norway.

REPRODUCTION

Reproductive strategy: protandrous hermaphroditic.

SPAWNING PERIOD

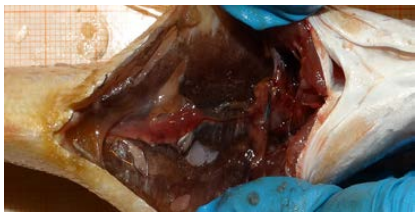
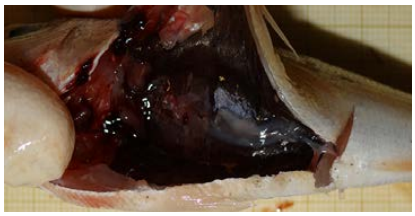
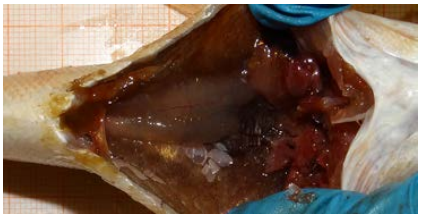
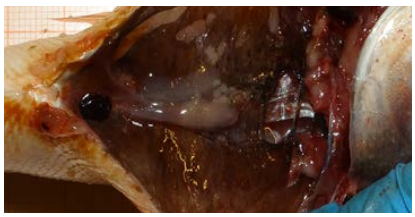
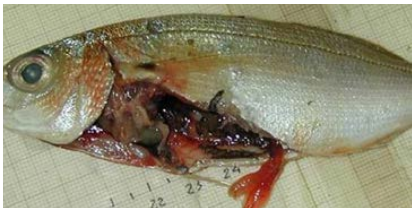
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
W. Mediterranean Sea	C													Bauchot and Hureau (1986)
GSA 1, 2 Alboran Sea	C													Velasco *et al.* (2011)
GSA 3 N.W. African coast	C													Le-Trong and Kompowski (1972)*
GSA 16 Strait of Sicily	C													Arculeo *et al.* (2000)
GSA 10, 19 S. Tyrrhenian Sea, N. Ionian Sea	C													Andaloro (1982)
E. Mediterranean Sea	C													Bauchot and Hureau (1986)
N.E. Atlantic Ocean														
Atlantic Ocean	C													Bauchot and Hureau (1986)
IE 9.a Algarve (S. Portugal)	C													Santos, Costa Monteiro and Erzini (1995)
IE 9.a Gulf of Cádiz	C													Velasco *et al.* (2011)

*in Arculeo *et al.* (2000).

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
W. Mediterranean Sea	C			13.0-18.0	Bauchot and Hureau (1986)
GSA 1, 2 Alboran Sea	C			19.00	Baro (1996)•
	F			20.10	Velasco *et al.* (2011)
	M			17.70	
GSA 3 N.W. African coast	C			19.0	Le-Trong and Kompowski (1972)*
GSAs 10, 19 S. Tyrrhenian Sea, N. Ionian Sea	C			16.50	Andaloro (1982)+
N.E. Atlantic Ocean					
IE 9.a Algarve (Portugal)	F			20.95	Santos, Costa Monteiro and Erzini (1995)
	M			19.70	
IE 9.a Gulf of Cádiz	F			21.70	Velasco *et al.* (2011)
	M			18.40	

* in Arculeo *et al.* (2000); + In Santos, Costa Monteiro and Erzini (1995); • in Russell, Carpenter and Pollard (2014b).

Pagellus acarne (FAO CODE: SBA – MEDITS CODE: PAGE ACA)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN	 TL 13.5 cm; TW 25 g; ST: August; GSA 11	 TL 13.5 cm; TW 25 g; ST: August; GSA 11
2b	RECOVERING	 TL 16.2 cm; TW 45 g; ST: May; GSA 11	 TL 17.4 cm; TW 59 g; ST: May; GSA 11
2c	MATURING	 TL 30.5 cm; ST: September; GSA 11	
3	MATURE/ SPAWNER		 TL 15.5 cm; ST: November; GSA 10-18
4a	SPENT	 TL 18.5 cm; ST: November; GSA 10-18	
4b	RESTING	 TL 15.5 cm; ST: November; GSA 10-18	

Order: Perciformes **Family: Sparidae**

***Pagellus erythrinus* (Linnaeus, 1758)**

Photo by C. Porcu

FAO CODE: PAC

MEDITS CODE: PAGE ERY

Common Name:
Common pandora (English)
Pageau (French)
Pagello fragolino (Italian)
Breca (Spanish)

GEOGRAPHIC DISTRIBUTION

Pagellus erythrinus is widely distributed along the eastern shores of the Atlantic Ocean and is found along the coast of West Africa from Guinea Bissau to the Strait of Gibraltar, as well as Cabo Verde, Madeira and the Canary Islands. It is present throughout the Mediterranean Sea and in the western Black Sea, and extends northward to Norway (Russell, 2014).

REPRODUCTION

Reproductive strategy: protogynic hermaphroditic species.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 1 Mazarrón Bay (S.E. Spain)	F													Valdés *et al.* (2004)
	M													
GSA 6 Spain	C													Larrañeta (1964,1967)
GSA 7 Gulf of Lion	C													Girardin (1978)
	C													Girardin and Quignard (1985)
GSA 7 Gulf of Lion	C													Campillo (1992b)
GSA 12, 13, 14 Tunisian coast	C													Ghorbel and Ktari (1982)
GSA 12 Gulf of Tunis	C													Zarrad *et al.* (2010)
GSA 14 Gulf of Gabès	C													Ghorbel (1981;1986)
Italian Seas	C													Relini, Bertrand and Zamboni (1999)
GSA 16 Strait of Sicily	C													Ragonese *et al.* (2004a)
GSA 18 S. Adriatic Sea	C													Spedicato *et al.* (1998)
GSA 20 Ionian Sea	C													Mytilineou (1987)
GSA 20 W. Greece	C													Papaconstantinou, Mytileneou and Panos (1988)
GSA 22 Aegean Sea	C													Mytilineou (1988)
GSA 22 Saronikós Gulf	C													Vassilopoulou and Papaconstantinou (1990b)
GSA 22 İzmir Bay (Aegean Sea)	C													Metin *et al.* (2011)
GSA 22 Edremit Bay	C													Hoşsucu and Cakır (2003)
GSA 23 Cretan Sea	C													Somarakis and Machias (2002)
GSA 24 N.E. Mediterranean Sea	C													Ok (2012)

Table continues next page ➜

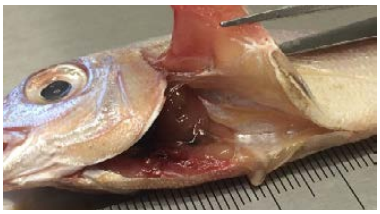
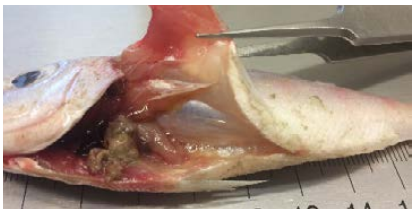
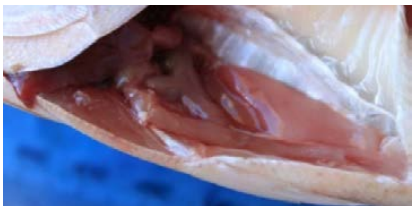
SPAWNING PERIOD (continued)

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
GSA 25 Cyprus	C													Livadas (1989c)
GSA 27 Libanese waters	C													Mouneimne (1978)
N.E. Atlantic Ocean														
IE 9.a Algarve (S. Portugal)	C													Santos, Costa Monteiro and Erzini (1995)
IE 9.a S. Portugal	C													Erzini *et al.* (2001)
	F													Coelho *et al.* (2010)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum Size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 4 Gulf of Alger	F	11.5-36.5		16.40	Cherabi (1987)
GSA 7 Gulf of Lion	C			14.0-17.0	Girardin (1978)
	F			15.0	Girardin (1981)
	M			17.0	
GSA 10 N. Sicily	F			16.3	SAMED (2003)
GSA 12, 13, 14 Tunisian coast	F	10.5-24.7		12.8	Ghorbel and Ktari (1982)
	M	11.0-26.4		13.3	
GSA 12 Gulf of Tunis	F			14.6	Zarrad *et al.* (2010)
	M			15.8	
GSA 14 Gulf of Gabès	F			13.9	Ghorbel (1981)
	M			13.4	
GSA 16 Strait of Sicily	F			12.5	Ragonese *et al.* (2004a)
	M			16.5	
	F			16.0	Fiorentino *et al.* (2005)
GSA 17, 18 Adriatic Sea	F	15.8-28.4		13.6	Jukic and Piccinetti (1981)
GSA 20 E. Ionian Sea	F	8.3-23.6		16.5	Mytilineou (1987)
	M	8.3-23.6		21.8	
GSA 20 E. Ionian Sea	F			13.7	SAMED (2003)
GSA 20 Gulf of Patrakos	F	8.3-24.8		18.3	Mytilineou (1987)
	M	8.3-24.8		23.0	
GSA 20 Gulf of Korinthiakos	F	10.6-30.7		20.3	
	M	11.8-30.7		26.6	
GSA 22 Aegean Sea	F			17.0	Mytilineou (1988)
	M			23.0	
	F	5.9-38.9		21.0	Vassilopoulou and Papaconstantinou (1990a)
	M	7.1-33.0		25.1	
	F			13.1	SAMED (2003)
GSA 22 C. Aegean Sea	F	6.2-24.9		11.3	Metin *et al.* (2011)
	M	7.8-27.8		15.1	
GSA 22 Edremit Bay (N. Aegean Sea)	F			15.0	Hoşsucu and Cakır (2003)
GSA 23 Cretan Sea	F	5.0-27.1		13.4	Somarakis and Machias (2002)
	M	5.0-27.1		14.2	
GSA 24 N.E. Mediterranean Sea	F			14.6	Ok (2012)
	M			15.1	
GSA 27 Libyan waters	C			13.0	Hashem and Gassim (1981)
N.E. Atlantic Ocean					
IE 9.a Algarve (S. Portugal)	F			18.3	Santos, Costa Monteiro and Erzini (1995)
	M			17.4	
IE 9.a S. Portugal	F	17.6-44.0		17.3	Coelho *et al.* (2010)
	M	17.2-44.8		17.6	

Pagellus erythrinus (FAO CODE: PAC – MEDITS CODE: PAGE ERY)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 10.0 cm; TW 12 g; ST: November; GSA 18	
2a	DEVELOPING VIRGIN	 TL 13.5 cm; TW 33 g; ST: August; GSA 18	 TL 12.5 cm; TW 24 g; ST: November; GSA 18
2b	RECOVERING	 TL 23.6 cm; TW 60 g; ST: August; GSA 11	 TL 27.3 cm; TW 221 g; ST: August; GSA 11
2c	MATURING	 TL 17.0 cm; TW 58 g; ST: June; GSA 11	 TL 23.9 cm; TW 158 g; ST: August; GSA 11
3	MATURE/ SPAWNER	 TL 17.8 cm; TW 67 g; ST: June; GSA 11	 TL 19 cm; TW 84 g; ST: June; GSA 19
4a	SPENT	 TL 18.5 cm; TW 78 g; ST: August; GSA 18	 TL 15.5 cm; TW 46 g; ST: August; GSA 18
4b	RESTING		 TL 30.1 cm; TW 304 g; ST: October; GSA 11

Order: Pleuronectiformes **Family: Scophthalmidae** ***Lepidorhombus boscii* (Risso,1810)**

Photo by M.C. Follesa

FAO CODE: LDB

MEDITS CODE: LEPM BOS

Common name:
Fourspotted megrim (English)
Cardine à quatre taches (French)
Rombo quattrocchi (Italian)
Gallo de cuatro manchas (Spanish)

GEOGRAPHIC DISTRIBUTION

Lepidorhombus boscii is the most southerly distributed of the two Megrim species and occurs in both of the ICES Divisions 8.c and 9.a. It is present in the northeast Atlantic Ocean, from the British Isles and the Faroe Islands (63° north latitude) southward to Cape Bojador (26° north) and west Sahara. It is found along the entire Mediterranean Sea coast, but not in the north Adriatic, Egypt or Cyprus. It is also found in the Sea of Marmara (Álvarez, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Italian waters	F													Bini (1968)+
	F													Tortonese (1975)+
GSA 9 Tyrrhenian Sea	F													Mannini, Reale and Righini (1990)
GSA 18 S. Adriatic Sea	F													Ungaro and Martino (1998)+
GSA 22 Saros Bay	C													Cengiz *et al.* (2015)
N.E. Atlantic Ocean														
IE 9.a Portuguese waters	F													Santos (1995)

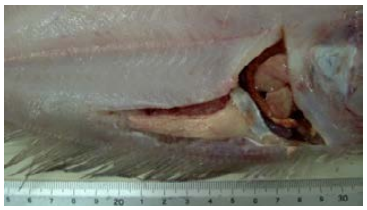
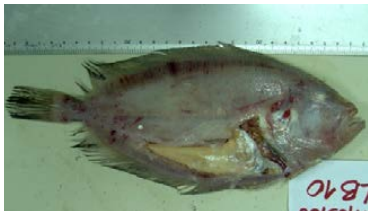
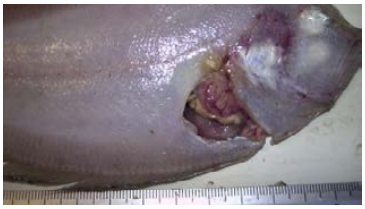
Peak of spawning period

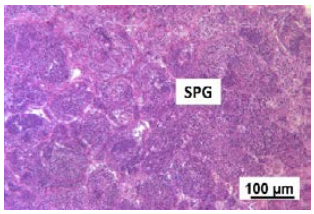
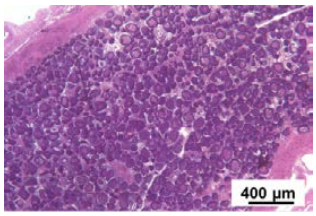
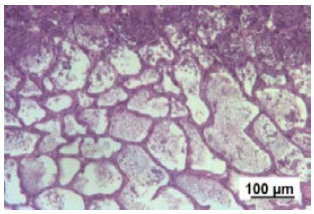
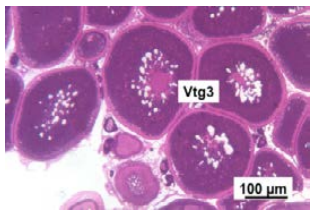
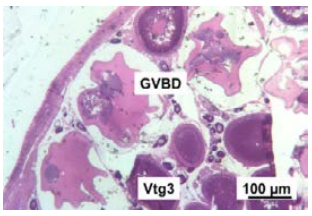
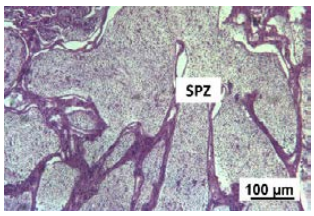
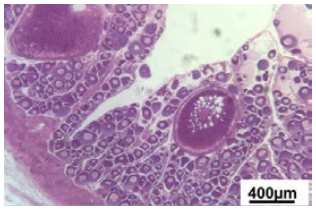
+ in Relini, Bertrand and Zamboni (1999).

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 9 Tyrrhenian Sea	F			>17.0	Mannini, Reale and Righini (1990)
GSA 18 S. Adriatic Sea	F			23.6	Ungaro and Martino (1998)+
GSA 22 Aegean Sea	F	5.5-29.5		13.8	Vassilopoulou, Ondrias and Papaconstantinou (1997)*
	M	5.5-23.5		10.6	
GSA 22 Saros Bay	F			14.9	Cengiz *et al.* (2015)
	M			15.3	
N.E. Atlantic Ocean					
IE 9.a Portuguese waters	F			20.0	Santos (1995)
	M			19.0	

+ in Relini, Bertrand and Zamboni (1999); * in Tsikliras and Stergiou (2013).

Lepidorhombus boscii (FAO CODE: LDB – MEDITS CODE: LEPM BOS)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN	 TL 21.2 cm; TW 69 g; ST: May; GSA 11	 GSA 19
2b	RECOVERING	 TL 38.8 cm; ST: May; GSA 11	 TL 25 cm; TW 132 g; ST: March; GSA 11
2c	MATURING	 TL 29 cm; TW 204 g; ST: March; GSA 11	
3	MATURE/ SPAWNER	 TL 27 cm; TW 176 g; ST: March; GSA 11	
4a	SPENT	 TL 26.8 cm; TW 183 g; ST: March; GSA 11	 TL 23.4 cm; TW 101 g; ST: May; GSA 11
4b	RESTING		 TL 19 cm; TW 54 g; ST: May; GSA 11

Lepidorhombus boscii (FAO CODE: LDB – MEDITS CODE: LEPM BOS)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		 GSA 11 (TB and E)
2a	DEVELOPING VIRGIN		
2b	RECOVERING	 GSA 11 (TB and E)	 GSA 11 (TB and E)
2c	MATURING	 GSA 11 (TBandE)	
3	MATURE/ SPAWNER	 GSA 11 (TB and E)	 GSA 11 (TB and E)
4a	SPENT	 GSA 11 (TB and E)	
4b	RESTING		

Order: Pleuronectiformes **Family: Soleidae**

Solea solea (Linnaeus, 1758)

Photo by F. Serena

FAO CODE: SOL

MEDITS CODE: SOLE VUL

Common name:
Common sole (English);
Sole commune (French);
Sogliola comune (Italian);
Sole (Spanish)

GEOGRAPHIC DISTRIBUTION

It is found in the eastern Atlantic Ocean from Trondheim Fjord (including the North Sea and the western Baltic) to Senegal including Cabo Verde. In the Mediterranean Sea, it is present throughout the basin (including the Sea of Marmara, the Bosporus and the southwestern Black seabed) (Golani *et al.*, 2011).

REPRODUCTION

Reproductive strategy: dioic, external fertilization. Indeterminate spawner.

SPAWNING PERIOD

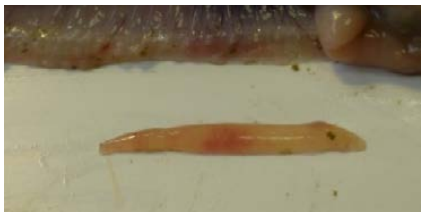
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Mediterranean	F	■	■	■	■									Fischer, Bauchot and Schneider (1987)
GSA 6 Spain	F	■	■	■								■	■	Ramos (1982)
	M	■	■	■	■							■	■	
GSA 7 Gulf of Lion	C	■	■	■								■	■	Shehata (1984)
GSA 17 N. C. Adriatic Sea	C											■	■	Grubisic 1962
	F		■	■										Vallisneri *et al.* (2000)
	M	■	■	■									■	
GSA 24 Iskenderun Bay	F				■	■								Türkmen (2003)
	M				■	■								
GSA 26 Egyptian waters	C	■	■	■	■							■	■	Mehanna (2014)
GSA 28 Marmara Sea	C				■	■	■							Slastenenko (1956)•
N.E. Atlantic Ocean														
IEs 4.a, 4.b, 4.c North Sea	C				■	■	■						■	Quéro, Desoutter and Lagardère (1986)
	C			■	■	■	■							Rijnsdorp and Vethaak (1997)
IE 7.f Off Trevose Head (United Kingdom)	C			■	■	■								ICES (2012b)
IEs 7.e, 7.d English Channel	F	■	■	■	■	■	■						■	Ramsay and Witthames (1996)
IE 8.c Bay of Biscay	C	■	■	■	■	■							■	Quéro, Desoutter and Lagardère (1986)
Ireland	C					■	■						■	Muus and Nielsen (1999)

■ Peak of spawning period

• in Tsikliras, Konstantinos and Stergiou (2010).

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
Mediterranean Sea	F			25.0	Fischer, Bauchot and Schneider (1987)
GSA 17 N. E. Adriatic Sea	C	14.0-37.0		25.0	Vallisneri *et al.* (2000)
	F			25.8	MEDISEH (2013)
GSA 24 Iskenderun Bay	F	10.5-28.2		15.2	Türkmen (2003)
	M	8.8-25.0		14.8	
GSA 26 Egyptian waters	F			19.6	Mehanna (2014)
	M			18.7	

Solea solea (FAO CODE: SOL – MEDITS CODE: SOLE VUL)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 TL 19.5 cm; TW 65 g; ST: December; GSA 17	 TL 22.0 cm; TW 81 g; ST: October; GSA 17
2a	DEVELOPING VIRGIN	 TL 20.5 cm; TW 81 g; ST: December; GSA 17	
2b	RECOVERING	 TL 21.5 cm; TW 72 g; ST: December; GSA 17	
2c	MATURING	 TL 28.0 cm; TW 215 g; ST: December; GSA 17	 TL 23.0 cm; TW 122 g; ST: October; GSA 17
3	MATURE/ SPAWNER	 TL 25.5 cm; TW 185 g; ST: November; GSA 17	 TL 25.5 cm; TW 141 g; ST: October; GSA 17
4a	SPENT	 TL 28.5 cm; TW 194 g; ST: June; GSA 17	 TL 27 cm; TW 176 g; ST: June; GSA 17
4b	RESTING		

Order: Scorpeniformes **Family: Sebastidae**

***Helicolenus dactylopterus* (Delaroche, 1809)**

Photo by C. Porcu

FAO CODE: BRF

MEDITS CODE: HELI DAC

Common name:

Bluemouth rockfish (English)
Sébaste-chèvre (French)
Scorfano di fondale (Italian)
Gallineta (Spanish)

GEOGRAPHIC DISTRIBUTION

Helicolenus dactylopterus is a benthic species widely distributed in the eastern Atlantic Ocean from Norway to South Africa, and in the Mediterranean Sea, inhabiting depths of between 100 m and 1 000 m (Whitehead *et al.*, 1986).

REPRODUCTION

Reproductive strategy: viviparous (zygoparous), internal fertilization, storage of spermatozoa in female ovaries, asynchrony of sexual cycles.

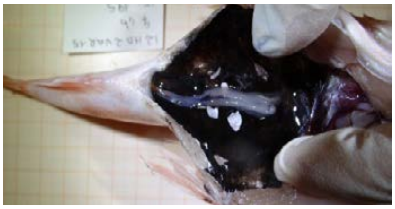
SPAWNING PERIOD

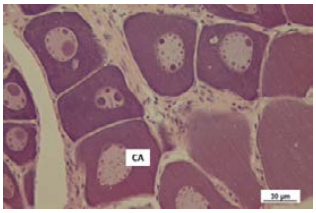
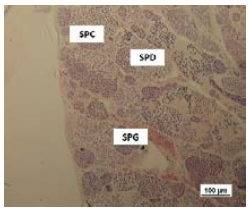
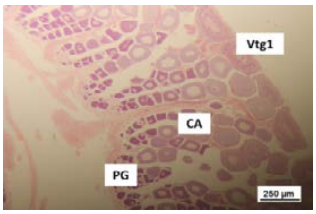
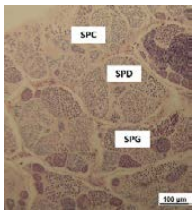
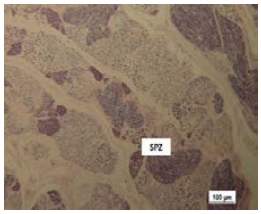
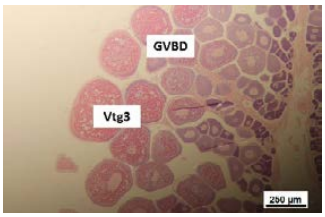
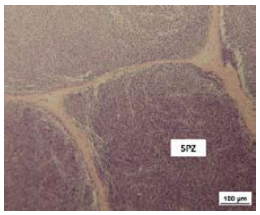
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
GSA 6 Catalan Sea	F													Muñoz *et al.* (1999)
	M													
	F													Muñoz and Casadevall (2002)
	M													
GSA 7 Gulf of Lion	F													Muñoz *et al.* (2010)
GSA 9 Ligurian Sea	F													Peirano and Tunesi (1986)
GSA 16 Strait of Sicily	F													Romanelli *et al.* (1997)
GSA 18 S. Adriatic Sea	F													Marzano *et al.* (1998)
GSA 19 N. Ionian Sea	F													Relini, Bertrand and Zamboni (1999)
N.E. Atlantic Ocean														
IEs 7.c.2, 7b, 6.a Rockall Trough	F													Kelly, Connolly and Bracken (1999)
IE 10.a.2 Azores Islands	F													Estácio *et al.* (2001)
	F													Mendonça *et al.* (2006)
	M													
IEs 10.a.2 Azores, 9.a Portugal waters	F													Sequeira *et al.* (2012)
	M													

Peak of spawning period

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 4 Algerian coast	F	11.0-32.0		14.2	Nouar (2003)
	M	8.0-28.0		15.1	
GSA 6 Catalan Sea	F			14.5 (SL)	Muñoz and Casadevall (2002)
	M			13.0 (SL)	
GSA 18 S. Adriatic Sea	F			17.2	Marzano *et al.* (1998)
GSA 19 N. Ionian Sea	F			19.0-20.0	Relini, Bertrand and Zamboni (1999)
N.E. Atlantic Ocean					
IEs 7.c.2, 7b, 6.a Rockall Trough	F			26.0	Kelly, Connolly and Bracken (1999)
	M			23.0	
IE 9.a Portugal waters	F			16.4	Sequeira *et al.* (2012)
	M			17.3	
IE 10.a.2 Azores Islands	F			28.1	Estácio *et al.* (2001)
	M			28.1	
	F			18.6	Sequeira *et al.* (2012)
	M			17.2	

Helycolenus dactylopterus (FAO CODE: BRF – MEDITS CODE: HELI DAC)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**		
2a	**DEVELOPING VIRGIN**	 TL 15.0 cm; TW 48 g; ST: August; GSA 11	 TL 16.2 cm; TW 62 g; ST: January; GSA 11
2b	**RECOVERING**	 TL 18.3 cm; TW 96 g; ST: July; GSA 11	 TL 25.2 cm; TW 256 g; ST: June; GSA 19
2c	**MATURING**	 GSA 19	 TL 22.1 cm; TW 171 g; ST: July; GSA 11
3	**MATURE/ SPAWNER**	 TL 18.2 cm; TW 95.6 g; ST: January; GSA 11	 TL 22.1 cm; TW 182 g; ST: July; GSA 11
4a	**SPENT**	 TL 27.0 cm; TW 303 g; ST: November; GSA 11	 TL 19.9 cm; TW 113 g; ST: November; GSA 11
4b	**RESTING**	 TL 19.5 cm; TW 107 g; ST: January; GSA 11	

Helycolenus dactylopterus (FAO CODE: BRF – MEDITS CODE: HELI DAC)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	**IMMATURE VIRGIN**		
2a	**DEVELOPING VIRGIN**	 GSA 11 (H and E)	 GSA 11 (H and E)
2b	**RECOVERING**	 GSA 11 (H and E)	 GSA 11 (H and E)
2c	**MATURING**		 GSA 11 (H and E)
3	**MATURE/ SPAWNER**	 GSA 11 (H and E)	 GSA 11 (H and E)
4a	**SPENT**		
4b	**RESTING**		

Order: Scorpaeniformes **Family: Triglidae**

***Chelidonichthys cuculus* (Linnaeus, 1758)**

Photo by F. Serena

FAO CODE: GUR

MEDITS CODE: ASPI CUC

Common name:
Red gurnard (English)
Grondin rouge (French)
Capone coccio (Italian)
Peona (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the eastern Atlantic Ocean from the British Isles (occasionally Norway) south to Mauritania, including Madeira and Azores Islands, and the Mediterranean Sea, as well as possibly in the Black Sea (Nunoo *et al.*, 2015).

REPRODUCTION

Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

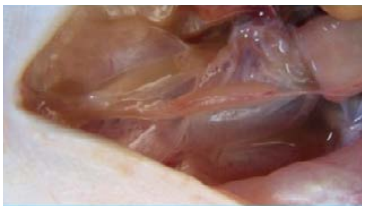
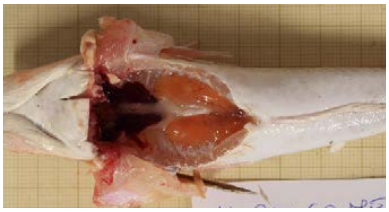
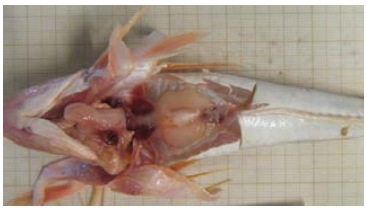
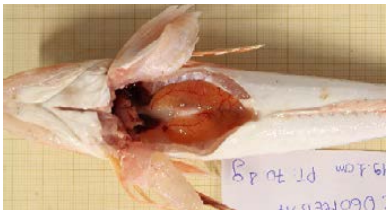
Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Italian waters	C													Tortonese (1975)
GSA 7 S. France	C													Campillo (1992a)+
GSA 9 C. Tyrrhenian Sea	C													Colloca *et al.* (2003)
GSA 17 N.C. Adriatic Sea	C													Vallisneri *et al.* (2014)
GSA 22 Saronikós Gulf	C													Papaconstantinou (1983)+

Peak of spawning period

+ Colloca *et al.* (2003).

