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Volume III

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ORDER, GADIFORMES (Anacanthini)

The order of the Gadiformes or Anacanthini includes several hundred /49 species generally living in more or less deep waters, many of which are of enormous importance as human food and thus have resulted in the establishment of grandiose industrial and commercial complexes in the principal countries of the world.

Among the characters common to this group, one should mention the fact that the swim bladder has no pneumatic duct, the position of the pelvic fins, which are thoracic or jugular and the absence of spiniform rays on the fins except for some species which show one large, often serrated spine, before the dorsal fin.

Despite the fact that the species are very well known, there is no general agreement on the systematic division of the order. The first to concern himself with this group of fishes was J. MUELLER (1846), who established the order of the Anacanthini, dividing them into two sub-orders, Anacanthini subbrachii, with two families, Gadoidei and Pleuronectides, and Anacanthini apodes, with the family of the Ophidini. GUENTER (1862) accepted the order established by MUELLER, but divided it into two different suborders, Anacanthini ciforme, including only the families Gadidae and Macruridae and, what is more important, he placed the so-called flatfishes in a distinct order, that of the Heterosomata, which order was accepted almost universally in subsequent classifications. Also dealing with this topic were JORDAN & GILBERT (1833), GILL (1884), JORDAN & EVERMANN (1898), BOULENGER (1901) and finally REGAN (1903) but it is not possible in this work to go into

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greater detail. We shall merely say that at present, REGAN'S classification is that generally followed by modern authors and it was also accepted by JORDAN (1923) with some minor changes.

We shall describe some of the more modern classifications of this group, to conclude with that used by us in this Atlas, and which, generally speaking, is based on that proposed by SVETOVIDOV (1962).

The classification used by the Zoological Record considers 6 families: Melanonidae, Macrouridae, Merlucciidae, Gadidae, Moridae and Bregmacerotidae. Also included in the order is the Ophidioidei group with four families: Brotulidae, Ophidiidae, Aphyonidae and Carapidae.

NORMAN (1966) considers only four families, based on the following schema: (page missing - translator's note).

ORDER: GADIFORMES

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In the classification proposed by GREENWOOD ET AL (1966), the order is divided into five suborders, according to the following schema:

Order	Suborder	Family
	Muraenolepoidei	MURAENOLEPIDAE
	Gadoidei	MORIDAE BREGMACEROTIDAE GADIDAE MERLUCCIIDAE
Gadiformes	Ophidioidei	OPHIDIIDAE CARAPIDAE PYRAMODONTIDAE
	Zoarcoidei	ZOARCIDAE
	Macrouroidei	MACROURIDAE

As will be seen, according to this classification, also included in the Gadiformes are the Ophidioidei, which REGAN (1903) and his immediate successors had excluded, considering them to be perciforms.

Previously, COPE (1872) had shown the great differences between the Gadiformes and the Pleuronectiformes, and subsequent authors provided new anatomical evidence supporting this theory. REGAN (1903), as we said, definitely distinguished them from the families Bleniidae, Zoarcidae, Brotulidae, Ophidiidae, etc. and BOULENGER (1904) observed that the morphological resemblances between these two groups of fish were due to convergence rather than to a relationship.

SVETOVIDOV (1962), in his work on the Gadiformes of the seas of the USSR, states that in the light of the most recent anatomical data, the origin of these fishes appears quite different from that of all the other groups which have been associated with them and an exact classification must be based on a totality of characters relating functionally to the principal biological characteristics of the group. A morphological peculiarity of the Gadoidae, typical perhaps only of them, and which is extremely marked and variable, is the structure of the vertical fins. There are species with one, two or three dorsal fins and one or two anal fins. Another biological peculiarity, also typical of the Gadoidae and no less variable than the morphological character mentioned above, is their ability to live in different areas of the hydrosphere and their varying

adaptation to movement, in that there are stable, more or less lazy species and migratory species. The majority of the species are benthonic, some are coastal and are also found in very shallow waters, while others live at considerable depths and lastly, there are those which live a pelagic life.