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 9 C. Tyrrhenian Sea	F	7.0-27.0		17.5	Colloca *et al.* (2003)
GSA 17 N.C. Adriatic Sea	F	10.8-26.2		16.7	Vallisneri, Montanini and Stagioni (2012)
	M	10.3-23.3		15.0	
	F	10.2-30.3	~10.0		Vallisneri *et al.* (2014)
	M	10.5-27.7	~10.0		
N.E. Atlantic Ocean					
IE 7.a N.W. Wales (Irish Sea, United Kingdom)	F	10.5-43.1		28.1	Marriott, Latchford and Mccarthy (2010)
	M	15.4-35.0		26.3	
	C	10.5-43.1		27.6	
IEs 7.e, 7.d English Channel	C	9.0-43.0		25.0	Dorel (1986); ICES (2006)
IE 7.e Bay of Douarnenez	F	14.0-45.0		28.4	Baro (1985 a,b)
	M	14.0-39.0		27.0	

Chelidonichthys cuculus (FAO CODE: GUR – MEDITS CODE: ASPI CUC)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN	 GSA 9	 GSA 9
2a	DEVELOPING VIRGIN		
2b	RECOVERING	 TL 13.4 cm; TW 21 g; ST December; GSA 11	 TL 16.5 cm; TW 42 g; ST: November; GSA 11
2c	MATURING	 TL 18.4 cm; TW 65 g; ST December; GSA 11	 TL 17.6 cm; TW 50 g; ST: December; GSA 11
3	MATURE/ SPAWNER	 TL 17.0 cm; TW 48 g; ST July; GSA 10-18	 TL 18.5 cm; TW - g; ST December; GSA 18
4a	SPENT	 TL 19.1 cm; TW 70 g; ST: November; GSA 11	 TL 20 cm; TW 29 g; ST: July; GSA 10-18
4b	RESTING	 TL 20.1 cm; ST: July; GSA 11	 TL 19 cm; ST: July; GSA 11

ORDER: Scorpeniformes **FAMILY: Triglidae**

***Eutrigla gurnardus* (Linnaeus, 1758)**

Photo by A. Mulas

FAO CODE: GUG

MEDITS CODE: EUTR GUR

Common name:
Grey gurnard (English)
Grondin gris (French)
Capone gorno (Italian)
Perlon (Spanish)

GEOGRAPHIC DISTRIBUTION

It is distributed in the Mediterranean and the Black Seas, and in the eastern Atlantic Ocean from Norway to Morocco, Madeira and Iceland (Hureau, 1986).

REPRODUCTION

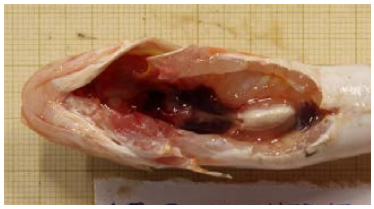
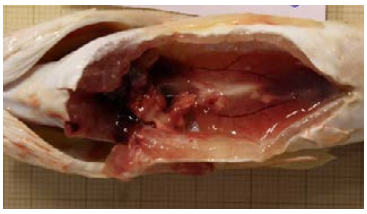
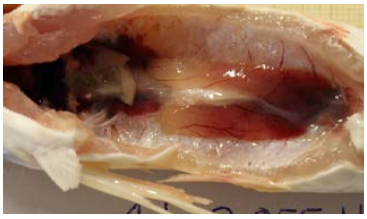
Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Italian waters	C													Bini (1968)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 17 N.E. Adriatic Sea	F	10.0-25.3		15.0	Vallisneri, Montanini and Stagioni (2012)
	M	9.7-17.2		12.2	
N.E. Atlantic Ocean					
IEs 4.a, 4.b, 4.c N. Sea	F			24.0	Muus and Nielsen (1999)
	M			18.0	
IE 7.e Bay of Douarnenez	F			31.2	Baro (1985 a,b)
	M			29.4	

Eutrigla gurnardus (FAO CODE: GUG – MEDITS CODE: EUTR GUR)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	
2a	DEVELOPING VIRGIN	 TL 13.9 cm; TW 22 g; ST: Novemeber; GSA 11
2b	RECOVERING	 TL 17.4 cm; TW 47 g; ST: July; GSA 11
2c	MATURING	 GSA 9
3	MATURE/ SPAWNER	 TL 21.5 cm; TW 84 g; ST: May; GSA 10-18
4a	SPENT	 GSA 9
4b	RESTING	 TL 17.5 cm; TW 42 g; ST: November; GSA 11

ORDER: Scorpeniformes **FAMILY: Triglidae**

Chelidonichthys lastoviza (Bonnaterre, 1788)

Photo by M.F. Marongiu

FAO CODE: CTZ

MEDITS CODE: TRIP LAS

Common name:
Streaked gurnard (English)
Grondin camard (French)
Capone ubriaco (Italian)
Rayado rubio (Spanish)

GEOGRAPHIC DISTRIBUTION

This species is found along the eastern Atlantic from Norway southward to South Africa, including the Gulf of Guinea, and Madeira, Azores and Canary Islands. In the eastern central Atlantic, this species is distributed from Morocco south to Angola, including Cabo Verde. It is also found throughout the Mediterranean Sea (De Morais *et al.*, 2015).

REPRODUCTION

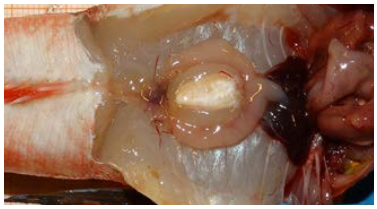
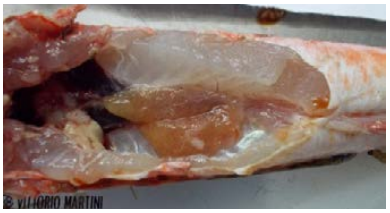
Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
Italian waters	F													Bini (1966–1970)
GSA 12 Gulf of Tunis	C													Ben Jrad *et al.* (2010)
GSA 22 Saronikós Gulf	C													Papaconstantinou (1986)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 7 Gulf of Lion	C			19.0-21.0	Kartas (1971)
GSA 12 Gulf of Tunis	F			15.7	Ben Jrad *et al.* (2010)
	M			16.4	
GSA 14 Gulf of Gabès	C			14.3	Boudaya (2000)
	M			14.7	
GSA 22 Saronikós Gulf	F			14.0-16.0	Papaconstantinou (1986)
	M			14.2	
GSA 26 Egypt	M			14.5	Abdallah and Faltas (1998)
N.E. Atlantic Ocean					
IE 7.e Bay of Douarnenez	F			29.6	Baro (1985 a,b)
	M			28.6	

Chelidonichthys lastoviza (FAO CODE: CTZ – MEDITS CODE: TRIP LAS)			
STAGE	**PHASE**	**FEMALES**	**MALES**
1	IMMATURE VIRGIN		
2a	DEVELOPING VIRGIN		
2b	RECOVERING	 TL 18 cm; TW 63 g; ST: May; GSA 11	 TL 19 cm; TW - g; ST: July; GSA 11
2c	MATURING	 TL 21.0 cm; TW 75 g; ST: May; GSA 11	
3	MATURE/ SPAWNER	 TL 21.5 cm; TW 84 g; ST: May; GSA 11	
4a	SPENT	 TL 23 cm; TW 104 g; ST: June; GSA 11	 TL 18 cm; TW 68 g; ST: May; GSA 11
4b	RESTING		

Order: Zeiformes **Family: Zeidae**

***Zeus faber* (Linnaeus, 1758)**

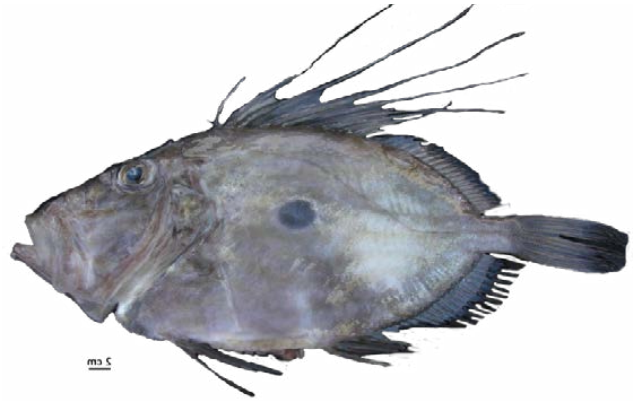


Photo by E. Beccornia

FAO CODE: JOD

MEDITS CODE: ZEUS FAB

Common name:
John Dory (English)
Saint Pierre (French)
Pesce San Pietro (Italian)
Pez de San Pedro (Spanish)

GEOGRAPHIC DISTRIBUTION

It occurs in the Eastern Central Atlantic, from Norway and the Faroe Islands to South Africa. It is also found in the Mediterranean, the Black Sea and in Indo-West Pacific region from South Africa to Kenya. It is caught off Australia, New Zealand, the South China Sea and Japan (Iwamoto, 2015).

REPRODUCTION

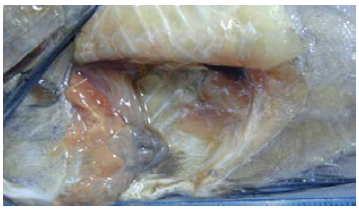
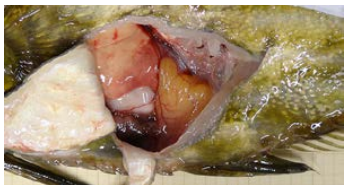
Reproductive strategy: dioic, external fertilization.

SPAWNING PERIOD

Geographic area	Sex	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Mediterranean Sea														
N. Mediterranean Sea	C			■	■	■	■	■	■	■				Fischer, Bauchot and Schneider (1987)
S. Mediterranean Sea				■	■	■	■							
GSA 22 Aegean Sea (Turkish coast)	C				■	■	■	■	■	■	■	■	■	Akyol (2001)
		■	■	■	■	■	■		■	■				Ismen *et al.* (2010)
N.E. Atlantic Ocean														
IE 7.a Irish Sea	C							■	■					Quero (1986)
IEs 7.e, 7.d English Channel	C							■	■					Janssen (1979)
IE 8 Bay of Biscay	C							■	■					Quero (1986)
							■	■	■					Muus and Nielsen (1999)

MATURITY

Geographic area	Sex	Size range TL, cm	Minimum size Mature, TL, cm	50% Mature (L_{50}) TL, cm	References
Mediterranean Sea					
GSA 17 Adriataic Sea	F			31.0	Vrgoč *et al.* (2006)
	M			31.0	
GSA 22 Aegean Sea (Turkish coast)	F	13.8-52.8		25.4	Ismen *et al.* (2010)
	M	12.2-42.9		25.4	
N.E. Atlantic Ocean					
IEs 7, 6, 5, 4 England and Wales	F			34.5	Dunn (2001)
	M			26.0	
IE 8 Bay of Biscay	F			37.0	Dorel (1986)

Zeus faber (FAO CODE: JOD – MEDITS CODE: ZEUS FAB)		
STAGE	**PHASE**	**FEMALES**
1	IMMATURE VIRGIN	 TL 19.0 cm; TW 99 g; ST: June; GSA 10-18
2a	VIRGIN DEVELOPING	 TL 23.2 cm; TW 155 g; ST: August; GSA 11
2b	RECOVERING	 TL 34.0 cm; TW 420 g; ST: August; GSA 11
2c	MATURING	 TL 41.9 cm; TW 1000 g; ST: August; GSA 11
3	MATURE/ SPAWNER	 TL 43.0 cm; TW 1100 g; ST: August; GSA 11
4a	SPENT	 TL 49.0 cm; TW 1493 g; ST: November; GSA 11
4b	RESTING	 TL 50.9 cm; TW 1570 g; ST: November; GSA 11

References

A.A.V.V. 2016. MEDITS-Handbook. Version n. 8, MEDITS Working Group. 177 pp.

Abaunza, P., Fariña, A.C. & Carrera, P. 1995. Geographic variations in sexual maturity of the horse mackerel, *Trachurus trachurus*, in the Galician and Cantabrian shelf. *Scientia Mar*ina, 59: 211–222.

Abdallah, M. & Faltas, S.N. 1998. Reproductive biology of *Trigla lucerna* and *Trigloporus lastoviza* in the Egyptian Mediterranean water. *Bulletin of the National Institute of Oceanography and Fishery*, 24: 285–303.

Abdel Razek, F.A, El-Sherief, S.S, Taha, S.M. & Muhamad, E.G. 2006. Some biological aspects of *Parapenaeus longirostris* (Lucas, 1846) (Crustacea: Decapoda) in the Mediterranean coast of Egypt. *Egyptian Journal of Aquatic Research*, 32(1): 385–400.

Abdel-Aziz, S.H. 1994. Observations on the biology of the common torpedo (*Torpedo torpedo*, Linnaeus, 1758) and marbled electric ray (*Torpedo marmorata*, Risso, 1810) from Egyptian Mediterranean waters. *Australian Journal of Marine and Freshwater Research,* 45: 693–704.

Abdel-Aziz, S.H., Ezzat, A. & Hussein, M. 1987. Sexuality, reproduction and fecundity of *Raja miraletus* (L) from the Mediterranean waters off Alexandria. *Bulletin of the Institute of Oceanography and Fisheries*, 13: 119–132.

Abelló, P. & Sardá, F. 1982. The fecundity of the Norway lobster (*Nephrops norvegicus*) off the Catalan and Portuguese coasts. *Crustaceana*, 43: 13–20.

Abelló, P. & Sardá F. 1989. Some observations on the biology and fishery of *Squilla mantis* L. in the Catalan area (N.W. Mediterranean). *In* E.A. Ferrero, ed. *Biology of stomatopods*, pp. 229–239.

Agnesi, S., Belluscio, A. & Ardizzone, G.D. 1998. Biologia e dinamica di popolazione di *Eledone cirrhosa* (Cephalopoda, Octopoda) nel Tirreno centrale. *Biologia Marina Mediterranea*, 5(2): 336–348.

Aguirre Villaseñor, H. 2000. *Aspectos byològicos y ecològicos del salmonete de fango Mullus barbatus L., 1758 y del Salmonete de Roca Mullus surmuletus L., 1758, del Meditèrraneo Nord occidental.* Universitat Politecnica de Catalunya, Barcellona (Degree thesis).

Agus, B. 2015. *Studio sui calamari* Loligo vulgaris (Lamarck,1798) e Loligo forbesii (Streenstrup, 1856) *delle acque della Sardegna*. University of Cagliari. (PhD dissertation).

Aguzzi, J., Allué, R. & Sardà, F. 2004. Seasonal dynamics in *Nephrops norvegicus* (Decapoda: Nephropidae) catches off the Catalan coasts (western Mediterranean). *Fisheries Research*, 69: 293–300.

Ak, Y. & Hossucu, B. 2001. Diversity, distribution and abundance of pelagic eggs and larvae of teleost fishes in Izmir Bay. E.U. Su Ürünleri Dergisi, 18: 155–173.

Akyol, O. 2001. Some biological properties and stock estimates of *Zeus faber* L., 1758 (Pisces, Zeidae) in the Aegean coasts of Turkey. *Journal of Fisheries and Aquatic Sciences,* 18: 39–46.

Akyol, O., Sxen, H. & Kinacigil, H.T. 2007. Reproductive biology of *Eledone moschata* (Cephalopoda: Octopodidae) in the Aegean Sea (Izmir Bay, Turkey). *Journal of the Marine Biological Association of the United Kingdom*, 87: 967–970.

Akyol, O., Tellibayraktar, B. & Ceyhan, T. 2011. Preliminary results on the cuttlefish, *Sepia officinalis*, reproduction in Izmir Bay (Aegean Sea). *Journal of Fisheries Sciences*, 5(2): 122–130.

Akyuz, E.F. 1957. Observation on the Iskenderun red Mullet (*M. barbatus*) and its environment. *Proceedings and Technical Papers of the General Fisheries Council for the Mediterranean*, 4: 93–99.

Al-Absawy, M. 2010. The reproductive biology and the histological and ultrastructural characteristics in ovaries of the female gadidae fish *Merluccius merluccius* from the Egyptian Mediterranean water. *African Journal of Biotechnology,* 9(17): 2544–2559.

Albertelli, G., Angelino, M.I., Della Croce, N. & Salemi Picone, P. 1988. Valutazione degli stocks di acciughe e parametri ambientali in Mar Ligure. Atti Seminari UU. OO. Responsabili progetti ricerca promossi nell'ambito schema preliminare di piano per la pesca e aquacultura. M.M.M. CNR Roma, 1: 89–97.

Alcazar, J.L., Carrasco, F.J., Llera, E.M., Mendez De La Moz, L., Ortea J.A. & Vizcaino, A. 1983. Biologia, dinàmica y pesca de la merluza en Asturia. *Recursos Pesqueros de Asturias,* 3:134.

Aldebert, Y. & Carrieres, C. 1989. L'exploitation du merlu dans le golfe du lion donnèess complèmentaires. *Bulletin de la Société zoologique de France*, 114(4): 15–20.

Alegria-Hernandez, V. 1990. Some aspects of the reproductive biology of bogue (*Boops boops* L., Pisces, Sparidae) from the mid–Adriatic channels. *Acta Adriat*ica, 31: 301–313.

Alegria-Hernandez, V. 1994. Reproductive cycle and changes in condition of the horse mackerel (*Trachurus trachurus* L.) from the Adriatic Sea. *Acta Adriatica*, 35(1/2): 59–67.

Alheit, J. & Pitcher, T.J., eds. 1995. Hake. Biology, fisheries and markets. Serie 15. Chapmann and Hall. London.

Alkusairy, H. & Saad, A. 2017. Some morphological and biological aspects of longnosed skate, *Dipturus oxyrinchus* (Elasmobranchii: Rajiformes: Rajidae), in Syrian marine waters (eastern Mediterranean). *Acta Ichtyoogica et Piscatoria*, 47(4): 371–383.

Alsayes, A., Fattouh, Sh., Abu Enin, S., Soliman, T. 2010. Development of trawl and shrimp fisheries at the Egyptian Mediterranean area. *World Journal of Fish and Marine Sciences,* 2(1): 1–7.

Álvarez, H. 2015. *Lepidorhombus boscii*. The IUCN Red List of Threatened Species 2015. www.iucnredlist.org/details/198729/1

Álvarez, P., Fives, J., Motos, L. & Santos, M. 2004. Distribution and abundance of European hake *Merluccius merluccius* (L.), eggs and larvae in the North East Atlantic waters in 1995 and 1998 in relation to hydrographic conditions. *Journal of Plankton Research,* 26: 811–826.

Anadón, E. 1960. Sobre el jurel del N.W. de España. *Boletín de la Real Sociedad Española de Historia Natural,* 58: 185–198.

Anastasopoulou, A., Mytilineou, C., Makantasi, P., Smith, C.J., Kavadas, S., Lefkaditou, E. & Papadopoulou, K.N. 2018. Life history aspects of two species of the Squalus genus in the Eastern Ionian Sea. *Journal of the Marine Biological Association of the United Kingdom,* 98(4): 937–948.

Anato, C.B. & Ktari, M.H. 1988. Etude comparative de la relation taillepoids de la Bogue: *Boops boops* (L., 1758), Teleosteen Sparide des cotes Tunisiennes (Mediterrané occidentale) et Béninoises (Atlantique oriental). *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 31(2): 264.

Andaloro, F. 1982. *Resume des parametres biologiques sur Pagellus acarne de la mer Tyrrhenienne meridionale et de la mer Jonienne septentrionale.* FAO Fisheries Report, 266: 89–92.

Anonymous 1986. Report of the ad hoc study group on hake. Lowestoft, *ICES CM 1986*/G: 93. 19 pp.

Anonymous 1999. Systematic list of Estonian fishes. World Wide Web Electronic Publication, 14 January 2000.

Apostolopoulos, G., Anastasopoulou, A., Mytilineou, Ch., Smith, C.J. & Megalofonou, P. 2014. Preliminary study on the reproductive biology and length– weight relationships of *Galeus melastomus* in the eastern Ionian Sea. *HydroMedit 2014,1st International Congress of Applied Ichthyology & Aquatic Environment.* November 13–15, Volos, Greece. Proceedings: 413–419.

Aranha, A., Menezes, G. & Pinho, M.R. 2009. Biological aspects of the velvet belly, *Etmopterus spinax* (Linnaeus, 1758) off the Azores, North East Atlantic. *Marine Biology Research*, 5: 257–267.

Arbault, S. & Lacroix–Boutin, N. 1969. Époques et aires de ponte des poissons téléostéens du Golfe de Gascogne en 1965–1966 (oeufs et larves). *Revue des travaux de l'Institut des pêches maritimes,* 33**:** 181–202.

Arculeo, M., Baino, R., Abella, A. & Riggio, S. 1992. Accrescimento e riproduzione di *Aristeus antennatus* (Crustacea–Decapoda) nel Golfo di Castellamare (Sicilia N/W). *Oebalia*, 17(2): 117–118.

Arculeo, M., Brusle'-Sicard, S., Potoschi, A. & Riggio, S. 2000. Investigations on gonadal maturation in *Pagellus acarne* (Pisces, Sparidae) in the Strait of Messina (Sicily). *Italian Journal of Zoology*, 67: 333–337.

Arculeo, M., Cannizzaro, L., Lo Brutto, S. & Vitale, S. 2014. Growth and reproduction of the deep–water rose shrimp, *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Penaeidae), in the Southern Tyrrhenian Sea. *Crustaceana*, 87(10): 1168–1184.

Arculeo, M., Galioto, G. & Cuttitta, A. 1993. Aspetti riproduttivi in *Parapenaeus longirostris* (Crustacea, Decapoda) nel Golfo di Castellammare (Sicilia N/W). *Biologia Marina Mediterranea,* 1: 307–308.

Arculeo, M., Payen G. & Riggio, S. 1994. Reproductive pattern and gonadal maturation in females of *Aristeus antennatus* from the North Western Sicily. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus. Proceedings of the International Workshop. N.T.R–I.T.P.P. Special publications,* 3: 41.

Ardizzone, G.D., Gravina, M.F., Belluscio, A. & Schintu, P. 1990. Depth-size distribution pattern of *Parapenaeus longirostris* (Lucas, 1846) (Decapoda) in the central Mediterranean Sea. *Journal of Crustacean Biology*, 10: 139–147.

Arneri, E. & Morales–Nin, B. 2000. Aspects of early life history of European hake from the central Adriatic. *Journal of Fish Biology,* 56: 1368–1380.

Arrobas, I. & Ribeiro Cascalho, A. 1987. On the biology and fishery of *Aristeus antennatus* (Risso, 1816) in the south Portuguese coast. *Investigación Pesquiera,* 51(1): 233–243.

Arslan, M. & İşmen A. 2014. Age, growth, reproduction and feeding of *Mullus barbatus* in Saros Bay (North Aegean Sea). *Journal of Black Sea/Mediterranean Environment,* 20(3): 184–199.

Atli, M. 1962. Kolyoz (*Scomber colias* L.) 'un biolojisi hakkında. *Hidrobiol. Mecm.*, 5: 125–143.

Aydin, M. & Karadurmuş, U. 2012. Age, growth, length–weight relationship and reproduction of the Atlantic Horse Mackerel (*Trachurus trachurus* Linnaeus, 1758) in Ordu (Black Sea). *Journal of Ordu University of Science and Technology,* 2(2): 68–77.

Ayza, O., Tuset, V.M. & González, J.A. 2011. Estimation of size at onset of sexual maturity and growth parameters in Norway lobster (*Nephrops norvegicus*) off the Portuguese coast. *Fisheries Research,* 108(1): 205–208.

Azevedo, M. 1996. Contribution to the study of the biology of black monkfish, *Lophius budegassa*, Spinola (ICES Divisions VIIIc and IXa). *Boletim do Instituto Portuguese do Investigationes Marìtimes,* 2: 5–13.

Bacha, M. & Amara, R. 2012. Inter–cohort differences in growth, condition and feeding of juvenile anchovy (*Engraulis encrasicolus*) in the Gulf of Béjaia (Algerian coast, SW Mediterranean): Implications for recruitment success. *Fisheries Research,* 129(30): 73-81.

Baino, R., Serena, F., Ragonese, S., Rey, J. & Rinelli, P. 2001. Catch composition and abundance of Elasmobranchs based on the MEDITS program. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 36: 234.

Balci, Z.A.B.Ö.B.A., Özba, M., Gökoğlu, M., Gülyavuz, H., Tali, A., & Kaya, M.P.Y. 2005. Antalya körfezi'nden avlanan barbunya (*Mullus barbatus* L., 1758) baliklarinin eeysel olgunluk yai ve boyu ile üreme zamaninin belirlenmesi. *Turkish Journal of Aquatic Life,* 3(4): 85–88.

Bañón, R., Piñeiro, C. & Casas, M. 2008. Biological observations on the gulper shark *Centrophorus granulosus* (Chondrichthyes: Centrophoridae) off the coast of Galicia (north–western Spain, eastern Atlantic). *Journal of the Marine Biological Association of the United Kingdom,* 88(2): 411–414.

Baro, J. 1985a. The Triglidae (Teleostei, Scorpaeniformes) of the Bay of Douarnenez. The growth of *E. gurnardus*, *T. lucerna*, *T. lastoviza* and *A. cuculus*. *Cybium,* 9: 127–144.

Baro, J. 1985b. The Triglidae (Teleostei, Scorpaeniformes) of the Bay of Douarnenez. The reproduction of *E. gurnardus*, *T. lucerna*, *T. lastoviza* and *A. cuculus*. *Cybium,* 9: 252–281.

Baro, J. 1996. *Biologia pesquera del besugo [Pagellus acarne (Risso, 1826)] del Mar de Alboran.* University of Malaga, Malaga, Spain. (PhD dissertation)

Barone, M. 2009. *Life History of* Raja clavata Linnaeus, 1758 (*Chondrichthyes, Rajiformes*). Pisa University, Italy. (PhD dissertation).

Barone, M., De Ranieri, S., Fabiani, O., Pirone, A. & Serena, F. 2007. Gametogenesis and maturity scale of Raja asterias Delaroche, 1809 (Chondrichthyes, Rajidae) from the South Ligurian Sea. *Hydrobiologia*, 580: 245–254.

Barraca, I.F. 1964. Quelques aspects de la biologie et de la pêche de chinchard, *Trachurus trachurus* (L.) de la côte Portugaise. *Ntas Estudos do Instituto Biologia Maritima,* 29**:** 1–21.

Basilone, G., Guisande, C., Patti, B., Mazzola, S., Cuttitta, A., Bonanno, A., Vergara, A.R. & Maneiro, I. 2006. Effect of habitat conditions on reproduction of the European anchovy (*Engraulis encrasicolus*) in the Strait of Sicily. *Fisheries Oceanography,* 15: 271–280.

Bass, A.J., D'Aubrey, J.D. & Kistnasamy, N. 1976. Sharks of the east coast of Southern Africa. VI. The families Oxynotidae, Squalidae, Dalatiidae and Echinorhinidae. *Oceanographic Research Institute Republic of South Africa investigational report,* 45: 1–103.

Bauchot, M.L. & J.C., Hureau. 1986. Sparidae. *In* P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese, eds. *Fishes of the North eastern Atlantic and the Mediterranean.* Vol. II, pp. 883–907. UNESCO, Paris.

Bauchot, M.L. 1987. Poissons osseux. Fiches FAO d'identification pour les besoins de la pêche. (rev. 1). Méditerranée et Mer Noire. Zone de pêche, 37. Vol. II. *In* M.S. Fischer, M.L. Bauchot & M. Schneider, eds. Commission des Communautés Européennes and FAO, Rome.

Bauchot, M.L., Hureau, J.C., & Miquel, J.C. 1981. Sparidae. *In* W. Fisher, ed. *Fiches FAO d'identijication des especes pour les besoins de peche. Atlantique centre est; zones de peche*, 34:47. V. IV.

Bayhan, Y.K., Unluer, T. & Akkaya, M. 2005. Some biological aspects of *Parapenaeus longirostris* (Lucas, 1846) (Crustacea, Decapoda) inhabiting the Sea of Marmara. *Turkish Journal of Veterinary and Animal Sciences,* 29(3): 853–856.

Bekadja, I.B., Mouffok, S., Kherraz, A. & Boutiba, Z. 2009. Etude Préliminaire sur la biologie et la dynamique des populations de la Crevette Profonde *Parapenaeus longirostris* (LUCAS, 1846) de la Façade maritime oranaise. *European Journal of Scientific Research*, 36: 134–144.

Belcari, P., Fedi, E. & Viva, C. 1989. Distribuzione e sex–ratio di *Illex coindetii* (Verany, 1839) (Cephalopoda, Oegopsida) nell'arcipelago toscano meridionale. *Nova Thalassia,* 10(1): 507–509.

Belcari, P., Ligas, A. & Viva, C. 2006. Age determination and growth of juveniles of the European hake, *Merluccius merluccius* (L., 1758), in the northern Tyrrhenian Sea (N.W. Mediterranean). *Fisheries Research,* 78: 211–217.

Belcari, P., Piatkowski, U., Zumholz, K., Sartor, P., Lefkaditou, E., Pierce, G.J., Hastie, L.C., Allcock, A.L. & Jereb, P. 2015. *Todaropsis eblanae*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. Cephalopod biology and fisheries in Europe: II. Species Accounts. (*ICES cooperative research report*), 325: 207–218.

Belcari, P., Sartor, P., Jereb, P, Lefkaditou, E., Pierce, G. J., Piatkowski, U., Borges, T. & Allcock, A.L. 2015. *Eledone cirrhosa*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. Cephalopod biology and fisheries in Europe: II. Species Accounts. (*ICES cooperative research report*), 325: 30–41.

Belcari, P. & Sartor, P. 1993. Bottom trawling teuthofauna of the northern Tyrrhenian Sea. *Scientia Marina*, 57(2–3): 145–152.

Belcari, P., Viva, C. & Mori, M. 2003. Fishery and biology of *Aristaeomorpha foliacea* (Risso, 1827) (Crustacea: Decaoda) in the Northern Tyrrhenian Sea (western Mediterranean). *Journal of the Northwest Atlantic Fishery Science,* 31:195–204.

Belhoucine, F. 2012. *Etude de la biologie de la croissance et de la reproduction d' un poisson téléeostén (*Merluccius merluccius *L., 1758) et son utilisation comme indicateur biologique de la pollution par lés metaux lords (Zinc, Plomb et Cadmium) dans la baie d'Oran (Algérie).* Université d'Oran (Algérie). (PhD dissertation)

Bellodi, A., Porcu, C., Cannas, R., Cau, Al., Marongiu, M.F., Mulas, A., Vittori, S. & Follesa, M.C. 2017. Life-history traits of the long-nosed skate *Dipturus oxyrinchus*. *Journal of Fish Biology*, 90: 867–888.

Ben Jrad, L., Fehri-Bedoui, R., Ben Slama, S. & Ben Hassine, O.K. 2010. Reproduction and diet of *Trigloporus lastoviza* (Triglidae) in the Gulf of Tunis. *Cybium*, 34(4): 353-365.

Ben Meriem, S., Fehri-Bedoul, R. & Gharbi, H. 2001. Size at maturity and ovigerous period of the pink shrimp *Parapenaeus longirostris* (Lucas, 1846) in Tunisia. *Crustaceana*, 74(1): 39–48.

Ben Salem, M. & Ktari, M.H. 1980. Présentation des espèces du genre Trachurus Rafinesque, 1810 et Caranx Lacepède, 1801 (Poissons, Téléostéens, Carangidae) des côtes tunisiennes: Morphologie et Biologie. *Bulletin de l'Office National des Pêches*, 4(1): 155–168.

Bendiab, A.A., Mouffok, S. & Boutiba, Z. 2012. Reproductive biology and growth of lesser spotted dogfish *Scyliorhinus canicula* (Linnaeus, 1758) in Western Algerian coasts (Chondrichthyes, Scyliorhinidae). *Biodiversity Journal*, 3(1): 41–48.

Benghali, S.M.A., Mouffok, S., Kherraz, A. & Boutiba, Z. 2014. Some aspects on the reproductive biology of greater forkbeard *Phycis blennoides* (Brünnich, 1768) in western Algerian coasts (Osteichthyes, Gadidae). *Ijrras*, 19 (3): 199–206.

Bensahla Talet, A., Belaouda, D. & Matoub, L. 1990. Periode de ponte et taille a la premiere maturité sexuelle de *Boops boops* (Linneo, 1758) des cotes Oranaises (Algerie). *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 32: 260.

Bertozzi, M., Pasolini, P., Hemida, F., Capapé, C. & Tinti, F. 2003. Species diversity in Algerian skates. *Proceedings of the 7th European Elasmobranch Association Meeting.* San Marino: 38.

Bettoso, N., Faresi, L. & Aleffi, F. 2006. Prime osservazioni sulle catture di Sepia officinalis (Mollusca: Cephalopoda) nel Golfo di Trieste. *Biologia Marina Mediterranea*, 13 (1): 806–808.

Biagi, F., Cesarini, A., Sbrana, M. & Viva, C. 1995. Reproductive biology and fecundity of *Merluccius merluccius* (Linnaeus, 1758) in the northern Tyrrhenian Sea. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 34: 237.

Bianchini, M.L, Di Stefano, L. & Ragonese, S. 1998. Size and age at onset of sexual maturity of female Norway lobster *Nephrops norvegicus* L. (Crustacea: Nephropidae) in the Strait of Sicily (Central Mediterranean Sea). *Scientia Marina*, 62(1–2): 151–159.

Bigongiari, N. 1992. *Biologia ed ecologia di* Illex coindetii *(Verany, 1839) nell'Arcipelago Toscano Meridionale*. University of Pisa, Italy. (PhD dissertation).

Bigot, J.L. & Roos, D. 2009. *Small pelagics in the Gulf of Lion (GSA 07)*. Report of the SCSA Working Group on Stock Assessment of Small Pelagic Species. Ancona, Italy, 26–30 October 2009.

Bini, G. 1968. *Atlante dei pesci delle coste italiane*. Mondo sommerso, Roma: 1–10.

Bini, G. 1966–1970. *Atlante dei pesci delle coste italiane*. I pesci dei mari d'Italia (introduzione) (1966); II. Osteitti (Acipenseriformi, Clupeiformi, Mictofiformi, Anguilliformi) (1970); III. Osteitti (Notacantiformi, Beloniformi, Gadiformi, Macruriformi, Signatiformi, Lampridiformi, Ciprinodontiformi, Bericiformi, Zeiformi) (1970); IV. Osteitti (Perciformi: Mugiloidei, Percoidei) (1968); V. Osteitti (Perciformi: Percoidei) (1968); VI. Osteitti (Perciformi: Trichiuroidei, Scombroidei, Stromatoidei, Callionimoidei, Ammoditoidei, Blennioidei) (1968); VII. Osteitti (Perciformi: Oftdioidei, Gobioidei, Scorpenoidei, Dactilopteroidei) (1969); VIII. Osteitti (Pleuronettiformi, Echeneiformi, Gobiesociformi, Tetraodontiformi, Lofiiformi) (1968). Mondo Sommerso, Roma.

Bini, G. 1976. *Atlante dei pesci delle coste italiane, 1. Leptocardi, Ciclostomi, Selaci*.

Bitetto, I., Casciaro, L., Facchini, M.T., Spedicato, M.T., Carbonara, P., & Lembo, G. 2012. Rapporto annuale sullo stato delle risorse della GSA 10. Tirreno centro–meridionale. *Rapporto annuale sullo stato delle risorse biologiche dei mari circostanti l'Italia:* 254 pp. (Technical Report).

Blasdale, T., Serena, F., Mancusi, C., Guallart, J. & Ungaro, N. 2009. *Dalatias licha*. The IUCN Red List of Threatened Species 2009: e.T6229A12585770.

Boeseman, M. 1967. Some remarks on *Raja nidarosiensis* Storm, including the first record of an egg–capsule from British waters. Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen. *Biological and Medical Sciences Series C.*, 70: 454–465.

Borges, F., Dinis, H. & Monteiro, C. 1977. Resultats preliminaires sur la ponte, composition des tailles et etat du stock du chinchard (*Trachurus trachurus* L.) de la côte continentale portugaise. *ICES C.M.* 1977/J: 1: 50 pp.

Borges, M.F. & Gordo, L.S. 1991. Spatial distribution by season and some biological parameters of horse mackerel (*Trachurus trachurus* L.) in the Portuguese continental waters (Division IXa). *ICES C.M.* 1991/H: 54: 16 pp.

Bottari, T., Micale, V., Liguori, M., Rinelli, P., Busalacchi, B., Bonfiglio, R. & Ragonese S., 2014. The reproductive biology of *Boops boops* (Linnaeus, 1758) (Teleostei: Sparidae) in the southern Tyrrhenian Sea (Central Mediterranean). *Cahiers de Biologie Marine,* 55(2): 281–292.

Bouaziz, A. 1992. *Le merlu* (Merluccius merluccius mediterraneus Cadenat, 1990) *de la baie de Bou Ismal: biologie et écologie*. Univ. ISMAL (Alger). (Theses magister Oceanogr. Biol.)

Bouaziz, A., Bennoui A. 2004. Etat d'exploitation de l'anchois *Engraulis encrasicolus* (Linné, 1758) dans la baie d'Alger. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 37: 318.

Bouaziz, A., Bennoui, A. & Brahmi, B. 2001. Sur l'estimation del'etat d'exploitation du merlu *Merluccius merluccius* (Linnaeus 1847) de la region centre de la cote algerienne. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 36: 243.

Bouaziz, A., Sermoud, R., Djabalii, F. & Maurin, C. 1998. Reproduction du merlu *Merluccius merluccius* (Linnaeus, 1758) dans la région de Bou–Ismaîl. *CIHEAM Cahiers Options Méditerranéennes,* 35: 109–117.

Boudaya, L. 2000. Écobiologie de deux espèces de Triglidae (Pisces, Teleostei) du golfe de Gabès: *Trigloporus lastoviza* (Bonnaterre, 1788) et *Aspitrigla obscura* (Linnaeus, 1764). Mémoire de DEA. Univ. Sud, Faculté des sciences de Sfax, Tunisie.

Bougis, P. 1952. Recherches biométriques sur les rougets (*Mullus barbatus* et *Mullus surmuletus* L.). *Archives de zoologie expérimentale et générale*, 89(2): 57–174.

Bouhlal, M. 1973. Le merlu des côtes nord de la Tunisie: Etude économique et biologique. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô,* 2(4): 579–603.

Bouhniol, J.P. & Pron, L. 1916. Le précocité sexuelle et les conditions thermiques de la maturation génitale et de la ponte chez quelques Sparides commun D'Algerie: *P. erythrinus, P. acarne, P. centrodentus, P. vulgaris, Box vulgaris, O. melanura, O. macrophtalmus*. C.R. Soc. Biol. LXXIX, 140.

Boyle, P.R. & Ngoile, M.A.K. 1993. Assessment of maturity state and seasonality of reproduction in *Loligo forbesi* (Cephalopoda: Loliginidae) from Scottish waters. *Recent Advances in Cephalopod Fisheries Biology*, 37–48.

Boyle, P.R., Pierce, G.J. & Hastie, L.C. 1995. Flexible reproductive strategies in the squid *Loligo forbesi*. *Marine Biology*, 121: 501–508.

Bradaï, M.N., Serena, F., Bianchi, I. & Ebert, D.A. 2007. *Oxynotus centrina*. The IUCN Red List of Threatened Species 2007: e.T63141A12622296

Brander, K. & Palmer, D. 1985. Growth rate of *Raja clavata* in the Northeast Irish Sea. *ICES Journal of Marine Science*, 42: 125–128.

Brito, A., Pascual, P.J., Falcón, J.M., Sancho, A. & Gonzáles, G. 2002. *Peces de las islas Canarias: catálogo comentado e ilustrado*. *In* F. Lemus, eds. Tenerife.

Bruno, I., Preciado, I., Perez, N., Velasco, F., Olaso, I., Araujo, H. & Gutiérrez-Zabala, J.L. 2006. Correlations between inter-annual variations in blue-whiting horse mackerel and European hake abundances as estimated from discard surveys and the role of these species in European hake diet in Northern Atlantic Spanish waters (ICES subareas VIIIc and North-IXa). *ICES CM* 2006/K: 30.

Cabiddu, S., Atzori, G., Mulas, A., Porcu, C. & Follesa, M.C. 2012. Reproductive period of *Dipturus oxyrinchus* (Elasmobranchii: Rajidae) in Sardinian Seas. *Biologia Marina Mediterranea,* 19(1): 142–143.

Cadenat, J. & Blache, J. 1981. Requins de Méditerranée et d'Atlantique (plus particulièrement de la côte occidentale d'Afrique). *Faune tropicale*, ORSTOM, 21: 1–330.

Campillo, A. & Amadei, J. 1978. Première données biologiques sur la langouste de Corse, *Palinurus elephas* Fabricius. *Revue des Travaux de l'Institut des Peches Maritimes*, 42: 347–373.

Campillo, A. 1992a. *Aspitrigla cuculus*. Les pêcheries francaises de Méditerranée: synthese des connaisances. *Rapports Internes de la Direction des Ressources Vivantes de l'Ifremer.* IFREMER, DRV92/019– RH/Sét: 107–108.

Campillo, A. 1992b. Les pêcheries françaises de Méditerranée: synthèse des connaissances. Institut Français de Recherche pour l'Exploitation de la Mer, France, 206 pp.

Campillo, A. 1994. Bio–ecology of *Aristeus antennatus* in the French Mediterranean. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 25.

Cannas, R., Follesa, M.C., Cabiddu, S., Porcu, C., Salvadori, S., Iglésias, S.P., Deiana, A.M. & Cau A. 2010. Molecular and morphological evidence of the occurrence of the Norwegian skate *Dipturus nidarosiensis* (Storm, 1881) in the Mediterranean Sea. *Marine Biology Research,* 6(4): 341–350.

Cannizzaro, L., Garofalo, G., Levi, D., Rizzo, P. & Gancitano, S. 1995. *Raja clavata* (Linneo, 1758) nel Canale di Sicilia: Crescita, distribuzione e abbondanza. *Biologia Marina Mediterranea,* 2: 257–262.

Cannizzaro, L., Rizzo, P., Levi, D. & Gancitano, S. 1995. Age determination and growth of *Squalus blainvillei* (Risso, 1826). *Fisheries Research*, 23: 113–125.

Cano Fortuna, M.R. & Sánchez Lizaso, J.L. 1996. Biología reproductiva de la boga *Boops boops* (L., 1758) (Pisces, Sparidae), en el Sureste de la Península Ibérica. Tomo Extraordinario. 125 Aniversario de la RSEHN.

Capapé, C. 1977a. Contribution à la biologie des Rajidae des côtes tunisiennes. 4. *Raja asterias* Delaroche, 1809: répartition geographique et bathymétrique, sexualité, reprodution et fecondité. *Bulletin du Museum national d'histoire naturelle du Paris*, 305: 305–326.

Capapé, C. 1977b. Contribution à la biologie des Scyliorhinidæ des côtes tunisiennes. I. *Scyliorhinus canicula* (Linné, 1758): répartition géographique et bathymétrique, sexualité, reproduction, fécondité. *Bulletin du Office Naionale des Peches de Tunisie*, 1(1): 83–101.

Capapé, C. 1985. Nouvelle description de *Centrophorus granulosus* (Schneider, 1801) (Pisces, Squalidae). Données sur la biologie de la réproduction et le régime alimentaire des specimens des côtes tunisiennes. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô,* 12*:* 97–141.

Capapè, C., Bradai, M.N., Seck, A.A., Diatta, Y., Tomasini, J.A. & Quignard, J.P. 2001. Aspects of the reproductive biology of the velvet belly, *Etmopterus spinax* (Elasmobranchii: Squalidae). *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô,* 28: 55–64.

Capapé, C., Guelorget, O., Reynaud, C., Marques, A., Bouchereau, J. & Zaouali, J. 2003. Effects of reproductive factors on interrelationships between three deep water sharks from Northern Tunisia (Central Mediterranean). *Annales Series Historia Naturalis,* 13: 191–190.

Capapé, C., Reynaud, C., Vergne, Y. & Quignard, J.P. 2008b. Biological observations on the small spotted catshark *Scyliorhinus canicula* (Chondrichthyes: Scyliorhinidae) off the Languedocian coast (southern France, northern Mediterranean *Pan–American Journal of Aquatic Sciences*, 3: 282–289.

Capapé, C., Guelorget, O., Vergne, Y. & Reynaud, C. 2008a. Reproductive biology of the blackmouth catshark, *Galeus melastomus* (Chondrichthyes: Scyliorhinidae) off the Languedocian Coast (Southern France, Northern Mediterranean). *Journal of the Marine Biological Association of the United Kingdom*, 88: 415–421.

Capapé, C., Hemida, F., Quignard, J.P., Mourad Ben Amor, M. & Reynaud, C. 2008c. Biological observations on a rare deep–sea shark, *Dalatias licha* (Chondrichthyes: Dalatiidae), off the Maghreb coast (south-western Mediterranean). *Pan–American Journal of Aquatic Sciences*, 3(3): 355–360.

Capapé, C. & Quignard, J.P. 1974. Contribution à la biologie des Rajidae des côtes tunisiennes. I – *Raja miraletus* Linné, 1758: Répartition géographique et bathymétrique, sexualité, reproduction, fécondité. *Les archives de l'Institut Pasteur Tunis,* 51(1–2): 39–60.

Capapé, C. & Quignard, J.P. 1978. Contribution à la biologie des rajidae des côtes tunisiennes. XIV – *Raja polystigma* Regan, 1923: répartition géographique et bathymétrique, sexualité, reproduction, fécondité. *Cahiers de Biologie Marine,* 19: 233–244.

Capapé, C., Reynaud, C., Vergne, Y. & Quignard, J.P. 2008. Biological observations on the small spotted catshark *Scyliorhinus canicula* (Chondrichthyes: Scyliorhinidae) off the Languedocian coast (southern France, northern Mediterranean *Pan–American Journal of Aquatic Sciences,* 3: 282–289.

Capapé, C., Seck, A.A. & Quignard, J.P. 1999. Aspects of the reproductive biology of the angular rough shark, *Oxynotus centrina* (Oxynotidae). *Cybium,* 23(3): 259–271.

Capapé, C., Tomasini, J.A. & Bouchereau, J.L. 1991. Observations sur la biologie de la reproduction de la petite rousett *Scyliorhinus canicula* (Linnaeus, 1758) (Pisces, Scyliorhinidae) du Golfe du Lion (France Méridionale). *Ichtyophysiologica Acta*, 14: 87–109.

Capapé, C. & Zaouali, J. 1977. Contribution à la biologie des Scyliorhinidae des côtes tunisiennes – VI – *Galeus melastomus* Rafinesque, 1810 – Répartition géographique et bathymétrique, sexualité, reproduction, fécondité. *Cahiers de Biologie Marine,* 18: 449–463.

Carbonara, P., Casciaro, L., Bitetto, I. & Spedicato, M.T. 2012. Reproductive cycle and length at first maturity of *Trachurus trachurus* in the Central–Western Mediterranean Seas. *Biologia Marina Mediterranea,* 19(1): 204–205.

Carbonara, P., Casciaro, L., Bitetto, I., Zupa, W., Gaudio, P., Facchini, M.T. & Spedicato, M.T. 2012. Reproductive cycle and length at first maturity of *Galeus melastomus* in the central Mediterranean Sea. *16th Annual Scientific Conference of the European Elasmobranch Association (EEA)*. Italy, Milan: 58.

Carbonara, P., Casciaro, L., Gaudio, P., Palmisano, M., Zupa, W. & Spedicato, M.T. 2013. Reproductive cycle and length at first maturity of S*quilla mantis* in the central–western Mediterranean. *Biologia Marina Mediterranea*, 20(1): 172–173.

Carbonara, P., Intini, S., Modugno, E., Maradonna, F., Spedicato, M.T., Lembo, G., Zupa, W. & Carnevali, O. 2015. Reproductive biology characteristics of red mullet (*Mullus barbatus* L., 1758) in Southern Adriatic Sea and management implications. *Aquatic Living Resources,* 28: 21–31.

Carbonara, P., Silecchia, T., Zupa, R. & Spedicato, M.T. 2006. Maturità e fecondità dello scampo *Nephrops norvegicus* (Linnaeus, 1758) nel Tirreno centro–meridionale. *Biologia Marina Mediterranea*, 13(1): 827–830.

Carbonara, P., Stagioni, M., Spedicato, M.T., Manfredi, C., Intini, S., Veloná, A., Cariani, A. & Tinti, F. 2013. Occurrence of *Dipturus nidarosiensis* (Storm, 1881) in southern Adriatic and Ionian Sea. *16th Annual Scientific Conference of the European Elasmobranch Association*, p. 58.

Carbonara, P., Zupa, R. & Spedicato, M.T. 2005. Occurrence of a spawning female of *Lophius budegassa* Spinola, 1807 in the Salerno Gulf. *Biologia Marina Mediterranea,* 12: 488–491.

Carbonell, A. 1994. Life cycle of *Aristeus antennatus* on Majorca island waters. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus. Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications,* 3: 13.

Carbonell, A., Carbonell, M., Monserrat, S., Grau, A. & Demestre, M. 1999. The red shrimp *Aristeus antennatus* (Risso, 1816) fishery and biology in the Balearic Islands, Western Mediterranean. *Fisheries Research,* 44: 1–13.

Carbonell, A., Lloret, J. & Demestre, M. 2008. Relationship between condition and recruitment success of red shrimp (*Aristeus antennatus*) in the Balearic Sea (Northwestern Mediterranean). *Journal of Marine Systems,* 71: 403–412.

Cardinale, M., Raetz, H.J. & Charef, A. 2011. Scientific, Technical and Economic Committee for Fisheries (STECF). *Report of the Assessment of Mediterranean Sea stocks – part 2 (STECF 11–14). EUR 25053 EN, JRC67797*. Publications Office of the EU, Luxembourg: 608 pp.

Carlucci, R., Capezzuto, F., Maiorano, P., Sion, L. & D'Onghia, G. 2009. Distribution, population structure and dynamics of the black anglerfish (*Lophius budegassa*) Spinola, 1807 in the Eastern Mediterranean Sea. *Fisheries Research,* 95: 76–87.

Carlucci, R., D'Onghia, G., Sion, L., Maiorano, P. & Tursi, A. 2006. Selectivity parameters and size at maturity in deep–water shrimps, *Aristaeomorpha foliacea* (Risso, 1827) and *Aristeus antennatus* (Risso, 1816) from the North–Western Ionian Sea. *Hydrobiologia*, 557: 145–154.

Carpenter, K.E., Smith-Vaniz, W.F., De Bruyne, G. & De Morais, L. 2015. *Mullus barbatus*. The IUCN Red List of Threatened Species 2015.

Carpenter, K.E., Smith-Vaniz, W.F., De Bruyne, G. & De Morais, L. 2015. *Mullus surmuletus*. The IUCN Red List of Threatened Species 2015: e.T198674A42691804. www.iucnredlist.org/details/198674/0

Carrillo, J. 1978. Biología y crecimiento del jurel (*Trachurus trachurus* (L.) y *Trachurus mediterraneus mediterraneus* Steindachner) del Mar Mediterráneo catalán. Universidad de La Laguna. Tesina de licenciatura.

Carvalho, N., Perrota, N.G. & Isidro, E.J. 2002. Age, growth and maturity in the chub mackerel (*Scomber japonicas* Houttuyn, 1782) from the Azores Archipelago. *Arquipelago – Life and Marine Sciences*, 19A: 93–99.

Casaponsa, J. 1993. *Contribución al estudio del género Trachurus (Pisces: Carangidae) en el Mar Catalán*. Universidad de Barcelona. (PhD dissertation).

Casavola, N., Marano, G. & Rizzi, E. 1996. Batch fecundity of *Engraulis encrasicolus* L. in the south–western Adriatic Sea. *Scientia Marina,* 60: 369–377.

Casciaro, L., Leonori, I., Bitetto, I., Santojanni, A., Spedicato, M.T., Carbonara, P. & Lembo, G. 2012. GSA 18 – Mare Adriatico meridionale. *In* A. Mannini & G. Relini, eds. Rapporto annuale sullo stato delle risorse biologiche dei mari circostanti d'italia: anno 2009. *Biologia Marina Mediterranea,* 19(1):138–161.

Casey, J. & Pereiro, J.A. 1995. European hake (*M. merluccius*) in the North–east Atlantic. *In* J. Alheit & T.J. Pitcher, eds. *Hake. Biology, fisheries and markets. Serie 15,* pp. 125–147. Chapmann and Hall. London.

Catalano, B., Dalù, M., Scacco, U. & Vacchi, M. 2007. New biological data on *Raja brachyura* (Chondrichthyes, Rajidae) from around Asinara Island (N.W. Sardinia, Western Mediterranean). *Italian Journal of Zoology*, 74(1): 55–61.

Cau, A., Deiana, A.M. & Mura, M. 1982. Nuovi dati sull'accrescimento e sulla maturità sessuale di *Aristaeomorpha foliacea* (Risso, 1827) (Decapoda, Penaeidea). *Naturalista Siciliano,* (4): 429–434.

Cau, A., Sabatini, A., Murenu, M., Follesa, M.C. & Cuccu, D. 1994. Considerazioni sullo stato di sfruttamento delle risorse demersali (Mari di Sardegna). *Biologia Marina Mediterranea*, 1: 67–768.

Ceccaldi, H.J. & Latrouite, D. 1994. The french fisheries for the european spiny lobster *Palinurus elephas*. *Spiny Lobster Management*, 12: 169–178.

Çelik, O. & Torcu, H. 2000. Ege Denizi, Edremit Körfezi Barbunya Balığı (*Mullus barbatus* Linnaeus, 1758)'nın Biyolojisi Üzerine Arastırmalar. *Turkish Journal of Veterinary and Animal Sciences*, 24: 287–295.

Cengiz, O. 2012. Age, Growth, Mortality and Reproduction of the Chub Mackerel (*Scomber japonicas* Houttuyn, 1782) from Saros Bay (Northern Aegean Sea, Turkey). *Turkish Journal of Fisheries and Aquatic Sciences*, 12: 799–809.

Cengiz, O., Özekinci, U., İşmen, A. & Öztekin, A. 2015. Some reproductive characteristics of four–spotted megrim (*Lepidorhombus boscii* Risso, 1810) from Saros Bay (Northern Aegean Sea, Turkey). *Tarım Bilimleri Dergisi*, 21(2): 270–278.

Ceriola, L., Ungaro, N. & Toteda, F. 2006. Some information on the biology of *Illex coindetii* Verany, 1839 (Cephalopoda, Ommastrephidae) in the south-western Adriatic Sea (Central Mediterranean). *Fisheries Research,* 82: 41–49.

Cerri, P.S. & Sasso-Cerri, E. 2003. Staining methods applied to glycol methacrylate embedded tissue sections. *Micron*, 34(8): 365–372.

Cetinic, P. 1999. Istraživanje kompetitivnih odnosa izmedu ribolova pridnenim povlacnom povlacnom mrežom (kocom), vršama za lov škampa i jednostrukim mrežema stajacicama za lov oslica u velebitskom kanalu, s posebnim osvrtom na populaciju škampa i oslica. IOF, Split, 53 pp.

Chali-Chabane, F. 1988. *Contribution a l'etude biologique et dynamique de la population de* Boops boops *de la baie de Bou–Ismail (Alger)*. Institut des Sciences de la Mer et de l'aménagement du littoral (ISMAL), Algeria. (MA thesis)

Chavance, P. 1980. Production des aires de ponte, survie larvaire et biomasse adulte de la sardine et de l'anchois dans l'est du Golfe de Lion (Méditerranée Occidentale). *Tethys*, 9(4): 399–413.

Chelli, M. 2003. Aspetti biologici e popolazionistici di *Todaropsis eblanae* (Ball, 1841) nelle acque del Mar Ligure sud orientale. University of Pisa. (Degree Thesis).

Cherabi, O. 1987. *Contribution a l'étude de la biologie du pageot commun* Pagellus erythrinus *et a l'écologie de la famille des Sparidés de la baie d'Alger*. (Thése de magistére).

Cherif, M., Zarrad, R., Gharbi, H., Missaoui, H. & Jarboui, O. 2007. Some biological parameters of the red mullet, *Mullus barbatus* L., 1758, from the Gulf of Tunis. *Acta Adriatica*, 48(2): 131–144.

Chiericoni, V., De Ranieri, S. & Sartor, P. 1996. Periodo di deposizione di *Micromesistius poutassou* (Risso, 1826) (Osteichthyes, Gadiformes) nel mar Tirreno settentrionale. *Biologia Marina Mediterranea*, 3: 540–541.

Cikeš Keč, V. & Zorica, B. 2012. The reproductive traits of *Scomber japonicas* (Houttuyn, 1782) in the Eastern Adriatic Sea. *Journal of Applied Ichthyology*, 28: 15–21.

Clark, R.S. 1922. Rays and Skates (Raiae). N. 1. Eggs capsulae and young. *Journal of the Marine Biological Association of the United Kingdom*, 12: 577–643.

Coelho, M.L., Quintela, J., Bettencourt, V., Olavo, G. & Villa, H. 1994. Population structure, maturation and fecundity of the squid *Loligo vulgaris* from southern Portugal. *Fisheries Research*, 21: 87–102.

Coelho, R. & Erzini, K. 2005. Length at first maturity of two species of lantern sharks (*Etmopterus spinax* and *Etmopterus pusillus*) of southern Portugal. *Journal of the Marine Biological Association of the United Kingdom,* 85: 163–165.

Coelho, R., Bentes, L., Correia, C., Gonçalves, J.M.S., Lino, P.G., Monteiro, P., Ribeiro, J. & Erzini, K. 2010. Life history of the common pandora, *Pagellus erythrinus* (Linnaeus, 1758) (Actinopterygii: Sparidae) from southern Portugal. *Brazilian Journal of Oceanography*, 58(3): 233–245."

Coelho, R. & Erzini, K. 2008. Life history of a wide–ranging deepwater lantern shark in the north–east Atlantic, *Etmopterus spinax* (Chondrichthyes: Etmopteridae), with implications for conservation. *Journal of Fish Biology*, 73(6): 1419–1443.

Coelho, R., Rey, J., Gil De Sola, L., Fernandez De Carvalho, J. & Erzini, K. 2010. Comparing Atlantic and Mediterranean populations of the velvet belly lantern shark, *Etmopterus spinax*, with comments on the efficiency of density–dependent compensatory mechanisms. *Marine Biology Research*, 6: 373–380.

Cohen, D.M., Inada, T., Iwamoto, T. & Scialabba, N. 1990. FAO Species catalogue. Gadiform fishes of the world. *Fisheries Synopsis* 125/10: 442 pp.

Colella, S. & Santojanni, A. 2012. Aspetti della biologia riproduttiva di *Nephrops norvegicus* L., 1758 (Crustacea Decapoda) nel Mar Adriatico Centrale e risultati preliminari. *Biologia Marina Mediterranea,* 19(1): 146–147.

Coll, M., Navarro, J. & Palomera, I. 2013. Ecological role, fishing impact, and management options for the recovery of a Mediterranean endemic skate by means of food web models. *Biological Conservation*, 157: 108–120.

Collette, B., Amorim, A.F., Boustany, A., Carpenter, K.E., De Oliveira Leite, Jr. N., Di Natale, A., Fox, W., Fredou, F.L., Graves, J., Viera Hazin, F.H., Juan Jorda, M., Kada, O., Minte Vera, C., Miyabe, N., Nelson, R., Oxenford, H., Teixeira Lessa, R.P. & Pires Ferreira Travassos, P.E. 2011. *Scomber colias*. The IUCN Red List of Threatened Species. Version 2014.3. www.iucnredlist.org/details/170357/0

Collignon, J. & Aloncle, H. 1972.Catalogue raisonné des Poissons des mers marocaines, I: Cyclostomes, Sélaciens, Holocéphales. *Bulletin de l'Institut des Peches Maritimes du Maroc,* 19: 1–164.

Colloca, F., Cardinale, M., Marcello, A. & Ardizzone, G.D. 2003. Tracing the life history of red gurnard (*Aspitrigla cuculus*) using validated otolith annual rings. *Journal of Applied Ichthyology,* 19: 1–9.

Colloca, F., Gentiloni, P., Agnesi, S., Schintu, P., Cardinale, M., Belluscio, A. & Ardizzone, G.D. 1998. Biologia e dinamica di popolazione di *Aristeus antennatus* (Decapoda: Aristeidae) nel Tirreno centrale. *Biologia Marina Mediterranea,* 5: 218–231.

Colmenero, A.I., Tuset, V.M., Recasens, L. & Sánchez, P. 2013. Reproductive biology of Black Anglerfish (*Lophius budegassa*) in the northwestern Mediterranean Sea. *Fishery Bulletin*, 111: 390–401.

Compagno, L.J.V. 1984. *Sharks of the World. An Annotated and Illustrated Catalogue of Shark Species Known to Date*. Part 1. Hexanchiformes to Lamniformes. FAO, Rome.

Compagno, L.J.V., Dando, M. & Fowler, S. 2005. *A Field Guide to the Sharks of the World*. Harper Collins Publishing Ltd., London.

Compagno, L.J.V., Ebert, D.A. & Cowley, P.D. 1991. Distribution of offshore demersal cartilaginous fishes (Class Chondrichthyes) of the west coast of southern Africa, with notes on their systematics. South *African Journal of Marine Science,* 11: 43–139.

Consalvo, I., Scacco, U., Romanelli, M. & Vacchi, M. 2007. Comparative study on the reproductive biology of *Torpedo torpedo* (Linnaeus, 1758) and *T. marmorata* (Risso, 1810) in the central Mediterranean Sea. *Scientia Marina,* 71(2): 213–222.