To conclude this introduction, which - unfortunately - we cannot prolong, we would point out that the Gadiformes are marine fishes exclusively, with the exception of a single monospecific genus (Lota), and are found prevalently in the northern hemisphere. They also prefer cold waters and among them, there is only one family living in tropical or subtropical waters (Bregmacerotidae), and contrary to what happens with most other families of fishes, which have representatives in both the North Pacific and the North Atlantic, in this latter ocean, the species are more numerous and abundant and at times generically exclusive. The classification proposed by SVETOVIDOV excludes the family Macruridae from the order and includes two sub-orders with four families in all, according to the following schema:

ORDER: GADIFORMES (Anacanthini ex parte)

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Teleost fishes, in which the body and part of the head are covered by small cycloid scales; fins have no spiniform rays; the insertion of the pelvic fins is anterior to the pectoral fins, swim bladder has no pneumatic duct and is sometimes rudimentary. Numerous pyloric caeci; rarely, absent or single. Often a hook is present under the chin. Four branchial arches, branchial cleft generally wide and branchial membranes free or attached to the isthmus for a

short distance. Pseudobranchi absent. The order is divided into two suborders, muraenolepidoidei and Gadoidei.

Family: MORIDAE

Gadoids living in deep waters, characterized by a peculiar swim bladder, which is connected to the hearing organ by means of two long horn-shaped appendices with thickened tips which tightly press against the membranes of the lateral occipitals. The posterior part of the bladder is tightly enclosed by the ribs. Approximately 17 genera are assigned to this family which is very widespread geographically; the genera marked with an asterisk are also present on our coasts:

Family: MORIDAE

Genus Mora Risso 1826 (type M. Mediterranea RISSO)

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Morids with two dorsal fins and the anal fin divided into two distinct parts. Snout very pronounced, teeth present on the vomer and on the palatines.

Genus: Lepidion SWAINSON 1838 (type Gallus lepidion RISSO)

Synonym: Haloporphyrus GUENTHER 1862 (type Gadus lepidion RISSO)

Morids with two dorsal fins and the free margin of the anal fin slightly grooved or not at all. Vomerine teeth present. About ten species are known, all living in deep water, only the first of which is found in Italian waters:

Genus: Gadella LOWE 143 (type G. gracilis Lowe)

Synonyms: Uraliptus COSTA 1846 (type Gadus maraldi RISSO)

Morids with two dorsal fins and anal fin with a straight free margin,

with the teeth of the upper jaw in series, the outer ones blunted and the inner ones in a single series. No hook on the chin. Probably a single species:

maraldi (RISSO) 1810 (Mediterraneo, Atlantic, Madera).

Genus: Physiculus KAUP 1858 (type P. dalwignkii KAUP)

Synonym: Pseudophysicis GUENTHER 1862 (type Lota breviscula RICHARDSON)

Leptophysicis GARMAN 1899 (type L. filifer GARMAN)

Morids with two dorsal fins and anal fin with a straight, slightly grooved free margin, teeth of the upper jaw in a single wide band; vomer toothless. About twenty species, one only of which is present in our waters:

Family: MORIDAE

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Genus: Eretmophorus GIGLIOLI 1889 (type E. kleinenbergi (GIGL.))

Morids with two dorsal fins and anal and ventral fins with 5 elongate rays, of which the middle ones end in lanceolate extensions. Abdomen large and conical. A single species is known, of which only about a dozen specimens have been caught, all very small, measuring from 13 to 103 mm in total length. Thus, some authors maintain that these are larval and juvenile forms, probably of the species

Lepidion lepidion;

kleinenbergi GIGLIOLI 1889 (Messina, Naples, Camogli).

Genus: Rhynchogadus TORTONESE 1948 (replaced by Hypsirhynchus FAC.)

Synonym: Hypsirhynchus FACCIOLA 1884 (type H. hepaticus FACCIOLA)

hepaticus FACCIOLA 1884 (Naples, Messina)

The name Hypsirhynchus, previously used by GUENTHER (1858) for a genus of Colubrid, was replaced by TORTONESE (1948) with Rhynchogadus.