Costa, A. 2013. Somatic Condition, Growth and Reproduction of Hake, *Merluccius merluccius* L., in the Portuguese Coast. *Journal of Marine Science,* 3: 12–30.

Costa, M.E., Erzini, K. & Borges, T.C. 2005. Reproductive biology of the blackmouth catshark, *Galeus melastomus* (Chondrichthyes: Scyliorhinidae) off the south coast of Portugal. *Journal of the Marine Biological Association of the United Kingdom,* 85: 1173–1183.

Cottiglia, M., Giglio, M.B., Ionta, G., Masala, B., Serra, E. & Tagliasacchi Masala, M.L. 1977. La biologia di *Palinurus elephas* Fabr. nelle acque sarde. Proposte per una nuova normativa regionale di pesca. *La programmazione in Sardegna*, 61–62: 1–11.

Crawford, R.J.M. 1987. Food and population variability in five regions supporting large stocks of anchovy, sardine and horse mackerel. *South African Journal of Marine Science*, 5: 735–757.

Crosnier, A., De Bondy, E. & Lefevere, S. 1968. Les crevettes commercialisables de la côte ouest de l'Afrique inter-tropicale. Etat de nos connaissances sur leur biologie et leur pêche en juillet 1967. Collection Initiations Documentations Techniques. ORSTOM 7: 60 pp.

Cuccu, D., Damele, F., Follesa, M.C., Murenu, M. & Cau, A. 2003. Aspetti biologici di *Eledone cirrhosa* (Cephalopoda Octopoda) nei mari circostanti la Sardegna. *Biologia Marina Mediterranea*, 10(2): 119–126.

Cuccu, D., Mereu, M., Cau, Al., Pesci, P. & Cau, A. 2013a. Reproductive development versus estimated age and size in a wild Mediterranean population of *Octopus vulgaris* (Cephalopoda: Octopodidae). *Journal of the Marine Biological Association of the United Kingdom*, 93(3): 843–849.

Cuccu, D., Mereu, M., Porcu, C., Follesa, M.C., Cau, Al. & Cau, A. 2013b. Development of sexual organs and fecundity in *Octopus vulgaris* Cuvier, 1797 from the Sardinian waters (Mediterranean Sea). *Mediterranean Marine Science*, 14(2): 270–277.

Cuttitta, A., Basilone, G., Patti, B., Bonanno, A., Garcia, A., Mazzola, S. & Giusto, G.B. 1999. Trends of anchovy (*Engraulis encrasicolus*) condition factor and gonadosomatic index in the Sicilian channel. *Biologia Marina Mediterranea,* 6: 566–568.

D'Onghia, G., Capezzuto, F., Mytilineou, Ch., Maiorano, P., Kapiris, K., Carlucci, R., Sion, L. & Tursi, A. 2005. Comparison of the population structure and dynamics of *Aristeus antennatus* (Risso, 1816) between exploited and unexploited areas in the Mediterranean Sea. *Fisheries Research*, 76: 22–38.

D'Onghia, G., Maiorano, P., Matarrese, A. & Tursi, A. 1998. Distribution, biology, and population dynamics of *Aristaeomorpha foliacea* (Risso, 1827) (Decapoda, Natantia, Aristeidae) in the North–Western Ionian Sea (Mediterranean Sea). *Crustaceana,* 71(5): 519–542.

D'Onghia, G., Matarrese, A., Tursi, A. & Maiorano, P. 1994. Biology of *Aristeus antennatus* and *Aristaeomorpha foliacea* in the Ionian Sea (Central Mediterranean Sea). *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 55.

D'Onghia, G., Matarrese, A., Maiorano, P. & Panza, M. 1997. Recruitment patterns of *Aristeus antennatus* (Risso, 1816) (Decapoda: Aristeidae) from the north–western Ionian Sea. *Biologia Marina Mediterranea,* 4(1): 244–253.

D'Onghia, G., Matarrese, A., Maiorano, P. & Perri, F. 1998. Valutazione di *Parapenaeus longirostris* (Lucas, 1846) (Crustacea, Decapoda) nel Mar Ionio. *Biologia Marina Mediterranea*, 5: 273–283.

Dagit, D.D., Hareide, N. & Clò, S. 2007. *Chimaera monstrosa*. The IUCN Red List of Threatened Species 2007: e.T63114A12610445.

De Morais, L., Smith-Vaniz, W.F., Carpenter, K.E., de Bruyne, G., Palmeri, A., Papakonstantinou, C. & Golani, D. 2015. *Chelidonichthys lastoviza*. The IUCN Red List of Threatened Species 2015: e.T198751A60815389.

De Ranieri, S. 1979. La maturità sessuale nelle femmine di *Mullus barbatus* L. nell' Alto Tirreno. *Xl Congresso Società Italiana di Biologia Marina, Orbetello*, 382–387.

De Ranieri, S., Mori, M. & Sbrana, M. 1998. Preliminary study on the reproductive biology of *Parapenaeus longirostris* (Lucas) off the Northern Tyrrhenian Sea. *Biologia Marina Mediterranea*, 5(1): 710–712.

Del Arbol, J., Rey, J. & Gil De Sola, L. 2004. Reproductive aspects of red mullet (*Mullus barbatus*) in the Alboran Sea. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 37: 342.

Demestre, M. & Fortuño, J.M. 1992. Reproduction of the deep–water shrimp *Aristeus antennatus* (Decapoda: Dendrobranchiata). *Marine Ecology Progress Series,* 84: 41–51.

Demestre, M. 1990. *Biologia pesquera de la gamba* Aristeus antennatus *(Risso, 1816) en el mar Catalan*. Univ. Barcelona. (PhD dissertation).

Demestre, M. 1994. Biology and demography of *Aristeus antennatus* in the Catalan Sea (N.W. Mediterranean). *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 17.

Demirel, N. & Yüksek, A. 2013. Reproductive biology of *Trachurus mediterraneus* (Carangidae): a detailed study for the Marmara–Black Sea stock. *Journal of the Marine Biological Association of the United Kingdom*, 93(2): 357–364.

Demirhan, S.A., Engin, S., Seyhan, K. & Akamca, E. 2005. Some biological aspects of thornback ray (*Raja clavata* L., 1758) in the southeastern Black Sea. *Turkish Journal of Fisheries and Aquatic Sciences,* 5: 75–83.

Dereli, H. & Erdem, M. 2011. Spawning period and first maturity size of deep water rose shrimp (*Parapenaeus longirostris*) in the Aegean Sea. *African Journal of Biotechnology,* 10(68): 15407–15415.

Deval, M.C. & Kapiris, K. 2016. A review of biological patterns of the blue–red shrimp *Aristeus antennatus* in the Mediterranean Sea: a case study of the population of Antalya Bay, eastern Mediterranean Sea. *Scientia Marina*, 80(3): 339–348.

Dieuzeide, R., Novella, M. & Roland, J. 1955. Catalogue des poissons des cotes algérinne. III Osteopterygiens (suite et fins). *Bulletin des travaux de la station d'aquiculture et de pêche de Castiglione,* 6(384): 53–94.

Djabali, I., Mouloud, F. & Hemida, F. 1988. *Résultats des travaux réalisés sur les stocks de sardines et des anchois des côtes algéroises*. *FAO Rapp. Pêches*, 395: 112–120.

Do Chi, T. 1975. Biométrie de la reproduction de *Squilla mantis* (L.) (Crustacé Stomatopode) dans le golfe d'Aigues–Mortes (Méditerranée noroccidentale). *PubblIca Stazione Zoologica di Napoli*, 39: 114–139.

Dodd, J.M. 1986. Reproduction in cartilaginous fishes (Chondrichthyes). *In* W.S. Hoar, D.J. Randall & E.M. Donaldson, eds. *Fish Physiology*, 9, part A. Academic Press, New York. 31–95.

Domínguez–Petit, R. 2007. Study of reproductive potential of *Merluccius merluccius* in the Galacian shelf. University of Vigo. Spain. Doctoral Thesis.

Domínguez–Petit, R., Korta, M., Saborido–Rey, F., Murua, H., Sainza, M. & Piñeiro, C. 2008. Changes in size at maturity of European hake Atlantic populations in relation with stock structure and environmental regimes. *Journal of Marine Systems,* 71: 260–278.

Donnaloia, M. 2008. Strategie riproduttive del nasello (*Merluccius merluccius* L. 1758) nel Mediterraneo occidentale e centrale. Università degli Studi di Bari. (Tesi di Laurea specialistica in Ecologia Marina).

Donnaloia, M., Carbonara, P., Spedicato, M.T. & Lembo, G. 2012. Reproductive strategies of European Hake (*Merluccius merluccius* L. 1758) in the South Adriatic Sea. *International Conference on Marine and Coastal Ecosystems: increasing knowledge for a sustainable conservation and integrated management*. 25 – 28 April 2012, Tirana, Albania.

Donnaloia, M., Gaudio, P., Bitetto, I., Casciaro, L., Zupa, W., Intini, S. & Spedicato, M.T. 2010. Sexual maturity of the horned octopus *Eledone cirrhosa* (Lamarck, 1798). *Biologia Marina Mediterranea*, 17(1) 336–337.

Dorel, D. 1986. *Poissons de l'Atlantique nord est relations taillepoids*. Institut Francais de Recherche pour l'exploitation de la Mer, France: 165 pp.

Dragičević, B., Dulčić, J. & Capapé, C. 2009. Capture of a rare shark, *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in the eastern Adriatic Sea. *Journal of Applied of Ichthyology*, 25(1): 56–59.

Drobisheva, S.S. 1970. Study on the biology of shrimps in the south–east part of the Mediterranean Sea with the aim to determine the perspective of fishery. *Trudy–Azovo–Chernomosk. Atlanticheskii Nauchno–Issledovatel'skii Institut Rybnogo Khozyaistva i Okeanografii,* 30: 173–208.

Duarte, R., Azevedo, M., Landa, J. & Pereda, P. 2001. Reproduction of angler fish (*Lophius budegassa* Spinola and *Lophius piscatorius* Linnaeus) from the Atlantic Iberian coast. *Fisheries Research,* 51: 349–361.

D'Udekem D'Acoz, C. 1999. *Inventaire et distribution des crustaces decapodes de l'Atlantique nord–oriental, de la Mediterranee et des eaux continentales adjacentes au Nord de 25° N*. Museum national d'Histoire naturelle, Paris.

Dulčić, J., Soldo, A. & Jardas, I. 2005. Review of Croatian selected scientific literature on species mostly exploited by the national small-scale fisheries. pp. 134–179. *In* AdriaMed. Adriatic Sea Small-scale Fisheries. *AdriaMed Technical Consultation on Adriatic Sea Small-scale Fisheries*.

Dunn, M.R. 1999. Aspects of the stock dynamics and exploitation of cuttlefish, Sepia officinalis (Linnaeus, 1758), in the English Channel. *Fisheries Research*, 40: 277–293.

Dunn, M.R. 2001. The biology and exploitation of John Dory, *Zeus faber* (Linnaeus, 1758) in the waters of England and Wales. *ICES Journal of Marine Science,* 58: 96–105.

Duysak, Ö., Özcan, G., Çek, Ş. & Türeli, C. 2014. Reproductive biology of the common cuttlefish (Sepia officinalis Linnaeus, 1758) in Iskenderun Bay (Northeastern Mediterranean Sea). *Indian journal of marine sciences*, 43(9): 1–6.

Ebert, D.A. & Stehmann, M.F.W. 2013. *Sharks, Batoids and Chimaeras of the North Atlantic*. FAO Species Catalogue for Fishery Purposes No. 7. Rome: FAO. Available at www.fao.org/docrep/017/i3178e/i3178e.pdf

Ege Journal of Fisheries and Aquatic Sciences, 18(1–2): 155–173.

Eiríksson, H. 2014. Reproductive biology of female Norway Lobster, *Nephrops Norvegicus* (Linnaeus, 1758) Leach, in Icelandic Waters during the period 1960–2010. Comparative overview of distribution areas in the Northeast Atlantic and the Mediterranean. *Advances in Marine Biology,* 68: 65–210.

El Bakali, M., Talbaoui, M. & Bendriss, A. 2010. Reproduction period, sex–ratio and sexual maturity of *Mullus surmuletus* (Teleostei, Mullidae) from the Northwest Moroccan Mediterranean coast (2007–2009). *Bulletin de l'Institut Scientifique Section Sciences de la Vie, – Rabat,* 32(2): 81–86.

El-Agamy, A., Zaki, M.I., Awad, G.S. & Negm, R.K. 2004. Reproductive biology of *Boops boops* (Family Sparidae) in the Mediterranean environment. *Egyptian Journal of Aquatic Research,* 30: 241–245.

Ellis, J.R. & Schackley, S.E. 1997. The reproductive biology of *Scyliorhinus canicula* in the Bristol Channel. *Journal of Fish Biology*, 51: 361–372.

Ellis, J.R., Silva, J.F., Mc Cully, S.R., Evans, M. & Catchpole, T. 2010. *UK Fisheries for Skates (Rajidae): History and Development of the Fishery, Recent Management Actions and Survivorship of Discards*. ICES Document CM 2010/E: 10: 38 pp.

Eltink, A.T.G.W. 1991. Batch fecundity and fraction spawning of horse mackerel (*Trachurus trachurus* L.). EC Study Contract, NBO–1990–207, 71 pp.

Eltink, A.T.G.W. 1992. Horse mackerel egg production and spawning stock size in the North Sea in 1991. *ICES C.M.* 1992/H: 21, 16 pp.

Erzini, K., Bentes, L., Lino, P.G., Ribeiro, J., Coelho, R., Monteiro, P., Correia, C. & Gonçalves, J.M. 2001. Reproductive aspects of seven sparid fishes from the southern coast of Portugal (Algarve). *Tenth European Congress of Ichthyology*, Prague.

Estácio, S., Mendonça, A., Krug, H.M., Meneze, G.M., Branco, J. & Pinho, M.R. 2001. Aspects of the reproduction of six demersal species captured in the Azores archipelago. *Arquipélago – Life and Marine Sciences*, 2B: 83–94.

Ezzat, A., Hosny, C.F. & Osman, A. 1997. Reproductive strategy of *Mullus barbatus* and *Mullus surmuletus* from Alexandria Waters, Egypt. *In* E. Özhan, ed. *Proceedings of the Third International Conference of the Mediterranean Coastal Environment, Medcoast,* 97, Qawra, Malta: 135–149.

Ezzeddine, S. & El Abed, A. 2004. Potential biological and environmental influences on the *Octopus vulgaris* population of the Gulf of Gabès (south–eastern Tunisian coast). *MedSudMed Technical documents*, 2: 42–49.

Ezzeddine-Najai, S. 1984. Reproduction de la seiche *Sepia officinalis* Linne, 1758 (Mollusque, Cephalopode) du Golfe de Tunis: étude morphologique et morphométrique. *Bulletin de l'Institut national scientifique et technique d'océanographie Pêche Salammbô*, 11: 71–118.

Ezzeddine-Najai, S. 1997. Sexual maturation in *Eledone moschata* (Cephalopoda, Octopoda) from the gulf of Gabes (Tunisia, eastern Mediterranean). *Vie Milieu*, 47(1): 69–76.

FAO-MiPAF 2006. Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. *AdriaMed Technical Documents,* 15: 184 pp.

Farmer, A.S.D. 1974. Reproduction in *Nephrops norvegicus* (Decapoda: Nephropidae). *Journal of Zoology*, 174: 161–183.

Farnocchia, I., Nannini, N. & De Ranieri, S. 2001. Ritrovamento di femmine mature di *Phycis blennoides* (Brünnich, 1768) nel Mar Tirreno settentrionale. *Biologia Marina Mediterranea*, 8(1): 712–714.

Fauré-Frémiet, E. 1942. Notes sur la biologie sexuelle de *Scyliorhinus canicula*. *Bulletin du Biologie France–Belgium*, 76: 244–249.

Favilla, M. 1996. Biologia ed ecologia di *Todaropsis eblanae* (Ball, 1841) (Cephalopoda: Ommastrephidae) nel Mar Tirreno settentrionale. Università di Pisa. (Degree Thesis).

Fernández-Rueda, P. & García–Flórez, L. 2007. *Octopus vulgaris* (Mollusca: Cephalopoda) fishery management assessment in Asturias (north–west Spain). *Fisheries Research*, 83: 351–354.

Ferrá, C., Fabi, G., Polidori, P., Tassetti, A.N., Leoni, S., Pellini, G. & Scarcella, G. 2016. *Raja asterias* population assessment in FAO GFCM GSA17 area. *Mediterranean Marine Science*, 17(3): 651–660.

Ferrer-Maza, D., Lloret, J., Muñoz, M., Faliex, E., Vila, S. & Sasal, P. 2014. Parasitism, condition and reproduction of the European hake (*Merluccius merluccius*) in the northwestern Mediterranean Sea. *ICES Journal of Marine Science,* 71: 1088–1099.

Ferrer-Maza, D., Muñoz, M., Lloret, J., Faliex, E., Vila, S. & Sasal, P. 2015. Health and reproduction of red mullet, *Mullus barbatus*, in the western Mediterranean Sea. *Hydrobiologia*, 753(1): 189–204.

Figueiredo, M.J., Figueiredo, I. & Bordalo Machado, P. 2001. Deep–water penaeid shrimps (Crustacea, Decapoda) from off the Portuguese continental slope: an alternative future resource? *Fisheries Research,* 51: 321–326.

Figueiredo, M.J. & Thomas, H.J. 1967. On the biology of the Norway lobster *Nephrops norvegicus* (L.). *Journal du Conseil Permanent International pour l'Exploration de la Mer*, 31: 89–101.

Finotto, L., Gristina, M., Garofalo, G., Riginella, E. & Mazzoldi, C. 2015. Contrasting life history and reproductive traits in two populations of *Scyliorhinus canicula*. *Marine Biology*, 162(6): 1175–1186.

Fiorentino, F., Mazzola, S., Garofalo, G., Patti, B., Gristina, M., Bonanno, A., Massi, D., Basilone, G., Cuttitta, A., Giusto, G.B., Gancitano, S., Sinacori, G., Rizzo, P., Levi, D. & Ragonese, S. 2005. Lo stato delle risorse demersali e dei piccoli pelagici e le prospettive di pesca "sostenibile" nello Stretto di Sicilia. *Convenzione con Assessorato Regione Siciliana Cooperazione, Commercio, Artigianato e Pesca*, Mazara del Vallo, Italia: 136 pp.

Fiorentino, F., Voliani, A., Belluscio, A., Chiericoni, V., Greco, S. & Silecchia, T. 1998. A comparison of growth pattern and demographic structure of Red Mullet (*Mullus barbatus*, L., 1758) in the Western Italian Seas. *Proceedings of the Symposium on Assessment of Demersal Resources by Direct Methods in the Mediterranean and the Adjacent Seas*, Pisa, 18–21 March 1998, 19 pp.

Fischer, W., ed. 1973. *FAO Species Identification Sheets for Fishery Purposes. Mediterranean and Black* Sea *(Fishing Area 37),* Vol. 1. FAO, Rome.

Fischer, W., Bauchot, M.L. & Schneider, M. 1987. Fiches FAO d'identification des espèces pour les besoins de la pêche (Révision 1). Méditerranée et mer Noire. Zone de pêche 37, Vol. II, pp. 761–1530. FAO, Rome.

Fives, J.M., Acevedo, S., Llloves, M., Whitaker, A., Robinson, M., King, P.A. 2001. The distribution and abundance of larval mackerel *Scomber scombrus* L., horse mackerel *Trachurus trachurus* L., hake *Merluccius merluccius* L. and blue waiting *Micromesistius poutassou* (Risso, 1816) in the Celtic Sea and west of Ireland during the years 1986,1989, 1992. *Fisheries Research,* 50: 17–26.

Flamigni, C. & Giovanardi, O. 1984. Biological data, collected during the Pipeta expeditions, on the squid *Loligo vulgaris* Lam.in the Adriatic. *FAO Fisheries Report*, 290: 143–146.

Flamigni, C. 1982. *Preliminary utilization of trawl survey data for hake (Merluccius merluccius L.) population dynamics in Adriatic Sea.* FAO CGPM, 290: 109–115.

Florio, G., Consoli, P., Perdichizzi, F., Rinelli, P. & Greco, S. 2003. Annotated checklist of the skates (Chondrichthyes, Rajidae) in the south–Tyrrhenian Sea from Cape Suvero (Calabria) to Cape S. Vito (Sicily). *Biologia Marina Mediterranea,* 10(2): 824–827.

Follesa, M.C. 2012. *La duplice valenza delle aree di ripopolamento attivo dell'aragosta rossa: utili siti di sperimentazione e potenti strumenti gestionali*. Università di Cagliari. (PhD dissertation).

Follesa, M.C., Addis, P., Murenu, M., Saba, R. & Sabatini, A. 2003. Annotated checklist of the skates (Chondrichthyes, Rajidae) in the Sardinian Seas. *Biologia Marina Mediterranea,* 10: 828–833.

Follesa, M.C., Cannas, R., Cabiddu, S., Cau, Al., Mulas A., Porcu C. & Cau A. 2012. Preliminary observations of the reproductive biology and diet for the Norwegian skate *Dipturus nidarosiensis* (Rajidae) from the Central Western Mediterranean Sea. *Cybium,* 36(3): 473–477.

Follesa, M.C., Cuccu, D., Murenu, M., Sabatini, A. & Cau, A. 1998. Aspetti riproduttivi negli aristeidi, *Aristaeomorpha foliacea* (Risso, 1827) e *Aristeus antennatus* (Risso, 1816), della classe di età 0+ e 1+. *Biologia Marina Mediterranea,* 5(2): 232–238.

Follesa, M.C., Mulas, A., Cabiddu, S., Porcu, C., Deiana, A.M. & Cau, A. 2010. Diet and feeding habits of two ray species, *Raja brachyura* and *Raja miraletus* (Chondrichthyes, Rajidae) in Sardinian waters (central–western Mediterranean). *Italian Journal of Zoology*, 77(1): 53–60.

Ford, E. 1921. A contribution to our knowledge of the life–histories of the dogfishes landed at Plymouth. *Journal of the Marine Biological Association of the United Kingdom,* 12: 468–450.

Freitas, A. 1985. The Penaeoidea of Southeast Africa. II. The families Aristeidae and Solenoceridae. *Investigational Report of Oceanographic Research Institute*, 57: 1–69.

Froglia, C. & Gramitto, M.E.1981b. Observations on growth of *Micromesistius poutassou* (Risso) (Pisces, Gadidae) in the Central Adriatic Sea. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 27(5): 49–53.2

Froglia, C. & Gramitto, M.E. 1981a. *Summary of biological parameters on the Norway lobster,* Nephrops norvegicus *(L.), in the Adriatic.* FAO Fishery Report, 253: 165–178.

Froglia, C. & Gramitto, M.E. 1988. An estimate of growth and mortality parameters for Norway lobster (*Nephrops norvegicus*) in the central Adriatic Sea. *In* J.F. Caddy & M. Savini, eds. Report of the fifth Technical Consultation of the General Fisheries Council for the Mediterranean. FAO Fishery Report, 394: 189–203.

Froglia, C. 1996. Growth and behaviuor of *Squilla mantis* (mantis shrimp) in Adriatic Sea (EU STUDY DG XIV/MED/93/016). *Final Report.*

Gaamour, A., Khemiri, S., Mili, S. & Ben Abdallah, L. 2004. L'anchois (*Engraulis encrasicolus*) des côtes nord de la Tunisie: reproduction et exploitation. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô*, 31: 17–35.

Gaard, E. 1987. An investigation of the squid *Loligo forbesi* Steenstrup on Faroe Bank. *ICES Document CM 1987/K:18*. 9 pp.

Gail, R. 1954. Etat sexuel et croissance du saurel des côtes Atlantiques du Maroc. (*Trachurus trachurus* L.). *Annales de Bioligie C.I.E.M.*, Vol. VIII: 90–91.

Galhardo, A.C., Serafim, P. & Castro, M. 2006. Aspects of the biology and fishery of the European spiny lobster (*Palinurus elephas*) from the southwest coast of Portugal. *Journal of Crustacean Biology,* 26(4): 601–609.

Gallagher, M.J., Nolan, C.P. & Jeal, F. 2005. Age, growth and maturity of the commercial ray species from the Irish Sea. *Journal of Northwest Atlantic Fishery Society,* 35: 47–66.

Gamulin, T. 1955. Contribution à la connaisance de l'écologie langouste *Palinurus vulgaris* (Latr.) dans l'Adriatique. *Acta Adriatica*, 12: 3–17.

Ganias, K., Mezarli, C., Voultsiadou, E. 2017. Aristotle as an ichthyologist: Exploring Aegean fish diversity 2,400 years ago. *Fish and Fisheries*, 18(6): 1038-1055.

García-Rodriguez, M. & Esteban, A. 1995. Algunos aspectos sobre la biologia y pesca de la merluza mediterranea *Merluccius merluccius* (Linnaeus, 1758) en la Bahia de Santa Pola (sureste de la peninsula Iberica). *Boletín Instituto Español de Oceanografía,* 11: 3–25.

García-Rodriguez, M. & Esteban, A. 1996. Biology (growth and reproduction) of *Aristeus antennatus* (Risso, 1816) (Decapoda, Dendrobranchiata), from the Gulf of Vera region (Western Mediterranean, Spain). *Proceedings of the 6th CCDM Florence*: 41.

García-Rodriguez, M. & Esteban, A. 1999. On the biology and fishery of *Aristeus antennatus* (Risso, 1816), (Decapoda, Dendrobranchiata) in the Ibiza Channel (Balearic Islands Spain). *Scientia Marina*, 63(1): 27–37.

García, A. & Pérez Rubín, J. 1986. The sardine and anchovy ichthyoplankton captured in nine fixed stations located at Bay of Malaga, from May to December in 1977. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 30(2): 273.

García-Rodríguez, M., Pérez Gil, J.L. & Barcala, E. 2009. Some biological aspects of *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Dendrobranchiata) in the Gulf of Alicante (S.E. Spain). *Crustaceana*, 82(3): 293–310.

Gauvrit, E., Le Goff, R. & Daguzan, J. 1997. Reproductive cycle of the cuttlefish, *Sepia officinalis* (L.) in the northern part of the Bay of Biscay. *Journal of Molluscan Studies*, 63: 19–28.

Gentiloni, P., Agnesi, S., Gargiulo, C., Belluscio, A. & Ardizzone, G.D. 2001. Dati sulla distribuzione e biologia del cefalopode *Illex coindetii* (Verany, 1839) nel mar Tirreno centrale. *Biologia Marina Mediterranea*, 8(1): 715–719.

Gharbi, H. & Ktari, M.H. 1981. Biologie de *Mullus barbatus* Linnaeus, 1758 et *Mullus surmuletus*, Linnaeus, 1758 (Poissons, Téléostéens, Mullidés) des côtes tunisiennes, taille et âge de première maturité sexuelle, cycle sexuel et coefficent de condition. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô*, 8: 41–51.

Ghorbel, M. & Ktari, M.H. 1982. Etude préliminaire de la reproduction de *Pagellus erythrinus* des eaux tunisiennes. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô*, 9: 23–38.

Ghorbel, M. 1981. Contribution a l'etude morphologique et biologique des poissons *Pagellus* et *Lithognathus* de Tunisie; etude dynamique prélimiare du pageau darts le Golf de Gabes. Rapport de stage, DEA de biologie marine et d'Océanographie, Faculte des Sciences de Tunis, 139 pp.

Ghorbel, M. 1986. *Le pageot commun* Pagellus erythrinus (*Poisson, Sparidae*). *Ecobiologie et état d'exploitation dans le Golfe de Gabes*. Université de Sfax, Tunisia. (PhD dissertation).

Giordano, D., Busalacchi, B., Bottari, T., Perdichizzi, F., Profeta, A., Pirrera, L., Modica, L. & Rinelli, P. 2010. Population dynamics and distribution of *Eledone cirrhosa* (Lamark, 1798) in the Southern Tyrrhenian Sea (Central Mediterranean). *Cahiers de Biologie Marine*, 51: 213–227.

Giordano, D., Perdichizzi, F. & Greco, S. 1998. Distribuzione ed abbondanza di *Eledone cirrhosa* (Lamark, 1798) nel Tirreno meridionale. *Biologia Marina Mediterranea*, 5(2): 349–354.

Giovanardi, O., Romanelli, M. & Fanelli, G. 1989. Distribuzione ed abbondanza degli stadi planctonici di pesci, in particolare clupeiformi, nelle acque del Mar Ionio. *Nova Thalassia*, 10(1): 187–194.

Giráldez, A. & Abad, R. 1995. Aspects on the reproductive biology of the Western Mediterranean anchovy from the coasts of Málaga (Alboran Sea). *Scientia Marina*, 59(1): 15–23.

Giráldez, A. & Torres, P. 2009. Criteria for age estimation of anchovy otoliths in the Alboran Sea (Western Mediterranean Sea) based on the monitoring of the hyaline edge formation. *Workshop on Age reading of European anchovy* (WKARA) Mazara del Vallo, Italy, 9–14 November 2009. 2008/2/ACOM43.

Giráldez, A. 2009. Study on the temporal variability of reproductive parameters of anchovy (*Engraulis encrasicolus* L.) in the Alboran Sea. Universidad de Málaga. (MSc dissertation)

Girardin, M. 1978. Les sparidae du golfe du Lion. Ecologie et biogéographie. Université Scientifique Tecnique du Languedoc, Montpellier.

Girardin, M. 1981. Pagellus erythrinus *(L., 1758) et* Boops boops *(L., 1758) (Pisces, Sparidae) du golfe du Lion. Ecologie prises commerciales et modèles de gestion*. University Languedoc, France. (These of 3rd cycle).

Girardin, M. & Quignard, J.P. 1985. Croissance de *Pagellus erythrinus* (Pisces: Teleosteens Sparidae) dans le Golfe du Lion. *Cybium,* 9: 359–374.

Golani D. 1994. Niche separation between colonizing and indigenous goatfish (Mullidae) along the Mediterranean Coast of Israel. *Journal of Fish Biology,* 45: 503–513.

Golani, D. 2004. Check-list of the Mediterranean Fishes of Israel. *Zootaxa*, 947: 1–200.

Golani, D., Kada, O., Nouar, A., Quignard, J.P. & Cuttelod, A. 2011. *Solea solea*. The IUCN Red List of Threatened Species 2011. www.iucnredlist.org/details/198739/0

Goñi D. & Latrouite, D. 2005. Review of the biology, ecology and fisheries of *Palinurus* spp. of European waters: *Palinurus elephas* (Fabricius, 1787) and *Palinurus mauritanicus* (Gruvel, 1911). *Cahiers de Biologie Marine,* 46: 127–142.

Goñi, R., Quetglas, A. & Reñones, O. 2003. Size at maturity, fecundity and reproductive potential of a protected population of the spiny lobster *Palinurus elephas* (Fabricius, 1787) from the Western Mediterranean. *Marine Biology*, 143: 583–592.

González, A.F. & Guerra, A. 1996. Reproductive biology of the short–finned squid *Illex coindetii* (Cephalopoda, Ommastrephidae) of the northeastern Atlantic. *Sarsia*, 81: 107–118.

González, Á.F., Rasero, M. & Guerra, Á. 1994. Preliminary study of *Illex coindetii* and *Todaropsis eblanae* (Cephalopoda: Ommastrephidae) in northern Spanish Atlantic waters. *Fisheries Research*, 21(1–2): 115–126.

Gordo, L.S. 1995. On the sexual maturity of the bogue (*Boops boops*) (Teleostei, Sparidae) from the Portuguese coast. *Scientia Marina*, 59: 279–286.

Greco, S., Perdichizzi, F., Spalletta, B., Capecchi, D. & Giordano, D. 1994. *Aristaeomorpha foliacea* and *Aristeus antennatus* in the Southern Eastern Tyrrhenian Sea. *In* M.L., Bianchini & S. Ragonese, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 37.

Grubiŝić, F. 1962. On the spawning period of some fishes from the central part of eastern Adriatic. *Biljeske Notes,* 18: 1–3.

Gualini, D. 1938. Prime osservazioni su la biologia e la morfologia di *Gadus poutassou* Düben. *Bollettino dei Musei di Zoologia ed Anatomia Comparata di Genova*, 18(107): 119–24.

Guallart, J. 1998. *Contribución al conocimiento de la biología y la taxonomía del tiburón batial* Centrophorus granulosus *(Bloch & Schneider, 1801) (Elasmobranchii, Squalidae) en el Mar Balear (Mediterráneo occidental)*. Universitat de Valencia. (PhD dissertation).

Guallart, J., Serena, F., Mancusi, C., Casper, B.M., Burgess, G.H., Ebert, D.A., Clarke, M. & Stenberg, C. 2006. *Centrophorus granulosus*. The IUCN Red List of Threatened Species 2016. www.iucnredlist.org/details/70705777/3

Guerra, A. 1975. Determinación de las diferentes fases del desarrollo sexual de *Octopus vulgaris* Lamarck, mediante un índice de madurez. *Investigacion Pesquera*, 39: 397–416.

Guerra, A. & Manriquez, M. 1980. Parámetros biométricos de *Octopus vulgaris*. *Investigacion Pesquera*, 44(1): 177–197.

Guerra, Á. & Rocha, F. 1994. The life history of *Loligo vulgaris and Loligo forbesi* (Cephalopoda: Loliginidae) in Galician waters (NW Spain). *Fisheries Research***,** 21: 43–69.

Guerra, Á., Robin, J.P., Sykes, A., Koutsoubas, D., Jereb, P., Lefkaditou, E., Koueta, N. & Allcock, A.L. 2015. *Sepia officinalis*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts.* (*ICES cooperative research report*), 325: 53–72.

Guescini, A., Piccinetti Manfrin, G. & Piccinetti, C. 1983. Distribution des larves de *Mullus barbatus* L. en Adriatique. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 28(5): 155–158.

Haidar, Z. 1958. Ecologie de la rouget barbet (*Mullus barbatus* L.) en Adriatique orientale. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 14.

Haidar, Z. 1970. L'oecologie du rouget (*M. barbatus*, L.) en Adriatique orientale. *Acta Adriatica*, 14: 1–94.

Hareide, N.R. & Garnes, G. 2001. The distribution and catch rates of deep–water fish along the Mid–Atlantic Ridge from 43 to 61° N. *Fisheries Research,* 51: 297–310.

Hashem, M.T. & Gassim, A.S. 1981. Some aspects of the fishery biology of *Pagellus erythrinus* (L) in the Libyan waters. *Bulletin of the Institute of Oceanography and Fishery,* 7(3): 429–441.

Hashem, M.T. 1973a. Age, growth and maturity of the goat fish (*M. barbatus*) in Abukir–Rosetta region during 1969–70. *Bulletin of the Institute of Oceanography and Fishery, Cairo*, 3: 163–182.

Hashem, M.T. 1973b. Some biological studies on the goat fish (*M. surmuletus,* L.) in the Egyptian Mediterranean waters. *Bulletin of the Institute of Oceanography and Fishery, Cairo*, 3: 95–115.

Hastie, L.C., Joy, J.B., Pierce, G.J. & Yau, C. 1994. Reproductive biology of *Todaropsis eblanae* (Cephalopoda: Ommastrephidae) in Scottish waters. *Journal of the Marine Biological Association of the United Kingdom,* 74: 367–382.

Heldt, H. 1952. Note préliminaire sur le merlu des mers tunisiennes. *Journal du Conseil Permanent International pour l'Exploration de la Mer,* 18(2): 234–235.

Heldt, J.H. 1938. La reproduction chez les Crustacés Décapodes de la famille des Pénéides. *Annales de l'Institut océanographique, Monaco*, 18: 31–206.

Hemida, F. 1987. *Contribution à l'étude de l'anchois Engraulis encrasicolus (Linné, 1758) dans la région d'Alger: biologie et exploitation*. USTHB, Alger. (PhD dissertation).

Henderson, A.C. & Casey, A. 2001. Reproduction and growth in the lesser–spotted dogfish *Scyliorhinus canicula* (Elasmobranchii: Scyliorhinidae), from the west coast of Ireland. *Cahiers de Biologie Marine,* 42(4): 397–405.

Hickling, C.F. 1927. Natural history of the hake. Parts I and 2, *Fishery Investigation,* London, 10(2):100 p.

Holden, M.J. 1975. The fecundity of *Raja clavata* in British waters. *ICES Journal of Marine Science,* 36: 110–118.

Holden, M.J., Rout, D.W. & Humphreys, C.N. 1971. The rate of egg laying by three species of ray. *Journal du Conseil/Conseil Permanent International pour l'Exploration de la Mer,* 33(3): 335–339.

Holthuis, L.B. 1980. *FAO species catalogue, 1. Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries.* FAO Fishery Synopsis, Rome, 125, 1: 261 pp.

Holthuis, L.B. 1991. Marine lobsters of the world. An annotated and illustrated catalogue of species of interest to fisheries known to date. FAO species catalogue 13(125). FAO, Rome.

Hoşsucu, B. & Cakir, D.T. 2003. Some parameters about population biology of the common pandora (*Pagellus erythrinus* L., 1758) (Sparidae) in the Edremit Bay (Turkey). *European Journal of Fisheries and Aquatic Sciences*, 20: 329–336.

Hunter, E., Shackley, S.E. & Bennett, D.B. 1996. Recent studies on the crawfish *Palinurus elephas* in South Wales and Cornwall. *Journal of the Marine Biological Association of the United Kingdom,* 76: 963–983.

Hureau, J.C. 1986. Triglidae. *In* P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen, E. Tortonese, eds.), *Fishes of the North–eastern Atlantic and the Mediterranean* Vol. 3, pp. 1230–1238. UNESCO, Paris.

ICES.1982. Report of the Working Group on Assessment of Hake Stocks. International Council for the Exploration of the Sea (*ICES*) *CM 1982/*Assess, 14: 63 pp.

ICES. 1983. Report of the Working Group on Assessment of Hake Stocks. *ICES CM 1983/*Assess, 20: 55 pp.

ICES. 1986. Report of the Working Group on Assessment of Hake Stocks. *ICES CM 1986/*Assess, 1: 48 pp.

ICES. 1987. Report of the Working Group on the Assessment of the Stocks of Hake. *ICES CM 1987/*Assess, 1: 57 pp.

ICES. 1990. Report of the Working Group on Fisheries Units in Sub–areas VII and VIII. *ICES CM 1990/* Assess, 23: 129 pp.

ICES. 2006. Report of the working group on the assessment of new MOU species (WGNEW), 13–15 December 2005, ICES Headquarters, ICES Advisory Committee on Fisheries Management, CM2006 / ACFM, 11: 234 pp.

ICES. 2007. Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, ICES CM 2007/ACFM, 21.

ICES. 2012a. Report of the Workshop 2 on Sexual Maturity Staging of sole, plaice, dab and flounder (WKMSSPDF2), 9–13 January 2012, Oostende, Belgium. ICES CM 2012/ACOM: 596 pp.

ICES. 2012b. Report of the working group for the Celtic Seas Ecoregion (WGCSE), 9–18 May 2012, Copenhagen, Denmark. ICES CM 2012/ACOM, 12: 1743 pp.

IEO. 2009. Informe sobre especies de jurel en el Mediterráneo. Instituto Español de Oceanografía. Internal report.

Iglésias, S.P., Toulhoat, L. & Sellos, D.Y. 2010. Taxonomic confusion and market mislabelling of the threatened skates: important consequences for their conservation status. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 20: 319–333.

Ikica, Z., Krstulović Šifner, S. & Joksimović, A. 2011. Some preliminary data on biological aspects of the Musky octopus, *Eledone moschata* (Lamarck., 1798) (Cephalopoda: Octopodidae) in Montenegrin waters. *Studia Marina*, 25(1), 21–35.

İlhan, D.U., Akalin, S., Özaydin, O., Tosunoğlu, Z. & Gurbet, R. 2009. İzmir Körfezi'nde Tekir Balığı'nın (*Mullus surmuletus* L., 1758) Büyüme ve Üremesi. *European Journal of Fisheries and Aquatic Sciences,* 26(1): 1–5.

Intini, S. 2013. *Crescita e tratti di life history di* Mullus barbatus *(Linnaeus, 1758) nell'Adriatico Meridionale*. Department of Biology, University of Bari. (PhD dissertation).

Ismen, A., Arslan, M., Yigin, C.C. & Bozbay, N.A. 2010. Age, growth, reproduction and feeding of John Dory, *Zeus faber* (Pisces: Zeidae),in the Saros Bay (North Aegean Sea). *Journal of Applied Ichthyology,* 29**:** 125–131.

Ivory, P., Jeal, F. & Nolan, C.P. 2005. Age determination, growth and reproduction in the lesser–spotted dogfish, *Scyliorhinus canicula* (L.). *Journal of the Northwest Atlantic Fishery Science,* 35: 89–106.

Iwamoto, T. 2015. *Zeus faber*. The IUCN Red List of Threatened Species 2015. www.iucnredlist.org/details/198769/0

Janssen, G.M. 1979.The occurrence of *Zeus faber* (Linnaeus, 1758) in the coastal waters of the Netherlands (Pisces, Zeiformaes). *Bulletin of the Museum of Zoology of Amsterdam*, 6: 153–158.

Jardas, I. 1973. A contribution to our knowledge of the biology and ecology of thornback ray (*Raja clavata* L.) and brown ray (*Raja miraletus*) in the Adriatic. *Acta Adriatica* 15: 1–42.

Jardas, I. 1979. Morphological, biological and ecological characteristics of the lesser spotted dogfish, *Scyliorhinus canicula* (Linnaeus, 1758) population in the Adriatic Sea. (in Croatian) *Izvješća–Report "Hvar" Cruises*, 4(2–3): 1–104.

Jardas, I. 1996. Jadranska ihtiofauna. Zagreb: Školska knjiga. 533 pp.

Jennings, A. n.d. Gulper Shark. *In* Florida Museum of Natural History [online]. www.floridamuseum.ufl.edu/fish/discover/species–profiles/centrophorus–granulosus

Jereb, P. & Ragonese, S. 1995. An outline of the biology of the squid *Illex coindetii* in the Sicilian Channel (central Mediterranean). *Journal of the Marine Biological Association of the United Kingdom*, 75: 373–390.

Jereb, P., Koutsoubas, D., Belcari, P., Pierce, P.J., Villanueva, R., Allcock, A.L. & Lefkaditou, E. 2015. *Illex coindetii*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research report),* 325: 178–192.

Jereb, P., Vecchione, M. & Roper, C.F.E. 2010. Family Loliginidae. *In* P. Jereb & C.F.E. Roper, eds. *Cephalopods of the world. An annotated and illustrated catalogue of species known to date. Volume 2. Myopsid and Oegopsid Squids.* FAO Species Catalogue for Fishery Purposes *4,* Vol. 2, pp. 38–117. FAO, Rome.

Joksimovic, A. 2005. *Population dynamic of red mullet* Mullus barbatus*, Linneaus, 1758 in the Montenegrin shelf*. Faculty of Biology, University of Belgrade. (PhD dissertation).

Jukic, S. & Piccinetti, C. 1981. *Quantitative and qualitative characteristics of demersal resources in the Adriatic Sea with some population dynamics estimates.* FAO Fish Report, 253: 73–79.

Kabasakal, H. & Kabasakal, E. 2002. Morphometrics of young kitefin sharks, *Dalatias licha* (Bonnaterre, 1788), from northeastern Aegean Sea, with notes on its biology. *Annales Series Historia Naturalis*, 12(2): 161–166.

Kada, O., Abdellaoui, S., Ramdani, M. & Nchit, D. 2009. Contribution à l'identification et à la caractérisation biologique et dynamique de l'anchois de la lagune de Nador (Maroc). *Bulletin de l'Institut Scientifique*, Rabat, *Section Sciences de la Vie*, 31(2): 91–98.

Kadri, H., Marouani, S., Bradai, M.N., Bouaïn, A. & Morize, E. 2014a. Age, growth, longevity, mortality and reproductive biology of *Dipturus oxyrinchus*, (Chondrichthyes: Rajidae) off the Gulf of Gabès (Southern Tunisia, central Mediterranean). *Journal of the Marine Biological Association of the United Kingdom*, 95: 569–577.

Kadri, H., Marouani, S., Saïdi, B., Bradai, M.N., Bouaïn, A. & Morize, E. 2014b. Age, growth, sexual maturity and reproduction of the thornback ray, *Raja clavata* (L.), of the Gulf of Gabès (south–central Mediterranean Sea). *Marine Biology Research*, 10(4): 416–425.

Kadri, H., Marouani, S., Saidi, B., Bradai, M.N., Ghorbel, M., Bouain, A. & Eric, M. 2012. Age, growth and reproduction of *Raja miraletus* (Linnaeus, 1758) (Chondrichthyes: Rajidae) of the Gulf of Gabès (Tunisia, Central Mediterranean Sea). *Marine Biology Research,* 8: 309–317.

Kallianiotis, A.A. 1992. *Biology and population structure of bogue [Boops boops (L.)] populations in the marine area of Crete*. University of Crete, Greece. (PhD dissertation).

Kapiris, K. & Thessalou–Legaki, M. 2009. Comparative reproduction aspects of the deep–water shrimps *Aristaeomorpha foliacea* and *Aristeus antennatus* (Decapoda, Aristeidae) in the greek Ionian Sea (Eastern Mediterranean). *International Journal of Zoology*, 1–9. Article ID 979512.

Kapiris, K., Kasalica, O., Klaoudatos, D. & Djurovic, M. 2013. Contribution to the biology of *Parapenaeus longirostris* (Lucas, 1846) in the South Ionian and South Adriatic Sea. *Turkish Journal of Fisheries and Aquatic Sciences*, 13(4): 647–656.

Karlou–Riga, C. & Economidis, P.S. 1996. Ovarian atretic rates and sexual maturity of European horse mackerel, *Trachurus trachurus* (l.), in the Saronikos Gulf (Greece). *Fishery Bulletin*, 94: 66–76.

Karlou–Riga, C. 2000. Otolith morphology, age and growth of *Trachurus mediterraneus* (Steindachner) in the Eastern Mediterranean. *Fisheries Research,* 46: 69–82.

Karlovac, O. 1953. An ecological study of *Nephrops norvegicus* (L) of the high Adriatic. *Ribarstveno–bioloska Ekspedicija M/B Hvar Izvjesca 1948–1949*, 5(2C): 1–50.

Kartas, F. 1971. *Les Triglidae de la mer Catalane, distribution, croissance et reproduction: genres Lepidotrigla*, Trigloporus lastoviza, Eutrigla gurnardus. University of Paris, France. (PhD dissertation).

Kasalica, O., Regner, S., Petrov, B. & Joksimović, A. 2011. Some aspects of the reproductive biology of the deep–water pink shrimp *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Penaeidae) on the Montenegrin shelf. *Crustaceana*, 84(14): 1683–1696.

Kelly, C.J., Connolly, P.L. & Bracken, J.J. 1999. Age estimation, growth, maturity, and distribution of the bluemouth rockfish *Helicolenus dactylopterus* (Delaroche 1809) from the Rockall Trough. *ICES Journal of Marine Science,* 56: 61–74.

Kerraz, A. 2010. *Aspect biologique et èvalutation de la Pêcherie de la Boga* Boops boops *(Linné, 1758) de la frange côtiere oranaise. Biologie, Croissance, Exploitation*. Faculté des Science, Universitè d' Orange, France. (PhD dissertation).

Kerstan, M. 1985. Age, growth, maturity, and mortality estimates of horse mackerel (*Trachurus trachurus*) from the waters west of Great Britain and Ireland in 1984. *Archiv für Fischereiwissenschaft,* 36: 115–154.

Khemiri, S. & Gaamour, A. 2009. Relation taille–masse, condition relative et cycle sexuel des anchois et des sardines des cotes tunisiennes. *Bulletin de l'Institut National des Sciences et Technologies de la Mer de Salambo*, 36: 45–57.

Knijn, R., Boon, T.W., Heesen, H.J.L. & Hislop, J.R.G. 1993. Atlas of North Sea fishes. (*ICES Cooperative Research Report*), 194**:** 1–268.

Knudsen, S. 2015. *Lophius budegassa*. *In* The IUCN Red List of Threatened Species 2015 [online].

Kokokiris, L., Stamoulis, A., Monokrousos, N. & Doulgeraki, S. 2014. Oocytes development, maturity classification, maturity size and spawning season of the red mullet (*Mullus barbatus barbatus* Linnaeus, 1758). *Journal of Applied Ichthyology,* 30: 20–27.

Korichi, H.S. 1988. Contribution a l'étude biologiques des deux espèces de saurels: *Trachurus trachurus* et *T. mediterraneus* et de la dynamique de *T. trachurus* en baie de BouIsmail. (Thèse de magistère, ISMAL).

Kousteni, V. & Megalofonou, P. 2011. Reproductive biology and embryonic development of *Squalus blainvillei* in the eastern Mediterranean Sea. *Scientia Marina*, 75(2): 237–249.

Kousteni, V. & Megalofonou, P. 2015. Aging and life history traits of the longnose spiny dogfish in the Mediterranean Sea: New insights into conservation and management needs. *Fisheries Research*, 168: 6–19.

Kousteni, V. & Megalofonou, P. 2016. Observations on the biological traits of the rare shark *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in the Hellenic Sea. *Journal of Fish Biology*, 89(3): 1880–1888.

Kousteni, V., Kontopoulou, M. & Megalofonou, P. 2010. Sexual maturity and fecundity of *Scyliorhinus canicula* (Linnaeus, 1758) in the Aegean Sea. *Marine Biology Research*, 6: 390–398.

Krstulovič Sifner, S.K. & Vrgoč, N. 2004. Population structure, maturation and reproduction of the European squid, *Loligo vulgaris*, in the Central Adriatic Sea. *Fisheries Research*, 69: 239–249.

Krstulovič Sifner, S.K. & Vrgoč, N. 2009. Reproductive cycle and sexual maturation of the musky octopus *Eledone moschata* (Cephalopoda: Octopodidae) in the northern and central Adriatic Sea. *Scientia Marina*, 73(3): 439–447.

Krstulović Šifner, S.K., Vrgoĉ, N., Dadić, V., Isajlović, I., Peharda, M. & Piccinetti, C. 2009. Long–term changes in distribution and demographic composition of thornback ray, *Raja clavata*, in the northern and central Adriatic Sea. *Journal of Applied Ichthyology,* 25: 40–46.

La Mesa, M. & De Rossi, F. 2008. Early life history of the black anglerfish *Lophius budegassa* Spinola, 1807 in the Mediterranean Sea using otolith microstructure. *Fisheries Research,* 93: 234–239.

Lalami, T.R. 1971. Contribution à l'étude systématique, biologique, écologique et statistique des poissons de la pêcherie d'Alger (Contribution to the systematic, biologic, ecologic and statistic fish in the Algerian fisheries). *Pélagos, Bulletin de l'Institut Océanographique d'Alger*, 3(4): 1–150.

Lamrini, A. 1998. Sexualité de la bogue (*Boops boops*, Linnaeus, 1758) au sud du détroit de Gibraltar. *Actes de l'Institut Agronomique et Vétérinaire* (Maroc), 18: 5–14.

Lamrini, A. 2010. Croissance et reproduction du rouget barbet de roche (*Mullus surmuletus* L. 1758) dans la baie de m'diq (MAROC). *Rapport Comité internationale Mer Méditerranée*, 39: 565–565.

Landa, J., Antolínez, A., Ámez, M.A., Barrado, J., Castro, B., Cañás, L., Autón, U., Fariña, A.C. & Hernández, C. 2014. Preliminary observation on sexual maturity of black anglerfish (*Lophius budegassa*) in north–eastern Atlantic waters. *Deep Sea Research Part II,* 106: 225–231.

Lannin, A. 2006. *The biology dynamic and fisheries for* Merluccius merluccius *in the water around Ireland*. University of Cork, Ireland. (PhD dissertation).

Larrañeta, M.G. & Rodriguez–Roda, J. 1956. Contribution al conocimiento de la pesquerie del salmonete de fango (*Mullus barbatus* L.) de las costas de Castello. *Investigación Pesquiera*, 3: 45–68.

Larrañeta, M.G. 1964. Sobre la biología de *Pagellus erythrinus*(L.) especialmente de las costas de Castellón. *Investigación Pesquiera,* 27: 121–146.

Larrañeta, M.G. 1967. Crecimiento de *Pagellus erythrinus* de las costas de Castellón. *Investigación Pesquiera,* 31: 185–258.

Larrañeta, M.G. 1970. Sorbe la alimentación, la maturez sexual y talla de primera captura de *Merluccius merluccius L. Investigación Pesquiera* 34(2): 267–280.

Latrouite, D. & Nöel, P. 1997. Fishery of the spiny lobster *Palinurus elephas* in France. Elements for the determination of a trade size. (Pêche de la langouste rouge *Palinurus elephas* en France, éléments pour fixer une taille marchande). *ICES*, Copenaghen.

Latrouite, D. 1992. Fiche Tecnique sur la langouste rouge. *Equinoxe*, 38: 29–30.

Laurenson, C.H., Dobby, H. & Mclay, H.A. 2008. The *Lophius budegassa* component of monkfish catches in Scottish waters. *ICES Journal of Marine Science*, 65: 1346–1349.

Layachi, M., Melhaoui, M., Srour, A. & Ramdani, M. 2007. Contribution à l'étude de la reproduction et la coissance du Rouget–barbet de vase (*Mullus barbatus* L., 1758) de la zone littorale méditerraéenne de Nador (Maroc). *Bulletin de l'Institut Scientifique*, Rabat, section Sciences de la Vie, 27: 43–51.

Lefkaditou, E. & Papacostantinou, C. 1995. Distribution, growth and maturity of *Eledone cirrhosa* (Cephalopoda: Octopoda) in the Thracian Sea (eastern Mediterranean). *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 34: 247.

Lefkaditou, E., Dogramatzi, K., Vidoris, P. & Papaconstantinou, C. 2012. Morphometric sexual dimorphism, size at maturity and growth of *Illex coindetii* in the Aegean Sea (eastern Mediterranean). CIAC 2012, Florianópolis, Brasil, 27 October – 2 November 2012.

Leloup, J. & Olivereau, M. 1951. Données biométrique comparatives sur la roussette (*Scyllium canicula* L.) de la Manche et de la Méditerranée. *Vie et Milieu*, 2: 182–209.

Leonardi, E. & Ardizzone, G.D. 1994. Biology of *Aristaeomorpha foliacea* along the Latium coast (Central Tyrrhenian Sea). *In* M.L. Bianchini & S.Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 33.

Leporati, C.S., Pecl, G.T. & Semmens, J.M. 2008. Reproductive status of *Octopus pallidus*, and its relationship to age and size. *Marine Biology*, 155:375–385.

Letaconnoux, R. 1951. Contribution à l'études des espèces de genre *Trachurus* et spécialement du *Trachurus trachurus* (Linné 1758) de la côte Belge. *Memoires of Office Scientifique et Technique des Pêches Maritimes,* 15: 1–67.

Le–Trong, P. & Kompowski, A. 1972. The bronze bream *Pagellus acarne* (Risso) from north–west African region. *Acta Ichthyologica Et Piscatoria,* 1: 3–17.

Levi, D., Andreoli, M.G. & Giusto, R.M. 1995. First assessment of the rose shrimp, *Parapenaeus longirostris* (Lucas, 1846) in the central Mediterranean. *Fisheries Research,* 21: 375–393.

Livadas, R.J. 1989c. A study of the biology and population dynamics of pandora (*Pagellus erythrinus* L., 1758), family Sparidae, in the Seas of Cyprus. *In* M. Savini & J.F. Caddy, eds. *Report of the Second Technical Consultation on Stock Assessment in the Eastern Mediterranean,* pp. 58–76. Athens, General Fisheries Council for the Mediterranean.

Livadas, R.J. 1989a. A study of the growth and maturity of striped mullet (*Mullus barbatus* L.), in waters of Cyprus. *FAO Fishery Report,* 412: 44–51.

Livadas, R.J. 1989b. The Growth and Maturity of Bogue (*Boops boops* L.) Family Sparidae, in waters of Cyprus. *FAO Fishery Report,* 412: 52–57.

Lloret, J., Lleonart, J. & Solé, I. 2000. Time series modelling of landings in Northwest Mediterranean Sea. *ICES Journal of Marine Science,* 57:171–184.

Lloris, D., Allue, C., Rucabado, J. & Bas, C. 1977. Percomorphi, Fam. Sparidae. En: Fichas de identificación de especies. Atlántico Oriental. Estrecho de Gibraltar–Cabo Verde (Zona CECAF 34). Datos Infomzativos *Inst. Investigación Pesquiera* 3.

Lo Bianco, S. 1909. Notizie biologiche riguardanti specialmente il periodo di maturità sessuale degli animali del Golfo di Napoli. *Mittheilungen aus der Zoologischen Station zu Neapel,* 19: 513 p.

Lordan, C., Collins, M.A., Key, L. & Browne, E.D. 2001. The biology of the Ommastrephid squid, *Todarodes sagittatus*, in the north–east Atlantic. *Journal of the Marine Biological Association of the United Kingdom*, 81: 299–306.

Lourenço, S., Moreno, A., Narciso, L., González, Á.F. & Pereira, J. 2012. Seasonal trends of the reproductive cycle of *Octopus vulgaris* in two environmentally distinct coastal areas. *Fisheries Research*, 127/128: 116–124.

Lucio, P. & Martín, I. 1989. Biological aspects of horse mackerel (*Trachurus trachurus* L. 1758) in the Bay of Biscay in 1987 and 1988. *ICES C.M.* 1989/H: 28, 21 pp.

Lucio, P. 1993. Biological notes of Spanish mackerel (*Scomber japonicus*) in the Bay of Biscay, 1990–1993. Working Document presented at 1993 ICES Mackerel, Horse Mackerel, Sardine and Anchovy Working Group, 22 June – 2 July. 1993. Copenhagen.

Lucio, P. 1997. Biological Aspects of Spanish (Chub) Mackerel (*Scomber japonicus*, Houttuyn, 1782) in the Bay of Biscay from the Basque Country Catches. *ICES C.M.*1997/BB:10.

Lucio, P., Murua, H. & Santurtun, M. 2000. Growth and reproduction of hake (*Merluccius merluccius*) in the Bay of Biscay during the period 1996–1997. *Ozeanografika*, 3: 325–354.

Lum–Kong, A., Pierce, G.J. & Yau, C. 1992. Timing of spawning and recruitment in *Loligo forbesi* (Cephalopoda: Loliginidae) in Scottish waters. *Journal of the Marine Biological Association of the United Kingdom*, 72: 301–311.

Lupi, L. 2008. *Contributo alla conoscenza della biologia riproduttiva di Scyliorhinus canicula (Linnaeus, 1758) (Ordine: Carchariniformes, Famiglia: Scyliorhinidae) del mare toscano*. Università degli studi di Pisa. (Degree thesis).

Macer, C.T. 1974. The reproductive biology of the horse mackerel *Trachurus trachurus* (L.) in the North Sea and English Channel. *Journal of Fish Biology,* 6**:** 415–438.

Mahé, K., Coppin, F., Vaz, S. & Carpentier, A. 2013. Striped red mullet (*Mullus surmuletus*, Linnaeus, 1758) in the eastern English Channel and southern North Sea: growth and reproductive biology. *Journal of Applied Ichthyology*, 29: 1067–1072.

Manaşirli, M. & Avşar, D. 2008. Reproductive biology of female *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Caridea) in Babadillimani bight in the northeastern Mediterranean. *Crustaceana*, 81(3): 289–298.

Mancusi, C., Pasolini, P., Serena, F. & Tinti, F. 2005. Taxonomic discrimination of *Raja polystigma* and *Raja montagui* in the Mediterranean Sea based on the comparative analysis of morphometric and genetic markers. *9th Meeting of the European Elasmobranch Association E.E.A*. Book of abstracts. Principality of Monaco.

Manfrin–Piccinetti, G. & Giovanardi, O. 1984. Donnès sur la biologie de *Sepia officinalis* L. dans l'Adriatique obtenues lors des expeditions Pipeta. *FAO Fisheries Report*, 290: 135–138.

Mangold, K. & Boletzky, S. 1973. New data on the reproductive biology and growth of *Octopus vulgaris*. *Marine Biology*, 19: 7–12.

Mangold, K. 1983. *Octopus vulgaris*. In. P.R., Boyle, ed. Cephalopod life cycles, Vol. I. Academic Press, London: 335–364.