Torchio (1960) described a specimen of Strinsia tinca RAFINESQUE 1810 and ascribed it to the family Moridae, designating it as a neo-type (1961). A later study by COHEN, D.M. & TORCHIO (1963) showed that it was not identical to the species of RAFINESQUE, but that it was a mutilated specimen of Gadella maraldi (RISSO 1810). However, the characteristics of Strinsia tinca n. gen., n. sp., as described by RAFINESQUE SCHMALZ (1810), suggest rather a macrurid and may be ascribed to any of the four following species:

Macrurus sclerorhynchus VAL. 1884, Coelorhynchus coelorhynchus (RISSO) 1810, Chalinura mediterranea (GIGLIOLI) 1893 and Macrourus aequalis GUENTHER 1878. Therefore, Strinsia tinca RAF. 1810 must be considered a "nomen dubium".

REPRODUCTION

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De Gaetani (1929) described the eggs and the larval stages of this species and Lo Bianco two juvenile stages. The egg is floating with an oily droplet and is fished in the Strait of Messina in the month of January. Lo Bianco in the Gulf of Naples caught a post-larva 13 mm long and another 16 mm at a depth of 170 m in the month of March. Therefore reproduction must take place in the winter months. D'Ancona (1932) described all the known stages. I was able to observe 5 juvenile specimens measuring 70 to 80 mm in total length, caught in August 1969 at depths of 450 and 560 meters, off the coast of Tuscany.

NUTRITION

Carnivorous, voracious species. Feeds mainly on fish, but also on crustaceans, mollusks and other invertebrates.

FISHING

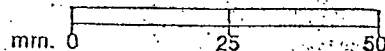
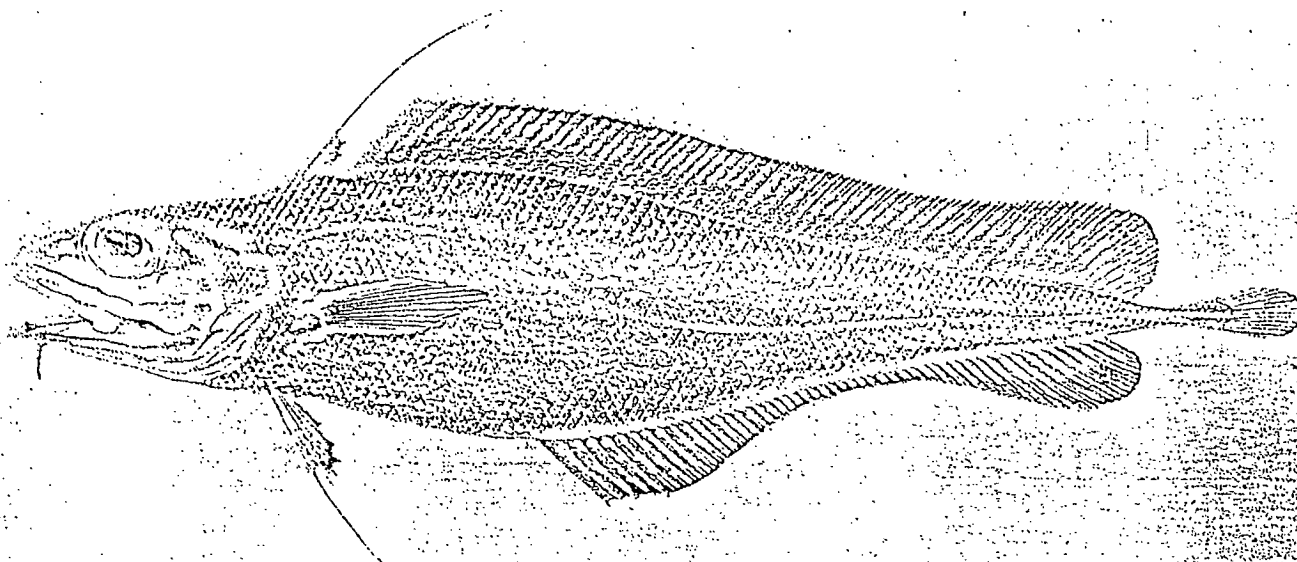
Is caught mainly with long fishing lines, below depths of 500 meters. That observed by me was caught with such a device off the coast of Varigotti (Liguria) in August of 1967 at a depth of 800 meters. It was caught in the Adriatic for the first time in October of 1950 (Kirinić and Lepetić) at a depth of 1100 meters using the same method.