Mangold, K. 1989. *Traité de Zoologie: Cephalopoda. Anatomie, Systématique, Biologie*. Tome V, fascicule 4. Masson, Paris.

Mangold–Wirz, K. 1963. Biologie des Céphalopodes benthiques et nectoniques de la Mer Catalane. *Vie et Milieu*, 13: 267 pp.

Mannini, P., Reale, B. & Righini, P. 1990. Osservazioni sulla biologia e la pesca di *Lepidorhombus boscii* (Risso) (Osteichthyes, Scopthalmidae) nel Tirreno Settentrionale. *Oebalia*, 16(1): 245–255.

Manzo, C., Cilenti, L., Fabbrocini, A. & D'Adamo, R. 2013. Population size structure, growth and reproduction of the European anchovy (*Engraulis encrasicolus*, L.) in the Lagoon of Lesina (south–western Adriatic Sea, Italy). *Transitional Waters Bulletin*, 7(2): 41–52.

Maragliano, M. & Spedicato, M.T. 1994. Osservazioni sulla riproduzione e l'accrescimento di *Illex coindetii* (Cephalopoda, Teuthoidea) nel Tirreno Meridionale. *Biologia Marina Mediterranea*, 1: 299–300.

Marano, C.A., Martino, M., Marzano, M.C., Ceriola, L. & Ungaro, N. 2006. Taglia di prima maturità di *Illex coindetii* (Verany, 1839) nell'Adriatico meridionale. *Biologia Marina Mediterranea*, 13(1): 881–883.

Marano, G., Marsan, R., Pastorelli, A.M. & Vaccarella, R. 1998. Areale di distribuzione e pesca dello scampo, *Nephrops norvegicus* (L.), nelle acque del basso Adriatico. *Biologia Marina Mediterranea,* 5(2): 284–292.

Maravelias, C.D., Haralabous, J. & Papaconstantinou, C. 2003. Predicting the presence of demersal fish species in the eastern Mediterranean using artificial neural networks. *Marine Ecology Progress Series,* 255: 249–258.

Marin, J. 1985. La langouste rouge: biologie et exploitation. *La Pêche Maritime*, Février, 105–113.

Marin, J. 1987. *Exploitation, biologie et dinamique du stock de langouste rouge de Corse*, Palinurus elephas, *Fabricius*. Faculté des Sciences de Luminy, Université Aix–Marseille, France. (PhD dissertation).

Marongiu, M.F., Bellodi, A., Cau, Al., Mulas, A., Porcu, C. & Follesa, M.C. 2013. Reproductive biology of the blackmouth catshark *Galeus melastomus* Rafinesque, 1810, in Sardinian Seas (central western Mediterranean*). Biologia Marina Mediterranea*, 20(1): 190–191.

Marongiu, M.F., Porcu, C., Bellodi, A., Cuccu, D., Mulas, A. & Follesa, M.C. 2015. Oviducal gland microstructure of two Rajidae species, *Raja miraletus* and *Dipturus oxyrinchus. Journal of Morphology*, 76: 1392–1403.

Marouani, S., Kadri, H., Saidi, B., Morize, E., Bouain, A. & Bradai, M.N. 2012. Age, growth, longevity, natural mortality and maturity of the longnose spurdog, *Squalus blainvillei* (Chondrichthyes: Squalidae), in the Gulf of Gabès (Central Mediterranean Sea). *Cahiers de Biologie Marine,* 53(2): 197–204.

Marriott, A.L., Latchford, J.W. & Mccarthy, I.D. 2010. Population biology of the red gurnard (*Aspitrigla cuculus* L.; Triglidae) in the inshore waters of Eastern Anglesey and Northwest Wales. *Journal of Applied Ichthyology,* 26: 504–512.

Martin, I. 1991. A preliminary analysis of some biological aspects of hake (*Merluccius merluccius* L.) in the Bay of Biscay. *ICES.*

Martinez Baños, P. & Mas, J. 1994. Life cycle of *Aristeus antennatus* in South Eastern Spain. *In* M.L., Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International workshop. N.T.R– I.T.P.P. Special publications,3: 9.

Martinez Baños, P. & Mas, J. 1996. Biology and fishery of *Aristeus antennatus* (Risso, 1816) in the Sea–waters Ibiza island (Sapnish Mediterranean). Proceedings of the 6th CCDM Florence: 58.

Martino, M., Ungaro, N., Di Turi, L. & Iaffaldano, B. 2001. Some information on the reproductive biology of *Micromesistius poutassou* (Risso, 1826) in the southern Adriatic basin. *Biologia Marina Mediterranea*, 8: 726–729.

Martins, M.M. 1996. New biological data on growth and maturity of Spanish mackerel (*Scomber japonicus*) off the Portuguese coast (ICES Division IX a). *ICES C.M.*1996/H:23.

Martins, M.M.B., Jorge, I.M. & Gordo, L.S. 1983. On the maturity, morphological characteristics and growth of *Scomber japonicas* Houttuyn, 1780 of west continental coast of Portugal. *ICES C.M.*1983/H:39: 9 pp.

Marzano, M.C., Ungaro, N., Marsan, R. & Iaffaldano, D. 1998. Note sulla riproduzione di *Helicolenus dactylopterus* (Delaroche, 1809) Osteichthyes, Scorpenidae nel bacino Adriatico sudoccidentale. *Biologia Marina Mediterranea*, 5(1): 697–701.

Massutí, E., Guijarro, B., Mas, R. & Guardiola, M.M. 2005. Selectividad de artes de arrastre en aguas de Mallorca (Illes Balears). *Informes Técnicos de l' Instituto Español de Oceanografía*, 184: 58.

Massutí, E., Morales–Nin, B. & Lloris, D. 1996. Bathymetric distribution and recruitment patterns of *Phycis blennoides* (Pisces: Gadidae) from the slope of the northwestern Mediterranean. *Scientia Marina,* 60(4): 481–488.

Massutí, M. 1963. La pêche des Crustacés aux Baleares (Méditerrannée occidentale) et dans l'Atlantique sud (Golfe de Cadix). *Débats et Documents Techniques pour la Peches Conseil General des Méditerrannée*, 7(14): 191–202.

Massutí, M. 1978. Premieres observations bionomiques et biologiques sur la crevette rose (*Aristeus antennatus* Risso) aux fonds des Iles Baleares. *Instituto Espanol de Oceanografia,* 551–557.

Matallanas, J. 1974. Sobre la presencia de *Raja brachyura* Lafont (Rajiformes, Rajidae), en la Mar Catalana. *Boletin Sociedad Historia Natural Baleares*, 19: 51–56.

Matarrese, A., Basanisi, M., Mastrototaro, F. & Marana, C.A. 1998. Dinamica di popolazione di *Micromesistius poutassou* (Risso, 1986) del Mar Ionio settentrionale. *Biologia Marina Mediterranea*, 5(2): 99–106.

Matarrese, A., D´Onghia, G., Basanisi, M. & Mastrototaro, F. 1998. Spawning and recruitment of *Phycis blennoides* (Phycidae) from the north–western Ionian Sea (middle–eastern Mediterranean). *Italian Journal of Zoology*, 65: 203–209.

Matarrese, A., D'Onghia, G. & Tursi, A. 1992. Struttura e dinamica dello stock di *Aristeus antennatus* (Risso, 1816) (Crustacea, Decapoda) nel Mar Jonio. *Oebalia*, 17: 61–66.

Matarrese, A., D'Onghia, G., Tursi, A. & Maiorano, P. 1997. Vulnerability and resilience of *Aristaeomorpha foliacea* (Risso, 1827) and *Aristeus antennatus* (Risso, 1816) (Crustacea, Decapoda) in the Ionian Sea. *Società Italiana di Ecologia, Atti*, 18: 535–538.

Matta, F. 1958. La pesca a strascico nell'arcipelago toscano. *Bollettino di Pesca, Piscicoltura e Idrobiologia*, 34,13(1–2): 135–172; 230–261.

Matta, F. 1959. La pesca a strascico nell'Arcipelago Toscano. *Bollettino di Pesca, Piscicoltura e Idrobiologia*, 13(1–2): 23–26.

Maynou, F., Abelló, P. & Sartor, P. 2004. Review of the fishery biology of the mantis shrimp, *Squilla mantis* (L.), in the Mediterranean. *Crustaceana*, 77(9):1084–1100.

Mazzi, V. 1977. Tecniche istologiche e istochimiche. Piccin Ed., Padova: 750 pp.

McCully, S.R., Scott, F., Ellis, J.R. 2012. Lengths at maturity and conversion factors for skates (Rajidae) around the British Isles, with and analysis of data in the literature. *ICES Journal of Marine Science,* 69: 1812–1822.

McEachran, J.D. & Branstetter, S. 1984. Squalidae. *In* P.J.P. Whitehead, J.C., Hureau, J., Nielsen & E. Tortonese, eds. *Fishes of the North–eastern Atlantic and the Mediterranean*, pp. 128–147. UNESCO, Paris.

McEachran, J.D., Seret, B. & Miyake, T. 1989. Morphological variation within Raja miraletus and the status of Raja ocellifera (*Chondrichthyes, Rajoidea*). *Copeia*, 3: 629–641.

McQuaid, N., Briggs, R.P. & Roberts, D. 2006. Estimation of the size of onset of sexual maturity in *Nephrops norvegicus* (L.). *Fisheries Research,* 81(1): 26–36.

MEDISEH. 2013. Mediterranean Sensitive Habitats. Giannoulaki, M., Belluscio, A., Colloca, F., Fraschetti, S., Scardi, M., Smit, C., Panayotidis, P., Valavanis, V. & Spedicato, M.T., ed. DG MARE Specific Contract SI2.600741, Final Report, 557 pp.

MedSudMed 2004. Data from the report of the Working Group on basic parameters related to small pelagic fish: length at sexual maturity of anchovy and sardine in the MedSudMed Project area (14–16 April 2004, Mazara del Vallo, Italy).

MedSudMed 2008. Preliminary results on spatial distribution of abundance indices, nursery and spawning areas of *Merluccius merluccius* and *Mullus barbatus* in the central Mediterranean. MedSudMed Techn. Doc FAO Rome GCP/RER/010/ITA/MSM–TD 19.

Megalofonou, P. & Chatzispyrou, A. 2006. Sexual maturity and feeding of the gulper shark, *Centrophorus granulosus*, from the Eastern Mediterranean Sea. *Cybium*, 30(4): 67–74.

Megalofonou, P. & Damalas, D. 2004. Morphological and biological characteristics of a gravid angular rough shark (*Oxynotus centrina*) and its embryos from the eastern Mediterranean Sea. *Cybium*, 28(2): 105–110.

Mehana, S.F. 2009. Growth, mortality and spawning stock biomass of the striiped red mullet *Mullus surmuletus*, in the Egyptian Mediterranean waters. *Mediterranean Marine Science*, 10(2): 5–17.

Mehanna, S. 2014. Reproductive dynamics of the common Sole *Solea solea* (Linnaeus, 1758) from Bardawil Lagoon, North Sinai, Egypt. *Bridging the gap between increasing knowledge and decreasing resources*. Tropentag, September 17–19, 2014. Czech Republic, Prague.

Mendonça, A., Isidro, E., Menezes, G., Pinho, M.R., Melo, O. & Estácio, S. 2006. New contribution to the reproductive features of bluemouth *Helicolenus dactylopterus dactylopterus* from the northeast Atlantic (Azores Archipelago). *Scientia Marina,* 70: 679–688.

Menini, S., Pirone, A., Fabiani, O., Voliani, A. & Baino, R. 2001. Osservazioni sulla fecondità e maturità gonadica in *Mullus barbatus*. *Biologia Marina Mediterranea,* 8(1): 736–740.

Mente, E., Karapanagiotidis, I.T., Logothetis, P., Vafidis, D., Malandrakis, E.E., Neofitou, N., Exadactylos, A. & Stratakos, A. 2009. The reproductive cycle of Norway lobster (*Nephrops norvegicus*). *Journal of Zoology*, 278: 324–332.

Mercer, J.P. 1973. *Studies on the Spiny Lobster (Crustacea: Decapoda: Palinuridae) on the West Coast of Ireland with Particular Reference to Palinurus elephas Fabricius 1787*. University College Galway, Ireland. (PhD dissertation).

Mereu, M., Cau, A., Agus, B., Cannas, R., Follesa, M.C., Pesci, P. & Cuccu, D. 2018. Artificial dens as a management tool for *Octopus vulgaris*: evidence from a Collaborative Fisheries Research project (central western Mediterranean Sea). *Ocean and Coastal Management*, 165: 428-433.

Meriç, N. 1995. A study on existence of some fishes on the continental slope of the Sea of Marmara. *Turkish Journal of Zoology*, 19(2): 191–198.

Meriel–Bussy, M. 1966. La croissance du merlu dans le golfe di Gascogne. *ICES Document* CM 1966/G: 175 pp.

Metin, G. 2005. İzmir Körfezi'nde Barbunya (*Mullus barbatus*, L., 1758) Balığının Üreme Özellikleri. E.U. *Journal of Fisheries and Aquatic Science,* 22(1–2): 225–228.

Metin, G., İlkyaz, A.T., Soykan, O. & Kinacigil, H.T. 2011. Biological characteristics of the common pandora, *Pagellus erythrinus* (Linnaeus, 1758), in the central Aegean Sea. *Turkish Journal of Zoology*, 35(3): 307–315.

Metochis, C.P., Carmona–Antoñanzas, G., Kousteni, V., Damalas, D. & Megalofonou, P. 2016. Population structure and aspects of the reproductive biology of the blackmouth catshark, *Galeus melastomus* Rafinesque, 1810 (Chondrichthyes: Scyliorhinidae) caught accidentally off the Greek coasts. *Journal of the Marine Biological Association of the United Kingdom*, 98: 909–925.

Mezedjiri, L., Kerfouf, A. & Tahar, A. 2013. Reproductive cycle of the European anchovy *Engraulis encrasicolus* (Linnaeus, 1758) (Clupeiformes Engraulidae) in the gulf of Skikda (Algerian East coasts). *Biodiversity Journal,* 4(2): 269–274.

Micale, V., D'Anna, G., Di Stefano, G., Guerrera, M.C., Muglia, U., Sieli, G. & Fiorentino, F. 2007. Oocyte development, spawning pattern and batch fecundity of the red mullet (*Mullus barbatus*, L. 1758) from a Mediterranean area subjected to a trawling ban. *XII European Congress of Ichthyology*. Cavtat (Croatia).

Mili, S., Bouriga, N., Missaoui, H. & Jarboui, O. 2011. Morphometric, reproductive parameters and Seasonal variations in fatty acid composition of the mantis shrimp *Squilla mantis* (Crustacea: Stomatopoda) in the Gulf of Gabes (Tunisia). *Journal of Life Sciences*, 5: 1058–1071.

Millán, M. 1999. Reproductive characteristics and condition status of anchovy *Engraulis encrasicolus* L. from the Bay of Cadiz (SW Spain). *Fisheries Research,* 41: 73–86.

Monteiro, P., Benthes, L., Coelho, R., Correia, C., Gonçalvest, J.M.S., Lino, P.G., Ribeiro, J. & Erzini, K. 2006. Age and growth, mortality and relative yield of the bogue, *Boops boops* Linné, 1758 (Sparidae), from the Algarve (south of Portugal) longline fishery. *Journal of Applied Ichthyology,* 22: 345–352.

Monteiro, R. & Lima Dias, M. 1965. On some aspects of the ovary development in the hake (*Merluccius merluccius*, L.) of the Portuguese coast. *ICES, Document* C.M. 1965/G: 37.

Moraitopolou–Kassimati, E. 1973. Distribution and fishing of the lobsters *Palinurus vulgaris* and *Homarus vulgaris* in Greek Seas. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 22(4):69–70.

Morales–Nin, B. 1992. Biology of red mullet *Mullus surmuletus* on Majorca Island waters. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 33: 302.

Morales–Nin, B. & Moranta, J. 2004. Recruitment and post –settlement growth of juvenile *Merluccius merluccius* on the Western Mediterranean shelf. *Scientia Marina*, 68: 399–409.

Moreno, A., Lefkaditou, E., Robin, J.P., Pereira, J., González, A.F., Seixas, S., Villanueva, R., Pierce, G.J., Allcock, A.L. & Jereb, P. 2015. *Loligo vulgaris*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research report*), 325: 115–134.

Moreno, A., Morais da Cunha, M. & Pereira, J.M.F. 1994. Population biology of veined squid (*Loligo forbesi*) and European squid (*Loligo vulgaris*) form the Portuguese coast. *Fisheries Research*, 21: 71–86.

Moreno, A., Pereira, J. & Cunha, M. 2005. Environmental influences on age and size at maturity of *Loligo vulgaris*. *Aquatic Living Resources*, 18: 377–384.

Moreno, A., Pereira, J., Arvanitidis, C., Robin, J.P., Koutsoubas, D., Perales–Raya, C., Cunha, M.M., Balguerias, E. & Denis, V. 2002. Biological variation of *Loligo vulgaris* (Cephalopoda: Loliginidae) in the Eastern Atlantic and Mediterranean. *Bulletin of Marine Science*, 71(1): 515–534.

Mori, M., Biagi, F. & De Ranieri, S. 1994. Reproductive biology of *Aristaeomorpha foliacea* in the Southern Tuscany archipelago (Cenral Tyrrhenian Sea). *In* M.L., Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 31.

Mori, M., Sbrana, M. & De Ranieri, S. 2000. Reproductive biology of female *Parapenaeus longirostris* (Crustacea, Decapoda, Penaeidae) in the northern Tyrrhenian Sea (western Mediterranean). *Atti della Società Toscana di Scienze Naturali, Memorie,* serie B, 107: 1–6.

Moriyasu, M. 1983. Détermination des stades de maturation sexuelle des mâles d'*Eledone cirrhosa* Lam. du golfe du Lion. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 28(5): 283–284.

Mouneimne, N. 1978. *Poissons des côtes du Liban*. Université P. & M. Curie. Paris. (PhD dissertation).

Moura, T., Figueiredo, I., Machado, P.B. & Serrano Gordo, L. 2004. Growth pattern and reproductive strategy of the holocephalan *Chimaera monstrosa* along the Portuguese continental slope. *Journal of the Marine Biological Association of the United Kingdom*, 84: 801–804.

Mugahid, A.R. & Hashem, M.T. 1982. Some aspects of the fishery biology of hake *Merluccius merluccius* L. in the Libyan waters. *Bulletin of the National Institute of Oceanography and Fishery*, 40: 145–162.

Muñoz, M. & Casadevall, M. 2002. Reproductive indices and fecundity of *Helicolenus dactylopterus dactylopterus* (Teleostei: Scorpaenidae) in the Catalan Sea (western Mediterranean). *Journal of the Marine Biological Association of the United Kingdom*, 82: 995–1000.

Muñoz, M., Casadevall, M. & Bonet, S. 1999. Annual reproductive cycle of *Helicolenus dactylopterus dactylopterus* (Teleostei: Scorpaeniformes) with special reference to the ovaries sperm storage. *Journal of the Marine Biological Association of the United Kingdom*, 79: 521–529.

Muñoz, M., Dimitriadis, C., Casadevall, M., Vila, S., Delgado, E., Lloret, J. & Saborido–Rey, F. 2010. Female reproductive biology of the bluemouth *Helicolenus dactylopterus dactylopterus*: spawning and fecundity. *Journal of Fish Biology,* 77: 2423–2442.

Murua, H. & Motos, L. 2006. Reproductive strategy and spawning activity of the European hake *Merluccius merluccius* (L.) in the Bay of Biscay. *Journal of Fish Biology*, 69: 1288-1303.

Mura, M., Campisi, S. & Cau, A. 1992. Osservazioni sulla biologia riproduttiva negli aristeidi demersali del Mediterraneo centro–occidentale. *Oebalia*, 17: 75–80.

Mura, M. & Cau, A. 1989. Sul dimorfismo sessuale e sex–ratio in *Aristeus antennatus* (Risso, 1816). *Oebalia*, 15(2): 811–814.

Murua, H., Motos, L. & Lucio, P. 1998. Reproductive modality and batch fecundity of the European hake (*Merluccius merluccius* L.) in the Bay of Biscay. *California cooperative oceanic fisheries investigations, progress report*, 39: 196–203.

Muus, B.J. & Nielsen, J.G. 1999. *Sea fish*. Scandinavian Fishing Year Book, Hedehusene, Denmark.

Mužinić, R. 1979. Some observations on the biology of the spanish mackerel (*Scomber japonicus*, outt.) in the central Adriatic. *Acta Biologica,* 8: 1–15.

Mytilineou, Ch. 1987. Preliminary study of the reproductive cycle and hermaphrodism in red pandora, *Pagellus erythrinus*, L. of the Patraikos and the Korinthiakos Gulfs and the Ionian Sea, Greece. *Proceedings of the Hellenic Symposium of Oceanography and Fisheries,* 2: 551–564

Mytilineou, Ch. 1988. Données biologiques sur le pageot, *Pagellus erythrinus*, des côtes orientales de la Gréce centrale. *FAO Fisheries Rep*ort, 412, pp. 77–82. Rome, FAO.

Mytilineou, Ch., Fourtouni, A. & Papaconstantinou, C. 1993. Notes on the reproductive cycle of Norway lobster, *Nephrops norvegicus* (L., 1758) in the North Aegean Sea. *Abstracts Volume of the International Senckenberg. Symposium on Crustacea decapoda*. Frankfurt, October 1993: 43–44.

Mytilineou, Ch., Fourtouni, A. & Papaconstantinou, C. 1995. Preliminary study on the biology of Norway lobster, *Nephrops norvegicus* in the Gulfs of Chalkidiki (Greece). *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 34: 38.

Mytilenou, Ch. & Vassipoulou, V. 1988. The reproductive cycle and sex ratio of hake *Merluccius merluccius* in Patraikos and Korinthiakos gulfs and the Ionina Sea. *Proceedings of the 4th Hellenic Congress of Ichthyologist,* 4:164–177.

N'Da, K. 1992. *Biologie du rouget de roche* Mullus surmuletus *(Poisson Mullidae) dans le Nord du golfe de Gascogne: reproducteurs, larves et juveniles*. Universitè de Bretagne Occidentale, Brest, France. (PhD dissertation).

Nannini, N., Sbrana, M. & De Ranieri, S. 1997. Biological aspects of *Trachurus trachurus* (Linnaeus, 1758) and *Trachurus mediterraneus* (Steindachner, 1868) in the northern Tyrrhenian Sea. *Biologia Marina Mediterranea,* 4: 561–563.

Navarro, J., Coll, M., Preminger, M. & Palomera, I. 2013. Feeding ecology and trophic position of a Mediterranean endemic ray: consistency between sexes, maturity stages and Seasons. *Environmental Biology of Fishes*, 96: 1315–1328.

Nazarov, N.A. & Dobrusin, M.S. 1977. *Trudi VNIRO,* 121: 40–48.

Nesis, K.N. 1995. Mating, spawning, and death in oceanic cephalopods: a review. *Ruthenica*, 6(1): 23–64.

Neves, A., Cabral, H., Sequeira, V., Figueiredo, I., Moura, T. & Gordo, L.S. 2009. Distribution patterns and reproduction of the cuttlefish, *Sepia officinalis* in the Sado estuary (Portugal). *Journal of the Marine Biological Association of the United Kingdom*, 89(3): 579–584.

Norman, M.D., Fin, J.K., Hochberg, F.G. Jereb, P., Vecchione, M. & Roper, C.F.E. 2016. Family Octopodidae. *In* P. Jereb, C.F.E. Roper, M.D. Norman & J.K. Fin, eds. *Cephalopods of the world. An annotated and illustrated catalogue of Cephalopods species known to date. Volume 3. Octopods and Vampire Squids. FAO Species Catalogue for Fishery Purposes 4, Vol. 3*, pp. 36–215. FAO, Rome.

Notarbartolo Di Sciara, G. & Bianchi, I. 1998. *Guida degli squali e delle razze del Mediterraneo*. Muzzio, Padova.

Nottage, A.S. & Perkins, E.J. 1983. Growth and maturation of roker, *Raja clavata* L. in the Solway Firth. *Journal of Fish Biology*, 23: 43–48.

Nouar, A. 2003. *Ecologie, biologie et exploitation d'une espèce de la famille de Scorpinidae* Helicolenus dactylopterus *des cotes algériennes*. University of Science and Technology Houari Boumediene. (PhD dissertation).

Nunoo, F., Russell, B., Bannermann, P. & Poss, S. 2015. *Chelidonichthys cuculus*. The IUCN Red List of Threatened Species 2015. www.iucnredlist.org/details/198750/0

Ochoa-Báez, R.I. 1998. *Estacionalidad reproductiva y producción ovárica de la anchoa europea* E. encrasicolus *en le mar Catalán*. Univ. Politécnica de Catalunya. (PhD dissertation).

Ok, M. 2012. *Evaluation of demersal fish assemblages of the northeastern levant Sea*. (PhD dissertation).

Olaso, I. 1990. Distribución y abundancia del megabento invertebrado en fondos de la plataforma Cantábrica. *Publicaciones Especiales. Instituto Español Oceanografía*, 5: 1–128.

Olgaç, G. & Özbaş, M. 2007. Reproduction of the common cuttlefish (Sepia officinalis, L., 1758) in Antalya Bay. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée*, 38: 494.

Oliver, P.A. 1991. *Dinàmica de la poblaciòn de merluza* (Merluccius merluccius L.) *de Mallorca* (*Reclutamento, Crescimento y Mortalidad)*. Universitat de les Illes Balears. (PhD dissertation).

Oliver, P. & Morillas, A. 1992. Etat d' exploration du Merlu (*Merluccius merluccius* L.) et du Rouget (*Mullus surmuletus* L.) des Iles Baleares. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 33: 304.

Önsoy, B. & Salman, A. 2005. Reproductive biology of the common cuttlefish *Sepia officinalis* L. (Sepiida: Cephalopoda) in the Aegean Sea. *Turkish Journal of Veterinary and Animal Sciences*, 29: 613–619.

Orlandi, C., Piccinetti Manfrin, G., Piccinetti, C., Specchi M., Castellarin, C. 1994. Osservazioni sulla presenza di uova di alice (*Engraulis encrasicolus* L.) nelle stazioni fisse di Trieste e di Fano (alto e medio Adriatico). *Bollettino della Società Adriatica di Scienze,* 70: 277–286.

Orsi Relini, G. & Relini, G. 2012. Modified reproductive characteristics in *Aristeus antennatus*. *Biologia Marina Mediterranea*, 19(1): 134-137.

Orsi Relini, L. 1979. The spawning of *Aristeus antennatus* in the gulf of Genova. *Quaderni del Laboratorio di tecnologia della pesca,* 3(2–5): 157–162.

Orsi Relini, L. & Arnaldi, D. 1986. Note di biologia della triglia di fango, *Mullus barbatus* L. 1758, del Mar Ligure; riproduzione e reclutamento. *Atti VIII Convegno del Gr. di Ecologia di base* "*G. Gadio*" *Ecologia della Liguria e del suo mare*, 237–250.

Orsi Relini, L. & Peirano, A. 1982. Osservazioni sull'accrescimento prematurativo del potassolo del Mar Ligure, *Micromesistius poutassou* (Risso, 1986), Osteichthyes, Gadidae. *In* Atti XIV Congresso SIBM, Massa Lubrense (NA), 20–24 September 1982. *Bollettino dei Musei e degli Istituti Biologici dell'Università di Genova,* 50: 280–286.

Orsi Relini, L. & Peirano, A. 1985. *Biological notes on the blue whiting, Micromesistius poutassou Risso, of the Ligurian Sea.* FAO Fisheries Report, 336:113–117.

Orsi Relini, L. & Pestarino, M. 1981. Riproduzione e distribuzione di *Aristeus antennatus* sui fondi batiali Liguri, nota preliminare. *Quaderni del Laboratorio di tecnologia della pesca,* 3(1): 123–133.

Orsi Relini, L. & Relini, G. 1979. Pesca e riproduzione del gambero rosso *Aristeus antennatus* (Decapoda, Penaeidae) nel Mar Ligure. *Quaderni della Civica Stazione di Idrobiologia*, 7: 39–62.

Orsi Relini, L. & Relini, G. 1985. *The red shrimps fishery in the Ligurian Sea: mismanagement or not?* Report. Technical Consultation on Stock Assessment in the Central Mediterranean. *In* S. Garcia & D. Charbonnier, eds. Rome (Italy): FAO, ISBN 92–5–002314–6: 9–11.

Orsi Relini L. & Semeira, M. 1983. Oogenesis and fecundity in bathyal penaeid prawns. *Aristeus antennatus* and *Aristaeomorpha foliacea*, Rappot P–V Reun. CIESM 28: 281–284.

Orsi Relini, L., Zamboni, A., Fiorentino, F. & Massi, D. 1998. Reproductive patterns in Norway lobster (*Nephrops norvegicus*, Crustacea Decapoda, Nephropidae) of different Mediterranean areas. *Scientia Marina*, 62(1): 25–41.

Otero, J., González, A.F., Pilar–Sieiro, M. & Guerra, A. 2007. Reproductive cycle and energy allocation of *Octopus vulgaris* in Galician waters, NE Atlantic. *Fisheries Research*, 85: 122–129.

Pacetti, D., Balzano, M., Colella, S., Sansojanni, A. & Frega, N.G. 2013. Effect of spawning on furan fatty profile of edible muscle and organ tissues from sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*). *Journal of Agricultural and Food Chemistry,* 61: 3969–3977.

Palomera, I. 1992. Spawning of anchovy *Engraulis encrasicolus* in the Northwestern Mediterranean relative to hydrographic features in the region. *Marine Ecology Progress Series,* 79: 215–223.

Palomera, I., Tejeir, B. & Aleman, X. 2003. *Size at first maturity of the N.W. Mediterranean anchovy.* Report presented to the FCM e SAC Subcommittee on Stock Assessment Working Group on Small Pelagic Species, Tanger, Morocco.

Palumbo, F. & Würtz, M. 1983/1984. Osservazioni sulla distribuzione e riproduzione di *E. cirrhosa* (Lam, 1798) (Cephalopoda, Octopoda) in Mar Ligure. *Nova Thalassia*, 6: 721–723.

Papaconstaninou, C. 1983. Aspects on the biology of *Aspitrigla cuculus* (Pisces: Scorpaenifirmes) from the Saronikos Gulf. *Thalassographica,* 6**:** 49–75.

Papaconstaninou, C. 1986. The life history of rock gurnard (*Trigloporus lastoviza*, Brünn., 1768) in the Saronikos Gulf. *Journal of Applied Ichthyology*, 2: 75–86.

Papaconstantinou, C. & Kapiris, K. 2001. Distribution and population structure of the red shrimp (*Aristeus antennatus*) on an unexploited fishing ground in the Greek Ionian Sea. *Aquatic Living Resources,* 14: 303–312.

Papaconstantinou, C. & Kapiris, K. 2003. The biology of the giant red shrimp (*Aristaeomorpha foliacea*) at an unexploited fishing ground in the Greek Ionian Sea. *Fisheries Research,* 62: 37–51.

Papaconstantinou, C., Mytileneou, C. & Panos, T. 1988. Aspects of the life history and fishery of red pandora, *Pagellus erythrinus* (Sparidae), off western Greece. *Cybium,* 132: 159–167.

Papaconstantinou, C., Petrakis, G. & Vassilopoulou, V. 1986. The fecundity of hake (*Merluccius merluccius* L.) and red pandora (*Pagellus erythrinus* L.) in Greek Seas. *Acta Adriatica,* 27: 85–95.

Papaconstantinou, C., Tsimenidis, N. & Daoulas, C. 1981. Age, growth and reproduction of red mullet (*Mullus barbatus* L., 1758) in the Gulfs of Saronikos and Thermaikos. *Thalassographica*, 4: 39–66.

Peirano, A. & Tunesi, L. 1986. Preliminary notes on the biology of *Helicolenus dactylopterus* (Delaroche, 1809) in the Ligurian Sea. *Rapport de la Commission Internationale pour l'exploration scientifique de la Mer Mediterranee*, 30: 233.

Perdichizzi, A. Pirrera, L., Giordano, D., Perdichizzi, F., Busalacchi, B., Profeta, A., Bottari, T. & Rinelli, P. 2011. Distribution patterns and population structure of *Illex coindetii* (Cephalopoda: Ommastrephidae) in the Southern Tyrrhenian Sea: Historical series of 14 years trawl survey. *Fisheries Research,* 109**:** 342–350.

Perdichizzi, A., Pirrera, L., Micale, V., Muglia, U. & Rinelli, P. 2012. A histological study of ovarian development in the giant red shrimp *Aristaeomorpha foliacea* (Crustacea: Decapoda: Aristeidae) from the Southern Tyrrhenian Sea (Western Mediterranean). *The Scientific World Journal*. Article ID 289608: 9 pp.

Pérez, N. & Pereiro, F.J. 1981. First data on sexual maturation and sex–ratio of hake VIII C. And IX a. *ICES C.M. 1981/G*, 37.

Pérez, N. & Pereiro, F.J. 1985. Aspectos de la reproducción de la merluza (*Merluccius merluccius* L.) de la plataforma gallega y cantábrica. *Boletin del Instituto Espanol de Oceanografia,* 2(3): 39–47.

Perrotta, R. 2004. Kitefin shark, *Dalatias licha* (Dalatiidae) fishery in the north eastern Atlantic and some recommendations for elasmobranchs exploitation. *Revista de Investigación y Desarollo Pesquero*, 16: 97–101.

Pertierra, J.P. 1992. *Biología pesquera de la anchoa,* E. encrasicolus *del litoral catalán*. University of Barcelona. (PhD dissertation).

Pesci, P. 2006. *Ecologia, biologia e struttura di popolazione delle triglie* Mullus barbatus *Linneo, 1758 e* Mullus surmuletus *Linneo, 1758 nei mari circostanti la Sardegna.* University of Cagliari, Italy. (PhD dissertation).

Petrillo, M., Martorano, M., Albertelli, G. & Della Croce, N. 1998. Uova di *Engraulis encrasicolus* e parametri ambientali nella zona pilota di Chiavari, Mar Ligure (1985–1996). *Biologia Marina Mediterranea*, 5(3): 349–360.

Piatkowski, U., Zumholz, K., Lefkaditou, E., Oesterwind, D., Jereb, P., Pierce, G.J. & Allcock, A.L. 2015. *Todarodes sagittatus. In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research report*), 325: 194–205.

Piccinetti, C. & Piccinetti Manfrin, G. 1970. Osservazioni su alcuni aspetti della biologia di *Squilla mantis* L. *Pubblica Stazione Zoologica di Napoli*, 38: 119–124.

Pierce, G.J., Hastie, L.C., Lefkaditou, E., Allcock, L., Smith, J.M., Wangvoralak, S. & Jereb, P. 2015. *Loligo forbesii. In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research report*), 325: 137–153.

Piñeiro, C. & Sainza M. 2003. Age estimation, growth and maturity of the European hake, *Merluccius merluccius* (Linnaeus, 1758) from Iberian Atlantic waters. *ICES Journal of Marine Science*, 60: 1086-1102.

Polonsky, A.S. & Tormosova, I.D. 1969. The spawning of the horse mackerel of the North–east Atlantic and the distribution of its eggs and larvae. *Trudy Atlantic NIRO*, 23: 27–48.

Polonsky, A.S. 1966. Materials on the biology of poutassou (*Micromesistius poutassou* (Risso). Paper presented to Symposium on ecology of pelagic fishes in Arctic waters, ICES, September 1966.

Porcu, C., Bellodi, A., Cannas, R., Marongiu, M.F., Mulas, A. & Follesa, M.C. 2015. Life–history traits of the commercial blonde ray, *Raja brachyura*, from the central–western Mediterranean Sea. *Mediterranean Marine Science,* 16(1): 90–102.

Porcu, C., Marongiu, M.F., Bellodi, A., Cannas, R., Cau, A., Melis, R., Mulas, A., Soldovilla, G., Vacca, L. & Follesa, M.C. 2017a. Morphological descriptions of the eggcases of skates (Rajidae) from the central-western Mediterranean, with notes on their distribution. *Helgoland Marine Research*, 71:10.

Porcu, C., Marongiu, M.F., Follesa, M.C., Bellodi, A., Mulas, A., Pesci, P. & Cau, A. 2014. Reproductive aspects of the velvet belly *Etmopterus spinax* (Chondrichthyes: Etmopteridae), from the central western Mediterranean Sea. Notes on gametogenesis and oviducal gland microstructure. *Mediterranean Marine Science,* 15(2): 313–326.

Porcu, C., Mulas, A., Bellodi, A., Cannas, R., Cau, Al., Marongiu, M.F. & Follesa, M.C. 2017b. Preliminary maturity estimates and diet of the rare shark *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in Sardinian seas. *Biologia Marina Mediterranea*, 24(1): 214-215.

Priede, I., Godbold, J.A., King, N.J., Collins, M.A., Baile, Y.D.M. & Gordon, J.D.M. 2010. Deep–Sea demersal fish species richness in the Porcupine Seabight, NE Atlantic Ocean: global and regional patterns. *Marine Ecology Progress Series,* 31: 247–260.

Quéro, J.C. 1986. Zeidae. *In* P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese, eds. *Fishes of the Northeastern Atlantic and the Mediterranean. Vol. II*, pp. 769–772. UNESCO, Paris.

Quéro, J.C., Desoutter, M. & Lagardère, F. 1986. Soleidae. *In* P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese, eds. *Fishes of the Northeastern Atlantic and the Mediterranean. Vol. III,* pp. 1308–1324. UNESCO, Paris.

Quetglas, A. & Morales-Nin, B. 2004. Age and growth of the ommastrephid squid *Todarodes sagittatus* from the western Mediterranean Sea. *Journal of the Marine Biological Association of the United Kingdom*, 84: 421–426.

Quetglas, A., Alemany, F., Carbonell, A., Merella, P. & Sánchez, P. 1998a. Some aspects of the biology of *Todarodes sagittatus* (Cephalopoda: Ommastrephidae) from the Balearic Sea (Western Mediterranean). *Scientia Marina*, 62(1–2): 73–82.

Quetglas, A., Alemany, F., Carbonell, A., Merella, P. & Sánchez, P. 1998b. Biology and fishery of *Octopus vulg*aris Cuvier, 1797, caught by trawlers in Mallorca (Balearic Sea, western Mediterranean). *Fisheries Research*, 36: 237–249.

Quignard, J.P. & Capapé, C. 1974. Recherches sur la biologie d'un sélacien du golfe de Tunis, *Torpedo torpedo* Linné, 1758. *Bulletin de l'Institut national scientifique et technique d'océanographie Péche Salammbô*, 3: 99–129.

Quincoces, I. 2002. *Crecimiento y reproducción de las especies* Lophius budegassa *Spinola 1807 y* Lophius piscatorius *Linneo 1758, del Golfo de Vizcaya*. Departamento de Zoologíay Dinámica Celular Animal. Universidad del País Vasco, Spain. (PhD dissertation)."

Quincoces, I., Santurtun, M. & Lucio, P. 1998. Biological aspects of black anglerfish (*Lophius budegassa*) in the Bay of Biscay waters during 1996±1997. *ICES Document*, CM 1998/O:47, 28 pp.

Ragonese, S., Andreoli, M.G., Bono, G., Giusto, G.B., Rizzo, P. & Sinacori, G. 2004a. Overview of the available biological information on demersal resources of the Strait of Sicily. *MedSud Med Technical Report*, 2: 67-74.

Ragonese, S., Bertolino, F. & Bianchini, M.L. 1997. Biometric relationship of the red shrimp *Aristaeomorpha foliacea* Risso, 1827 in the Strait of Sicily (Mediterranean Sea). *Scientia Marina*, 61(3): 367–377.

Ragonese, S. & Bianchini, M.L. 1995. Size at sexual maturity in red shrimp females *Aristaeomorpha foliacea*, from the Sicilian Channel (Mediterranean Sea). *Crustaceana*, 68(1): 73–82.

Ragonese, S., Bianchini, M.L., Di Stefano, L., Campagnuolo, S. & Bertolino, F. 1994. *Aristaeomorpha foliacea* in the Sicilian channel. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 45.

Ragonese, S., Cigala Fulgosi, F., Bianchini, M.L., Norrito, G. & Sinacori, G. 2003. Annotated check list of the skates (Chondrichthyes, Rajidae) in the Strait of Sicily (Central Mediterranean). *Biologia Marina Mediterranea,* 10(2): 874–881.

Ragonese, S., Fiorentino, F., Garofalo, G., Gristina, M., Levi, D., Gancitano, S., Giusto, G.B., Rizzo, P. & Sinacori, G. 2004b. Distribution, abundance and biological features of picarel (*Spicara flexuosa*), Mediterranean (*Trachurus mediterraneus*) and Atlantic (*T. trachurus*) horse mackerel based on experimental bottom-trawl data (MEDITS, 1994-2002) in the Strait of Sicily. In D. Levi, T. Bahri, G. Basilone, B.L. Abdallah, A. Bonanno, A. Gaamour, B. Patti & R. Zarradi, eds. Report of the *MedSudMed Expert Consultation on Small pelagic Fishes: Stock Identification and oceanographic Processes Influencing their Abundance and Distribution*. Salambô, Tunisia, 1-3–October 2003. *FAO MedSudMed Techical Documents*, 5: 100-114.

Ragonese, S. & Jereb, P. 1986. *Loligo forbesi* Steenstrup 1856 (Cephalopoda: Loliginidae) nel versante siciliano del "mare pelagico" (Canale di Sicilia): nota preliminare sulla distribuzione, composizione per taglia e biologia riproduttiva. *Nova Thalassia*, 8(3): 529–535.

Ragonese, S., Nardone, G., Ottonello, D., Gancitano, S., Giusto, G.B. & Sinacori, G. 2009. Distribution and biology of the blackmouth catshark *Galeus melastomus* in the Strait of Sicily (Central Mediterranean Sea). *Mediterranean Marine Science*, 10(1): 55–72.

Raitt, D.P.S. 1966. The biology and commercial potential of tho blue whiting (meoiotiuu poutaesoe) in the north–east Atlantic, *Paper presented to Symposium on ecology of pelagic fishes in Arctic waters, ICES*, September 1966.

Ramírez-Amaro, S., Ordines, F., Puerto, M.A., García, C., Ramon, C., Terrasa, B. & Massutí, E. 2017. New morphological and molecular evidence confirm the presence of the Norwegian skate *Dipturus nidarosiensis* (Storm, 1881) in the Mediterranean Sea and extend its distribution to the western basin. *Mediterranean Marine Science*, 18(2): 251–259.

Ramos, J. 1982. Contribucion al estudio de la sexulidad del lenguado *Solea solea* (Linneo, 1758) (Pisces, Soleidae). *Investigación Pesquiera*, 46: 275–286.

Rampa, R., Arneri, E., Belardinelli, A., Caputo, E., Cingolani, N., Colella, S., Donato, F., Giannetti, G. & Santojanni, A. 2005. Length at first maturity of the Adriatic anchovy (*Engraulis encrasicolus, L.*). General Fisheries Commission for the Mediterranean (GFCM), Scientific Advisory Committee (SAC) Subcommittee on Stock Assessment (SCSA). Rome, 26–30 September 2005.

Ramsay, K. & Witthames, P. 1996. Using oocyte size to assess seasonal ovarian development in *Solea solea* (L.). *Journal of Sea Research,* 36(3/4): 275–283.

Recasens, L. 1992. *Dinamica de poblaciones i pesqueria del lluc* (Merluccius merluccius) *al Golfo de Lleon i la mar Catalan*. Universitat de Barcelona. (PhD dissertation)."

Recasens, L., Chiericoni, V. & Belcari, P. 2008. Spawning pattern and batch fecundity of the European hake (*Merluccius merluccius*, Linnaeus, 1758) in the western Mediterranean. *Scientia Marina,* 72: 721–732.

Recasens, L., Lombarte, A., Morales–Nin, B. & Torres, G.J. 1998. Spatiotemporal variation in the population structure of the European hake in the N.W. Mediterranean. *Journal of Fish Biology,* 53: 387–401.

Regner, S. 1996. Effects of environmental changes on early stages and reproduction of anchovy in the Adriatic Sea. *In* I. Palomera & P. Rubiés, eds. The European anchovy and its environment. *Scientia Marina*, 60(2): 167–177.

Regueira, M., González, A.F., Guerra, Á. & Soares, A. 2013. Reproductive traits of horned octopus *Eledone cirrhosa* in Atlantic Iberian waters. *Journal of the Marine Biological Association of the United Kingdom,* 93(6): 1641–1652.

Reid, A., Jereb, P. & Roper, C.F.E. 2005. Family Sepiidae. *In* P. Jereb & C.F.E. Roper, eds. Cephalopods of the world. *An annotated and illustrated catalogue of species known to date. Chambered nautiluses and sepioids (Nautilidae, Sepiidae, Sepiolidae, Sepiadariidae, Idiosepiidae and Spirulidae). FAO Species Catalogue for Fishery Purposes 4, Vol. 1*, pp. 57–152. FAO, Rome.

Reiner, F. 1996. *Catálogo dos peixes do arquipélago de Cabo Verde*. Instituto Português de Investigação Marítima, Lisboa.

Relini, G., Bertrand, J. & Zamboni, A. 1999. Sintesi delle conoscenze delle risorse da pesca dei fondi del Mediterraneo centrale (Italia Corsica). *Biologia Marina Mediterranea*, 6(1): 868.

Relini, G., Biagi, F., Serena, F., Belluscio, A., Spedicato, M.T., Rinelli, P., Follesa, M.C., Piccinetti, C., Ungaro, N., Sion, L. & Levi, D. 2000. I selaci pescati con lo strascico nei mari italiani. *Biologia Marina Mediterranea,* 7(1): 347–384.

Relini, G. & Lanteri, L. 2010. Osteichthyes. *In* G. Relini, eds. *Checklist della flora e della fauna dei mari italiani.* Parte II. *Biologia Marina Mediterranea,* 17(1): 649–674.

Relini Orsi, L. & Wurtz, M. 1975. Osservazioni sulla alimentazione di *Galeus melastomus* (Chondrichtyes, Scyliorhinidae) dei fondi batiali liguri. *Quaderni del Laboratorio di tecnologia della pesca*, 2(1): 17–36.

Reñones, O., Massuti, E. & Morales-Nin, B. 1995a. Life history of the red mullet *Mullus surmuletus* from the bottom–trawl fishery off the Island of Majorca (north–west Mediterranean). *Marine Biology*, 123: 411–419.

Reñones, O., Massuti, E. & Oliver, P. 1995b. Some aspects of the reproduction pattern of hake (*Merluccius merluccius*) in the Balearic Islands. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 34: 255.

Rey, J., Gil De Sola, L. & Massuti, E. 2005. Distribution and Biology of the Blackmouth Catshark *Galeus melastomus* in the Alboran Sea (Southwestern Mediterranean). *Journal of the Northwest Atlantic Fishery Science*, 35: 215–223.

Ria, M., Rustighi, C., Casotti, M., Silvestri, R. & Baino, R. 2005. Note sulla distribuzione e biologia di *Loligo vulgaris* e *Loligo forbesi* nelle acque toscane. *Biologia Marina Mediterranea*, 12(1): 575–579.

Riad, R. & Kilada, R. 2012. Reproductive biology of the musky octopus *Eledone moschata* (Cephalopoda: Octopodidae) in the eastern Mediterranean, Egypt. *Egyptian Journal of Aquatic Biology and Fisheries*, 16(4): 103–113.

Ribeiro-Cascalho, A. & Arrobas, I. 1987. Observations on the biology of *Parapenaeus longirostris* (Lucas, 1846) from the south Portuguese coast. *In* III Colloquium Crustacea Decapoda Mediterranea. *Investigación Pesquiera, Barcelona*, 51(1): 201–212.

Righini, P. & Abella, A. 1994. Life cycle of *Aristeus antennatus* and *Aristaeomorpha foliacea* in the Norther Tyrrhenian Sea. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 29.

Rijnsdorp, A.D. & Vethaak, A.D. 1997. Changes in reproductive paramters of North Sea plaice and sole between 1960 and 1995. *ICES*: C.M. U (14): 31 pp.

Rinelli, P., Bottari, T., Florio, G., Romeo, T., Giordano, D. & Greco, S. 2005. Observations on distribution and biology of *Galeus melastomus* (Chondrichthyes, Scyliorhinidae) in the southern Tyrrhenian Sea (central Mediterranean). *Cybium*, 29(1): 41–46.

Rizzo, P., Gancitano, S., Cannizzaro, L., Levi, D. & Mulone, S. 1995. Determinazione dell'età ed accrescimento in *Centrophorus granulosus* (Schneider, 1801). *Biologia Marina Mediterranea*, 1: 389.

Rjeibi, M., Ezzedine-Najai, S., Chemmam, B. & Missaoui, H. 2013. Reproductive biology of *Eledone cirrhosa* (Cephalopoda: Octopodidae) in the Northern and Eastern Tunisian Sea (Western and Central Mediterranean). *Malacologia*, 56(1–2): 69–84.

Robin, J.P., Denis, V., Royer, J. & Challier, L. 2002. Recruitment, growth and reproduction in *Todaropsis eblanae* (Ball 1841) in the area fished by French Atlantic trawlers. *Bulletin of Marine Science*, 71: 711–724.

Rocha, F. & Guerra, Á. 1996. Signs of an extended and intermittent terminal spawning in the squids *Loligo vulgaris* Lamarck and *Loligo forbesi* Steenstrup (Cephalopoda: Loliginidae). *Journal of Experimental Marine Biology and Ecology*, 207: 177–189.

Rocha, F., Guerra, A. & Gonzalez, A.F. 2001. A review of reproductive strategies in cephalopods. *Biological Reviews*, 76: 291–304.

Rodríguez-Cabello, C., Pérez, M. & Sánchez, F. 2013. New records of chondrichthyans species caught in the Cantabrian Sea (southern Bay of Biscay). *Journal of the Marine Biological Association of the United Kingdom*, 93(7): 1929–1939.

Rodríguez-Cabello, C., Velasco, F. & Olaso, I. 1998. Reproductive biology of lesser spotted dogfish *Scyliorhinus canicula* (L., 1758) in the Cantabrian Sea. *Scientia Marina*, 62: 187–191.

Rodríguez–Rúa, A., Pozuelo, I., Prado, M.A., Gómez, M.J. & Bruzón, M.A. 2005. The gametogenic cycle of *Octopus vulgaris* (Mollusca: Cephalopoda) as observed on the Atlantic coast of Andalusia (south of Spain). *Marine Biology*, 147: 927–933.

Romanelli, M., Colasante, A., Scacco, U., Consalvo, I., Finoia, M.G. & Vacchi, M. 2007. Commercial catches, reproduction and feeding habits of *Raja asterias* (Chondrichthyes: Rajidae) in a coastal area of the Tyrrhenian Sea (Italy, northern Mediterranean). *Acta Adriatica*, 48(1): 57-71.

Romanelli, M., Palladino, S., Tarulli, E. & Ferretti, M. 1997. Stima dell'accrescimento di *Helicolenus dactylopterus dactylopterus* (Delaroche, 1809), nello Stretto di Sicilia (Mar Mediterraneo). *Biologia Marina Mediterranea*, 2: 269–273.

Roper, C.F.E., Nigmatullin, C. & Jereb, P. 2010. Family Ommastrephidae. *In* P. Jereb & C.F.E. Roper, eds. *Cephalopods of the world. An annotated and illustrated catalogue of species known to date. Myopsid and Oegopsid Squids*. FAO Species Catalogue for Fishery Purposes No. 4, Vol. 2, pp. 269–347. FAO, Rome.

Rotllant, G., Moranta, J., Massuti, E., Sarda, F. & Morales–Nin, B. 2002. Reproductive biology of three gadiforms fish species through the Mediterranean deep–sea range (147–1850 m). *Scientia Marina*, 66: 157–166.

Rousset, J. 1990. Catches and geographical distribution of selachians on the western coast of Brittany. *Journal of the Marine Biological Association of the United Kingdom*, 70: 255–260.

Russell, B. 2014. *Pagellus erythrinus*. The IUCN Red List of Threatened Species 2014: e.T170224A1296530.

Russell, B., Carpenter, K.E. & Pollard, D. 2014b. *Pagellus acarne*. The IUCN Red List of Threatened Species 2014: e.T170229A1297432.

Russell, B., Carpenter, K.E. & Pollard, D. 2014a. *Boops boops*. The IUCN Red List of Threatened Species 2014. http://dx.doi.org/10.2305/IUCN.UK.2014-3.RLTS.T170251A1301787.en.

Rustighi, C., Casotti, M. & Voliani, A. 2004. Note sulla biologia e la distribuzione spaziale di *Phycis blennoides* nel Mar Ligure Sud-orientale. *Biologia Marina Mediterranea,* 11(2): 624–628.

Ryland, J.S. & Ajayi, T.O. 1984. Growth and population dynamics of three Raja species (Batoidei) in Carmarthen Bay, British Isles. *ICES Journal of Marine Science*, 41: 111–120.

Saad, A., Séret, B. & Ali, M. 2004. Liste commentée des Chondrichthyens de Syrie. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 37: 430.

Sabatés, A. 1990. Distribution pattern of larval fish populations in the Northwestern Mediterranean. *Marine Ecology Progress Series*, 59: 75–82.

Saglam, H. & Ak, O. 2011. Reproductive biology of *Raja clavata* (Elasmobranchii: Rajidae) from southern Black Sea coast around Turkey. *Helgoland Marine Research*, 66: 117–126.

Şahin, C., Kasapoğlu, N., Gözler, A.M., Kalayci, F., Hacimurtazaoğlu, N. & Mutlu, C. 2009. Age, growth, and gonadosomatic Index (GSI) of Mediterranean horse mackerel (*Trachurus mediterraneus* Steindachner, 1868) in the Eastern Black Sea. *Turkish Journal of Zoology*, 33: 157–167.

Sahrhage, D. 1970. Ein Beitrag zur Biologie des Stöckers (*Trachurus trachurus* (L.)) in der Nordsee. *Berichte der Deutschen Wissenschaftlichen Kommission für Meeresforsch*, 21**:** 122–169.

SAMED. 2002. *Stock assessment in the Mediterranean* (*SAMED*). European Commission, DG XIV (Fisheries), Final Report of Project 99/047.

SAMED. 2003. *Stock Assessment in the Mediterranean*. Final report to the European Commission, DG Fisheries (DG XIV), Project No 99/047.

Sánchez, P. & Martìn, P. 1985. Talla de primera madurez y selectividad en algunas especies demersales de interés comercial del litoral catalàn. *Informes Tecnicos de Instituto Español de Oceanografia*, 100: 19–27.

Sánchez, P. 1984. Determinación de la edad y de los párametros del crecimiento de *Illex coindetii* (Verany, 1837) en al mar Catalán (Mediterráneo occidental). *Investigacion Pesquera*, 48(1): 59–70.

Sánchez, **P.** 1995. Age and growth of *Illex coindetii*. *ICES Marine Science Symposia*, 199: 441–444.

Sánchez, P., González, A.F., Jereb, P., Laptikhovsky, V.V., Mangold, K.M., Nigmatullin, Ch.M. & Ragonese, S. 1998. *Illex coindetii*. *FAO Fisheries Research*, 376(4): 59–76.

Sánchez, P. & Guerra, A. 1994. Bathymetric distribution and aspects of the life history of the loliginid squid *Loligo vulgaris* (Mollusca: Cephalopoda) in the Catalan Sea (N.W. Mediterranean). *Iberus*, 12(2): 1–12.

Sánchez, P., Villanueva, R., Jereb, P., Guerra, Á., González, A.F., Sobrino, I., Balguerias, E., Pereira, J., Moreno, A., Allcock, A. L., Lefkaditou, E., Pierce, G.J., Iglesias, J. & Piatkowski, U. 2015. *Octopus vulgaris*. *In* P. Jereb, A.L. Allcock, E. Lefkaditou, U. Piatkowski, L.C., Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research report),* 325: 14–28.

Santic, M., Pallaoro, A. & Jardas, I. 2006. Co-variation of gonadosomatic index and parameters of length–weight relationships of Mediterranean horse mackerel, *Trachurus mediterraneus* (Steindachner, 1868), in the eastern Adriatic Sea. *Journal of Applied Ichthyology,* 22: 214–217.

Santojanni, A., Angelini, S., Belardinelli, A., Carpi, P., Cingolani, N., Colella, S., Donato, F., Gramolini, R., Martinelli, M. & Panfili, M. 2012. *Programma nazionale per la raccolta dei dati alieutici. Campionamento biologico delle catture della pesca professionale di piccoli pelagici in basso Adriatico (GSA 18), anno 2011*. Progetto del Ministero Italiano delle politiche Agricole, Alimentari e Forestali. ISMAR–CNR. Relazione finale: 54 pp. (Technical report).

Santos, A. & Cascalho, A. 1994. Present state of knowledge on *Aristeus antennatus* in the south of Portugal. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 29.

Santos, M.N., Costa Monteiro, A.C. & Erzini, K. 1995. Aspects of the biology and gillnet selectivity of the axillary Seabream (*Pagellus acarne*, Risso) and common pandora (*Pagellus erythrinus*, Linnaeus) from the Algarve (south Portugal). *Fisheries Research*, 23: 223–236.

Santos, P. 1995. *Growth, mortality and maturation of Lepidorhombus boscii in Portuguese waters*. Demersal Fish Committee. ICES, Copenhagen.

Santos, R.S., Porteiro, F.M. & Barreiros, J.P. 1997. Marine fishes of the Azores: annotated checklist and bibliography. *Arquipélago – Life and Marine Sciences*, 1: 1–244.

Sarano, F. 1986. Cycle ovarien du Merlu, *M. merluccius*, poisson à ponte Fractionée. *Revue des Travaux de l'Institut des Peches Maritimes,* 48: 65–76.

Sardà, F. 1991. Reproduction and moult synchronism in *Nephrops norvegicus* (L.) (Decapoda, Nephropidae) in the Western Mediterranean: is spawning annual or biennial? *Crustaceana*, 60: 186–199.

Sardà, F. & Cartes, J.E. 1994. Life cycle of *Aristeus antennatus* in Catalan Sea. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 21.

Sardà, F. & Demestre, M. 1987. Estudio biologico de la gamba *Aristeus antennatus* (Risso, 1816) en el mar Catalan (N.E. de Espana). *Investigación Pesquera*, 51(1): 213–232.

Sbrana, M., Belcari, P., De Ranieri, S., Sartor, P. & Viva, C. 2007. Comparison of the catches of European hake (*Merluccius merluccius*, L. 1758) taken with experimental gillnets of different mesh sizes in the northern Tyrrhenian Sea (western Mediterranean). *Scientia Marina*, 71(1): 47–56.

Sbrana, M. Chiericoni, V. & Biagi, F. 1998. Biologia riproduttiva e fecondità di *Micromesistius poutassou* (Risso, 1826) del Mar Tirreno Settentrionale. *Biologia Marina Mediterranea*, 5(2): 107–116.

Semmens, J.M., Pecl, G.T., Villanueva, R., Jouffre, D., Sobrino, I., Wood, J.W. & Rigby, P.R. 2004. Understanding octopus growth: patterns, variability and physiology. *Marine and Freshwater Research*, 55: 367-377.

Sequeira, V., Neves, A., Barros Paiva, R., Pereira De Lima, J., Vieira, A.R. & Serrano Gordo, L. 2012. Life history parameters as possible discriminators of bluemouth *Helicolenus dactylopterus* (Delaroche, 1809) populations in Portuguese waters. *Fisheries Research,* 125–126: 69–76.

Serejo, C.S., Young, P.S., Cardoso, I.C., Tavares, C., Rodrigues, C. & Almeida, T.C. 2007. Abundância, diversidade e zonação dos crustáceos no talude da costa central do Brasil (11° – 22°S) coletados pelo programa REVIZEE\Score Central: prospecção pesqueira. *In* P.A.S. Costa, G. Olavo & A.S. Martins, eds. *Biodiversidade da fauna marinha profunda na costa central brasileira*. Rio de Janeiro: 133–162.

Serena, F. 2005. *Field identification guide to the sharks and rays of the Mediterranean and Black* Sea. FAO Species Identification Guide for Fishery Purposes. FAO, Rome: 109 pp.

Serena, F., Baino, R. & Righini, P. 1988. Geographical and depth distribution of Rays in Northern Tyrrhenian Sea. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 31(2): 277.

Serena, F., Mancusi, C. & Barone, M. 2010. Guida pratica di identificazione delle razze (RAJIDAE) del Mar Mediterraneo. Linee guida per la raccolta e l'analisi dei dati. *Biologia Marina Mediterranea,* 204 pp.

Serena, F., Mancusi, C., Barone, M. & Abella, J. 2005. *Abundance and distribution of rays in the South Ligurian and North Tyrrhenian Sea*. ICES Annual Science Conference; Theme Session on Elasmobranch Fisheries Science, 20–24 September 2005. CM2005/No 20.

Serra-Pereira, B., Figueiredo, I., Bordalo-Machado, P., Farias, I., Moura, T. & Gordo, L.S. 2005. Description of Portuguese mixed–fisheries with positive landings of *Raja brachyura* Lafont, 1873 and *Raja montagui* Fowler, 1910. *ICES CM Documents 2005*, 18: 1–10.

Serra-Pereira, B., Figueiredo, I. & Gordo, L.S. 2011. Maturation, fecundity, and spawning strategy of the thornback ray, *Raja clavata*: do reproductive characteristics vary regionally? *Marine Biology,* 158: 2187–2197.

Shehata, S. 1984. *Contribution à la connaissance des Soleidae (Poissons, Téléostéens) du golfe du Lion*. Université des Sciences et Techniques du Languedoc, Montpellier. (PhD dissertation).

Shiganova, T.A. 1998. Invasion of the Black Sea by the ctenophore *Mnemopsis leidyi* and recent changes in the pelagic community structure. *Fisheries Oceanography,* 7**:** 305–310.

Sieli, G., Badalucco, C., Di Stefano, G., Rizzo, P., D'Anna, G. & Fiorentino, F. 2011. Biology of red mullet, *Mullus barbatus (*L. 1758), in the Gulf of Castellammare (N.W. Sicily, Mediterranean Sea) subject to a trawling ban. *Journal of Applied Ichthyology,* 27: 1218–1225.

Silva, L., Ramos, F. & Sobrino, I. 2004. Reproductive biology of *Eledone moschata* (Cephalopoda: Octopodidae) in the Gulf of Cádiz (south–western Spain, ICES Division IXa). *Journal of the Marine Biological Association of the United Kingdom*, 84: 1221–1226.

Silva, L., Sobrino, I. & Ramos, F. 2002. Reproductive biology of the common octopus *Octopus vulgaris* Cuvier, 1797 (Cephalopoda: Octopodidae) in the Gulf of Cádiz (SW Spain). *Bulletin of Marine Science*, 71: 837–850.

Silva, S., Vila, Y., Acosta, J.J. & Tornero, J. 2007. *Size at first maturity in European hake estimates based on different maturity criteria.* Workshop on sexual maturity staging of Hake and Monk (WKMSHM), 21–24 November 2007. Lisbon, Portugal. ICES Document CM /2007/ACFM: 34. 82 pp.

Sinovčić, G. 1998. The population dynamics of the juvenile anchovy, *Engraulis encrasicolus* (L.) under the estuarine conditions (Novigrad Sea–Central eastern Adriatic). *Cahiers Options Méditerranéennes,* 35: 273–282.

Sinovčić, G. 1999. Some ecological aspects of juvenile anchovy, *Engraulis encrasicolus* (L.), under the estuarine conditions (Novigrad Sea – Central Eastern Adriatic). *Acta Adriatica*, 40: 99–107.

Sinovčić, G. 2000. Anchovy, *Engraulis encrasicolus* (Linnaeus, 1758): biology, population dynamics and fisheries case study. *Acta Adriatica*, 41(1): 3–53.

Sinovčić, G. & Zorica, B. 2006. Reproductive cycle and minimal length at sexual maturity of *Engraulis encrasicolus* (L.) in the Zrmaja River estuary (Adriatic Sea, Croatia). *Estuarine, Coastal and Shelf Science,* 69: 439–448.

Sion, L., D'Onghia, G. & Tursi, A. 2003. First data on distribution and biology of *Squalus blainvillei* (Risso, 1826) from the Eastern Mediterranenan Sea. *Journal of the Northwest Atlantic Fishery Science,* 31: 213–219.

Slastenenko, E. 1956. *Karadeniz Havzasi Baliklari (The fishes of the Black Sea basin)*. E.B.K., Yayini, Istanbul.

Slimani, A., Elouamari, N. & Hamdi, H. 2003. *Etat des stocks des principales ressources en Mediterranee marocaine.* Document presente au groupe de travail du Sous comite d'evaluation des stocks (SCSA–SAC–GFCM) Tanager, Morocco, 12–14 March 2003, 32 pp.

Smith–Vaniz, W.F. 2015. *Trachurus mediterraneus*. The IUCN Red List of Threatened Species 2015.

Sobrino, I. & Garcia, T. 2007. Reproduction of the rose shrimp *Parapenaeus longirostris* (Lucas, 1846) in the Gulf of Cadiz (southwestern Iberian Peninsula). *Boletín del Instituto Español De Oceanografía,* 23(1–4): 57–71.

Sobrino, I., Moreno, A., Jereb, P., Balguerias, E., Seixas, S., Pierce, G.J., Lefkaditou, E. & Allcock, A.L. 2015. *Eledone moschata*. *In* P. Jereb, Al Allcock, E. Lefkaditou, U. Piatkowski, l.C. Hastie & G.J. Pierce, eds. *Cephalopod biology and fisheries in Europe: II. Species Accounts*. (*ICES cooperative research* report)*,* 325: 43–51.

Solá, A., Motos, L., Franco, C. & Lago-De-Lanzós, A. 1990. Seasonal occurence of pelagic fish eggs and larvae in the Cantabrian Sea (VIIIc) and Galicia (IXa) from 1987 to 1989. *ICES C.M.* 1990/hH: 25, 38 pp.

Somarakis, S. & Machias, A. 2000. *Evaluation of the Greek anchovy southern stock*. DG XIV. Project 97–0048. Final report, 2000.

Somarakis, S. & Machias, A. 2002. Age, growth and bathymetric distribution of red pandora (*Pagellus erythrinus*) on the Cretan shelf (eastern Mediterranean). *Journal of the Marine Biological Association of the United Kingdom,* 82: 149–160.

Somarakis, S., Machias, A., Giannoulaki, M., Siapatis, A., Torre M., Anastasopoulou, K., Vassilopoulou, V., Kalianiotis, A. & Papaconstantinou, C. 2005. Icthyoplanktonic and acoustic biomass estimates of anchovy in the Aegean Sea (June 2003 and June 2004). GFCM working document, Sub-Committee for Stock Assessment, Working Group on Small Pelagic Species, FAO, Rome, 26-30 September 2005.

Soro, S. & Paolini, M. 1994. *Illex coindetii* (Verany, 1839): aspetti biologici ed evoluzione della popolazione in alto e medio Adriatico. *Biologia Marina Mediterranea*, 1(1): 213–217.

Soro, S. & Piccinetti Manfrin, G. 1989. Biologia e pesca di cefalopodi in Adriatico. *Nova Thalassia*, 10(1): 493–498.

Specchi, M., Cassetti, P. & Orlandi, C. 1998. Ecological observations on *Sardina pilchardus* (Walb.) and *Engraulis encrasicolus* (L.) in the Adriatic Sea and the Gulf of Trieste. *Biologia Marina Mediterranea*, 5(3): 339–348.

Spedicato, M.T., Contegiacomo, M., Carbonara, P. & Lembo, G. 1998. Sistemi di produzione innovativi orientati alla maricoltura di nuove specie: *Pagellus erythrinus*, *Pagellus bogaraveo*. *Biologia Marina Mediterranea,* 5(3): 1180–1185.

Spedicato, M.T., Greco, S., Lembo, G., Perdichizzi, F. & Carbonara, P. 1995. Prime valutazione della struttura dello stock di *Aristeus antennatus* (Risso, 1816) nel Tirreno centro meridionale. *Biologia Marina Mediterranea*, 2(2): 239–244.

Spedicato, M.T., Lembo, G. & Carbonara, P. 2003. Annotated checklist of the skates (Chondrichthyes, Rajidae) in the central–southern Tyrrhenian Sea. *Biologia Marina Mediterranea,* 10(2): 941–945.

Spedicato, M.T., Lembo, G., Carbonara, P. & Silecchia, T. 1994. Biological parameters and dynamics of *Aristaeomorpha foliacea* in the Southern Tyrrhenian Sea In M.L., Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 35.

Spedicato, M.T., Lembo, G., Silecchia, T., Carbonara, P. 1996. Distribuzione e biologia di *Parapenaeus longirostris* nel Tirreno Centro-Meridionale. *Biologia Marina Mediterranea*, 3: 579–581.

Stehmann, M. & Bürkel, D.L. 1984b. Rajidae. In P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese, ed. *Fishes of the North–Eastern Atlantic and Mediterranean (FNAM), Vol. I*, pp. 163–196. UNESCO, Paris.

Stehmann, M. & Bürkel, D.L. 1984a. Chimaeridae. *In* P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese, ed. *Fishes of the North–Eastern Atlantic and Mediterranean (FNAM), Vol. I,* pp. 212–218. UNESCO, Paris.

Stehmann, M. 1995. A record of *Raja clavata*, the eastern Atlantic thornback skate, from the southern Madagascar Ridge at Walters Shoal (Elasmobranchii, Rajidae). *Journal of Ichthyology,* 35(5): 63–74.

Stehmann, M.F.W. 2008. *Dipturus nidarosiensis*. *In* C. Gibson, S.V. Valenti, S.V. Fordham & S.L. Fowler, eds. *The Conservation of Northeast Atlantic Chondrichthyans: Report of the IUCN Shark Specialist Group Northeast Atlantic Red List Workshop*, pp. 163–178. UNESCO, Paris.

Stergiou, K.I., Christou, E.D., Georgopoulous, D., Zenetos, A. & Souvermezoglou, C. 1997. The Hellenic Seas: physics, chemistry, biology and fisheries. *In* A.D. Ansell, R.N. Gibson & M. Barnes, eds. *Oceanography and Marine Biology: an annual review*, pp. 415–538. UCL Press.

Stergiou, K. I., Tsikliras, A. C. 2006. Underrepresentation of regional ecological research output by bibliometric indices. *Ethics in Science and Environmental Politics*, 15–17.

Steven, G.A. 1934. Observations on the growth of the claspers and cloaca in *Raja clavata* Linnaeus. *Journal of the Marine Biological Association of the United Kingdom,* 19: 887–899.

Steven, G.A. 1936. Migrations and growth of the thornback Ray (*Raja clavata* L.). *Journal of the Marine Biological Association of the United Kingdom,* 20: 605–614.

Tom, M., Goren, M. & Ovadia, M. 1988. The benthic phase of the life cycle of *Parapenaeus longirostris* (Crustacea, Decapoda, Penaeidae) along the Mediterranean coast of Israel. *Hydrobiologia*, 169: 339–352.

Tortonese, E. 1956. Leptocardia, Cyclostomata, Selachii. Fauna d'Italia, Vol. II. Calderini ed. Bologna, Italy.

Tortonese, E. 1975. Osteichthyes, parte II. Fauna. d'Italia. Calderini, ed. Bologna, Italy.

Tsikliras, A.C., Konstantinos, E.A. & Stergiou, I. 2010. Spawning period of Mediterranean marine fishes. *Reviews in Fish Biology and Fisheries,* 20: 499–538.

Tsikliras, A.C. & Stergiou K.I. 2013. Age at maturity of Mediterranean marine fishes. *Mediterranean Marine Science*, 16(1):5-20.

Tsimenidis, N.C. 1980. Contribution to the study of the angler–fishes *Lophius budegassa* Spinola, 1807 and *L. piscatorius* L., 1758 in Greek Seas. *Institute of Oceanography and Fisheries Research* Spec. Publ., 4: 180–190.

Tuck, I.D., Atkinson, R.J.A. & Chapman, C.J. 2000. Population biology of the Norway lobster, *Nephrops norvegicus* (L.) in the Firth of Clyde, Scotland II: fecundity and size at onset of sexual maturity. ICES *Journal of Marine Science*, 57: 1227–1239.

Tuggac, M. 1957. On the biology of the *Scomber colias* Gmelin. *General Fisheries Commission for the Mediterranean*, 4: 145–159.

Türkmen, M. 2003. Investigation of some population parameters of common sole, *Solea solea* (L., 1758) from Iskenderun Bay. *Turkish Journal of Veterinary and Animal Sciences*, 27: 317–323.

Tursi, A., D'Onghia, G., Lefkatidou, E., Maiorano, P. & Panetta, P. 1995. Population biology of *Eledone cirrhosa* (Mollusca, Cephalopoda) in the north Aegean Sea (eastern Mediterranean Sea). *Vie et Milieu*, 45(2): 139–145.

Tursi, A., D'Onghia, G., Matarrese, A. & Piscitelli, G. 1993. Observations on population biology of the blackmouth catshark *Galeus melastomus* (Chondrichthyes, Scyliorhinidae) in the Ionian Sea. *Cybium,* 17(3): 187–196.

Tursi, A., Mattarrese, A., D'Onghia, G. & Sion, L. 1994. Population biology of red mullet (*Mullus barbatus*) from the Ionian Sea. *Marine Life,* 4(2): 33–43.

Tursi, A., Panza, M., Basanisi, M., Costantino, G. & D'Onghia, G. 1995. Rinvenimento di esemplari con gonade matura di *Phycis blennoides* (Pisces, Osteichthyes) nel batiale del Mar Ionio. *Biologia Marina Mediterranea,* 2(2): 295–297.

Ungaro, N. 2004. Biological parameters of the brown ray, *Raja miraletus*, in the Southern Adriatic basin. *Cybium,* 28(2): 174–176.

Ungaro, N. & Martino, M. 1998. *Lepidorhombus boscii* (Risso, 1810): biologia della specie e demografia della popolazione sui fondi strascicabili dell'adriatico pugliese. *Biologia Marina Mediterranea,* 5(2): 192–200.

Ungaro, N., Marano, G. & Marsan, R. 1994. *Galeus melastomus* Rafinesque, 1810 (Selachii, Scyliorhinidae). Distribuzione e biologia sui fondi batiali del basso Adriatico. *Pugliese delle Scienze. Atti e relazioni,* 49: 195–207.

Ungaro, N., Marano, G. & Marzano, M.C. 2002. On the length at maturity of the smallspotted catshark *Scyliorhinus canicula* (L.) in the southern Adriatic Sea (Mediterranean Sea). *In* M. Vacchi, G. La Mesa, F. Serena & B. Seret, eds. *Proceedings of the 4th European Elasmobranch Association Meeting*, pp. 171–175. ICRAM, ARPAT and SFI, Livorno, Italy.

Ungaro, N., Marano, G. & Musci, E. 1997. Aspetti relativi alla riproduzione di selaci demersali nel bacino adriatico sud–occidentale. *Biologia Marina Mediterranea*, 4(1): 567–570.

Ungaro, N., Marano, G., Auteri, R., Voliani, A., Massutí, E., García–Rodríguez, M. & Osmani, K. 2002. Distribution, abundance and biological features of angler fish (*Lophius piscatorius* and *Lophius budegassa*) (Osteichthyes: Lophiiformes) in the Mediterranean Sea. *Scientia Marina*, 66: 55–63.

Ungaro, N., Marano, G., Ceriola, L., Martino, M., Marzano, M.C. & Pasolini, P. 2005. Prime informazioni sulle taglie maturative di *Raja clavata* Linnaeus, 1758 e *Raja asterias* Delaroche, 1809 nel basso Adriatico. *Biologia Marina Mediterr*anea, 12(1): 598–601.

Ungaro, N., Marano, G., Marsan, R. & Pastorelli, A.M. 1999. On the reproduction of *Nephrops* norvegicus (L.) in the Southern Adriatic Sea (Mediterranean Sea): sex ratio, maturity length and potential fecundity. *Crustacean Issues*, 12: 553–561.

Ungaro, N., Rizzi, E. & Marano, G. 1993. Note sulla biologia e pesca di *Merluccius merluccius* (L.) nell'Adriatico pugliese. *Biologia Marina Mediterranea,* 1: 329–334.

Üstün, F., Torcu-Koç, H. & Zerdoğan, Z. 2010. Age, growth and mortality of striped red mullet (*Mullus surmuletus* L.) in Edremit Bay (Northern Aegean Sea, Turkey). 46th Croatian & 6th International Symposium on Agriculture Section 6. Fisheries, Game Management and Beekeeping (sa2011_a0610).

Vacchi, M. & Relini Orsi, L. 1979. Aspetti riproduttivi in *Etmopterus spinax* L. (Chondrichthyes, Squalidae). *Quaderni della Civica Stazione Idrobiologica di Milano*, 7: 64–74.

Valdés, P., García–Alcázar, A., Abdel, I., Arizcun, M., Suárez, C. & Abellán, E. 2004. Seasonal changes on gonadosomatic index and maturation stages in common pandora *Pagellus erythrinus* (L.). *Aquaculture International*, 12: 333–343.

Vallisneri, M., Montanini, S. & Stagioni, M. 2012. Size at maturity of triglid fishes in the Adriatic Sea, northeastern Mediterranean. *Journal of Applied Ichthyology*, 28: 123–125.

Vallisneri, M., Piccinetti, C., Stagni, A.M., Colombari, A. & Tinti, F. 2000. Population dynamics, growth and reproduction of *Solea vulgaris* (Quensel, 1806) in the upper Adriatic Sea. *Biologia Marina Mediterranea,* 7: 101–106.

Vallisneri, M., Tommasini, S., Stagioni, M., Manfredi, C., Isajlović, I. & Montanini, S. 2014. Distribution and some biological parameters of the red gurnard, *Chelidonichthys cuculus* (Actinopterygii, Scorpaeniformes, Triglidae) in the North–central Adriatic Sea. *Acta ichthyologica et piscatoria*, 44(3): 173–180.

Vasconcellos, S.G.M. 1960. On the size relation and fecundity of the stock of spiny lobster, *Palinurus vulgaris* Lat., at the coast of Portugal. *ICES*, 219:1–6.

Vassilopoulou, V. & Papaconstantinou, C. 1990a. Growth in weight, condition factor and reproductive cycle of red pandora *Pagellus erythrinus* in the Saronicos Gulf. *Proceedings of the Hellenic Symposium of Oceanography and Fisheries,* 3: 584–591.

Vassilopoulou, V. & Papaconstantinou, C. 1990b. Weight growth, robustness and reproductive cycle of *Pagellus erythrinus* in the Saronic Gulf. 3rd Panellenic Symposium of the Hellenic Centre of Marine ReSearch, Athens 14–17/5/1990: 584–591.

Vassilopoulou, V. & Papacostantinou, C. 1991. Aspects of the biology and dynamics of the red mullet (*Mullus barbatus*) in the Aegean Sea. *FAO Fisheries Report*, 477: 115–126.

Vassilopoulou, V. & Papaconstantinou, C. 1995. Sexual maturity of the striped mullet (*Mullus surmuletus*) in the Aegean Sea. *Rapport Comité internationale Mer Méditerranée*, 34: 261.

Vassilopoulou, V. 1987. Sexual maturity of the red mullet *Mullus barbatus* in the Korinthiakos and Patraikos Gulfs and in the Ionian Sea, Greece. *Proceedings of the Hellenic Symposium of Oceanography and Fisheries,* 2: 565–569.

Vassilopoulou, V. 1989. Biological aspects of red mullet (*Mullus barbatus* L., 1758) off the coasts of central Greece. *Proceedings of the International Seminar on the combat of pollution and the conservation of marine wealth in the Mediterranean Sea,* Ras-Lanuf, Libya.

Vassilopoulou, V. 1992. Biological aspects of red mullet, *Mullus barbatus* off the coasts of Central Greece. *Bulletin of Marine Biology Research Centre,* 9: 62–81.

Vassilopoulou, V., Ondrias, I. & Papaconstantinou, C. 1997. Data on the sexual maturity of the flatfish *Lepidorhombus boscii* (Risso) in the northeastern Mediterranean Sea (Greece). *Proceedings of the American Fishery Society Annual Meeting,* 127: 42–43.

Velasco, E.M., Jimenez-Tenorio, N., Del Arbol, J., Bruzon, M.A., Baro, J. & Sobrino, I. 2011. Age, growth and reproduction of the axillary Seabream, *Pagellus acarne*, in the Atlantic and Mediterranean waters off southern Spain. *Journal of the Marine Biological Association of the United Kingdom*, 91(6): 1243–1253.

Vidalis, F. 1950. Study on the biology of *Boops boops* in Greek water. *Praktika of the Hellenic Hydrobiological Institute*, 4: 51–71.

Viette, M., Giulianini, P.G. & Ferrero, E.A. 1997. Reproductive biology of scad, *Trachurus mediterraneus* (Teleostei, Carangidae), from the Gulf of Trieste. *ICES Journal of Marine Science*, 54: 267–272.

Voliani, A., Abella, A. & Serena, F. 1998. Problematiche inerenti la valutazione dello stato di sfruttamento di *Mullus barbatus*. *Biologia Marina Mediterranea,* 5(2): 169–183.

Vrantzas, N., Kalagia, M. & Karlou, C. 1992. Age, growth and state of stock of red mullet (*Mullus barbatus* L., 1758) in the Saronikos gulf of Greece. Annex 4 to: Fourth session of the technical consultation on stock assessment in the Eastern Mediterranean. *FAO Fisheries Report*, 477: 51–67. FAO, Thessaloniki, Greece.

Vrgoč, **N., Krstulović, Šifner, S., Dadić, V. & Jukić-Peladić, S.** 2006. Demographic structure and distribution of John Dory, *Zeus faber* L. 1758, in the Adriatic Sea. *Journal of Applied Ichthyology*, 22: 205–208.

Walker, P.A. 1999. *Fleeting images: Dynamics of North Sea Ray populations*. University of Amsterdam, the Netherlands. (PhD dissertation)

Westhaus-Ekau, P. & Ekau, P.W. 1982. Preliminary report of the investigations on "cavala" (*Scomber japonicus*) and "chicharro" (*Trachurus picturatus*). Internal Report Department of Oceanography and Fisheries. University of Azores. Horta.

Wheeler, A. 1969. *The fishes of the British Isles and North–West Europe*. I–XVII. McMillan eds. London, Melbourne and Toronto.

Whitehead, P.J.P. 1985. *Clupeiod fishes of the world. Chirocentridae, Clupeidae and Pristigasteridae.* FAO species catalogue, Paper No125, Vol. 7, Pt. 1. FAO, Rome. 303 pp.

Whitehead, P.J.P. 1990. Engraulididae. *In* J.C. Quero, J.C. Hureau, C. Karrer, A. Post & L. Saldanha, eds. *Checklist of the fishes of the eastern tropical Atlantic (CLOFETA) JNICT, Lisbon; SEI, Paris, Vol. 1*, pp. 228–229. UNESCO, Paris.

Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen, J. & Tortonese, E. 1984. *Fishes of the North-Eastern Atlantic and Mediterranean (FNAM), Vol. I.* UNESCO, Paris.

Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen, J. & Tortonese, E. eds. 1986. *Fishes From the North–eastern Atlantic and the Mediterranean*. UNESCO, Paris.

Whittamore, J.M. & McCarthy, I.D. 2005. The population biology of the thornback ray, *Raja clavata* in Caernarfon Bay, North Wales. *Journal of the Marine Biological Association of the United Kingdom,* 85: 1089–1094.

Williams, T., Helle, K. & Aschan, M. 2008. The distribution of chondrichthyans along the northern coast of Norway. *ICES Journal of Marine Science*, 65: 1161–1174.

Wirszubski, A. 1953. On the biology and biotope of the red mullet *M. barbatus*, L. *Bulletin. Sea Fisheries Research Station*, 1–20.

Würtz, M. & Giuffra, E. 1989. Riproduzione e accrescimento di *Loligo vulgaris* (Cephalopoda, Myopsida) in Mar Ligure. *Oebalia*, 15(2): 831–834.

Yahiaoui, M. 1994. Distribution and reproduction cycle of *Aristeus antennatus and Aristaeomorpha foliacea* in Algeria. *In* M.L. Bianchini & S. Ragonose, eds. *Life cycles and fisheries of the deepwater shrimps Aristaeomorpha foliacea and Aristeus antennatus.* Proceedings of the International Workshop. N.T.R– I.T.P.P. Special publications, 3: 51.

Yigin, C. & Ismen, A. 2010. Age, growth, reproduction and feed of longnosed skate, *Dipturus oxyrinchus* (Linnaeus, 1758) in Saros Bay, the north Aegean Sea. *Journal of Applied Ichthyology,* 26: 913–919.

Yigin, C.C., Ismen, A. & Arslan, M. 2015. Reproductive biology of *Lophius budegassa* (Lophiidae) in the North Aegean Sea. *Cybium,* 39(1): 31–36.

Zamboni, A. & Relini, G. 1986. Note di biologia di *Spicara flexuosa* (Osteichthyes, Centracanthidae) del Mar Ligure. *Bollettino dei Musei e Degli Istituti Biologici dell'Università di Genova*, 52: 251–265.

Zarrad, R., Cherif, M., Gharbi, H., Jarboui, O. & Missaoui, H. 2010. Reproductive cycle and sex reversal of *Pagellus erythrinus* (Linnaeus, 1758) in the Gulf of Tunis (Central Mediterranean). *Bulletin de l'Institut National des Sciences et Technologies de la Mer de Salammbô*, 37: 13–20.

Zarrad, R., Missaoui, H., Alemany, F., Salah, R.M., García, A., Ridha, M.R., Thman, J. & Amor, E.A. 2006. Spawning areas and larval distributions of anchovy *Engraulis encrasicolus* in relation to environmental conditions in the Gulf of Tunis (Central Mediterranean Sea). *Scientia Marina*, 70(2): 137–146.

Zorica, B., Vilibic, I., Kec, V.C. & Sepic, J. 2013. Environmental conditions conductive to anchovy (*Engraulis encrasicolus*) spawning in the Adriatic Sea. *Fisheries Oceanography,* 22(1): 32–44.

Zoubi, A. 2001. Biologie de reproduction des principales especes demersales de la Mediterranee marocaine. *Rapport du Commission Internationale our l'exploration scientifique de la mer Méditerranée,* 36: 340.

Zumholz, K. & Piatkowski, U. 2005. Research cruise data on the biology of the lesser flying squid, *Todaropsis eblanae*, in the North Sea. *Aquatic Living Resources*, 18: 373–376.

Zúñiga, L.R. 1967. Estudio del crecimiento de *Boops boops* (L.) die Levante español. *Investigación Pesquera*, 31(3): 383–418.

Zupa, R., Santamaria, N., Bello, G., Deflorio, M., Basilone, G., Passantino, L. & Corriero, A. 2013. Female reproductive cycle and batch fecundity in the central–southern Adriatic population of *Engraulis encrasicolus* (Osteichthyes: Engraulidae). *Italian Journal of Zoology,* 80(4): 510–517.

Zupanovic, S. 1961. Contribution to the knowledge of the biology of the Adriatic Chondrichthyes fish. *Acta Adriatica*, 9(3): 151.

Zupanovic, S. & Jardas, L. 1986. A contribution to the study of biology and population dynamics of the Adriatic hake *Merluccius merluccius* (L.). *Acta Adriatica,* 27(1–2): 97–146.

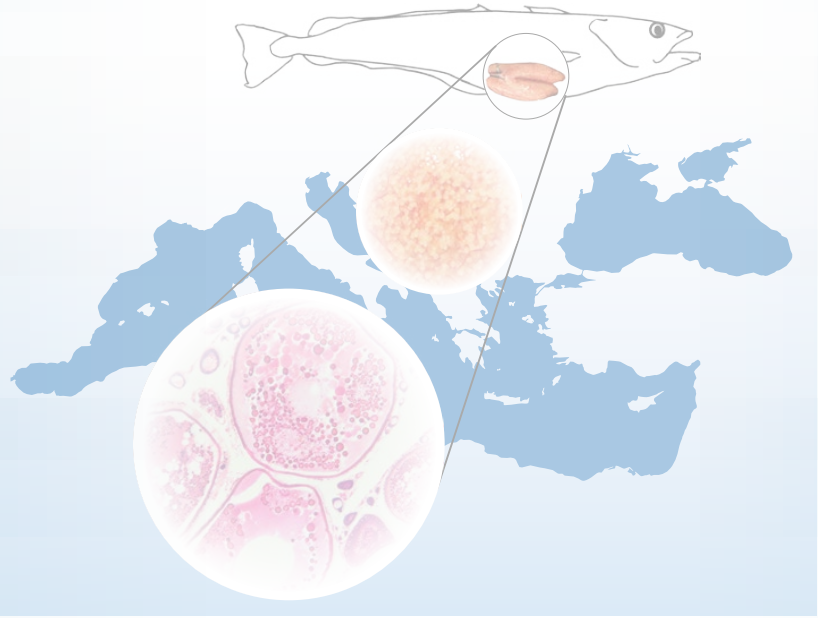
ATLAS OF THE MATURITY STAGES OF MEDITERRANEAN FISHERY RESOURCES

This atlas stems from an experience on fish maturity staging carried out at the Mediterranean level. It aims to present sound approaches to maturity sampling for a wide range of Mediterranean species, based on an accurate and precise determination of the different maturity stages. It includes macroscopic photos of gonads belonging to the main species, and for some of them, a validation-based histological analysis is also presented. The main categories investigated in the atlas are bony fish, cartilaginous fish, both oviparous and viviparous, crustaceans and cephalopods.

Maturity is one of the most relevant biological parameters used in stock assessment programmes. Indeed, the macroscopic stage of gonadal development is an essential feature in estimating the maturity ogive and spawning stock biomass. It is also useful for determining the spawning season of a species and for monitoring long-term changes in the spawning cycle, as well as for many other research needs related to the biology of fish.

In current data collection programmes carried out in the Mediterranean which cover extensive samplings of maturity stages, some specific technical aspects have not always been taken into consideration, and collected data cannot reach the required precision levels. Also, the coding schemes in use and the uncertainty in the interpretation of particular stages can give rise to misinterpretations of the actual maturity stage leading to inaccurate spawning stock biomass estimations. Several stock assessments are therefore based on time-invariant maturity ogives and only partially cover the spatial distribution of the stocks. Hence, on several occasions, the need has been expressed to improve the identification of the macroscopic maturity stages through a standardization of operational procedures and terminology.

Hence, one of the solutions for overcoming these problems was to develop an atlas of the macroscopic and histological maturity stages of the main species of commercial interest in the Mediterranean.



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