DIMENSIONS

The specimen observed by me was 500 mm long in total length (420 without the tail). Lozano says that it can reach a length of 560 mm, but it is probable that it reaches even larger dimensions.

GEOGRAPHICAL DISTRIBUTION

Known in the Eastern Atlantic from the southern waters around the British Isles down to the coast of Mauritania. Common to Madeira and the Canary Islands. In the Mediterranean, it is reported on the Spanish, French and Algerian coasts in the western basin and it also appears in Greece, Lebanon and Turkey, in the eastern basin. In our waters, it is quite common in the Ligurian Sea and off the coasts of Sicily, above all in the Gulf of Catania. Also found in the Adriatic in 1950 for the first time.



Lepidion lepidion (Risso) 1810

Gadus lepidion Risso 1810 - *Lota lepidion* Risso 1826 - *Lota joptera* Cocco 1829 - *Lepidion Rissoi* Swainson 1838 - *Haloporphyrus lepidion* (Risso 1810) Giglioli 1880 - *Lepidion rubescens* Swainson 1889.

OBSERVATIONS ON THE GENUS

The genus, which was established by Swainson in 1838, on the species described in this table, is characterized by the presence of two dorsal fins, of which the very short, first one has the first ray prolonged as a filament; wide mouth with bands of villiform teeth, which are also present on the vomer - but not on the palatines. The body is thin, similar to those of Gadella and Physiculus. There is a hook on the chin. The anal fin is deeply grooved in the central part and the ventral fins have a fibrous ray.

About ten species are ascribed to the genus, all from deep water, including three European ones, only one of which is present in our waters.

OBSERVATIONS ON THE SPECIES

The species is very rare in the Mediterranean and is the only Gadiformes of which neither the eggs nor the larval and juveniles stages are known, which led D'Ancona to advance the hypothesis that the known forms like Eretmophorus kleinenbergi actually represented known stages of the Lepidion lepidion. This hypothesis, which however is not supported by any proof, was also followed by Norman and Svetovidov, 'fide d'Ancona,' but, given the considerable differences between the two forms, modern authors tend to exclude this synonymy.

To conclude, according to Goode and Bean (1895), it seems to be established that there are three European species of the same genus, which are very similar, L. lepidion, L. glintheri (Gigi, 1880) and L. eques (Guenther 1887). Maurin (1968), is not, however, of that opinion and, based on the observations of Raimbault (1963), he maintains that the species are only two, L. glintheri and L. lepidion and that L. eques is a synonym of L. lepidion, as Lozano Rey also supposes (1960).

HABITS

Species which lives in deep waters between 500 and 2000 meters, on muddy bottoms. Raimbault (1963), who caught 220 specimens, pointed out that the areas most abounding in this species were between 750 and 900 meters and beyond. Two small specimens of less than 10 cm. in total length, were caught to the east of Corsica between depths of 115 and 175 meters.

REPRODUCTION

Nothing is known in this regard.

DIET

Carnivorous species, which probably feeds on crustaceans, mollusks and other benthonic marine organisms.

FISHING

Is caught with a trawl net by deep-water fishing boats and also with deep-sea lines.

SIZE

It would seem that the maximum length may exceed 30 cm. That described by Risso was of that length, that of Vinciguerra measured 260 mm, and that studied by me was 187 mm in total length (170 mm standard length).

GEOGRAPHICAL DISTRIBUTION

Was reported in the Mediterranean at Nice, Monaco, Genoa, in the Balearie Islands, off the mouth of the Bonifacio, on the Sardinian coasts and recently, by Torchio (1961) in Messina and by Raimbault (1963) on the Coasts of Cataluña and to the east of Corsica.

GADELLA MARADII

REPRODUCTION

Lo Bianco (1911) described a post-larval specimen 26 mm long . fished in the Gulf of Naples, at the surface, in the month of March. Subsequently, Spartà (1928) described two other smaller larval stages,

one 8.64 mm fished off Ganzirri in March 1923 and another 18.80 mm long caught in the same location on April 27, 1919. Reproduction would therefore appear to take place in spring. I have no more recent information in this regard.

DIET

Carnivorous and probably aggressive species, given the size of the teeth and the width of the mouth.

FISHING

In the Gulf of Naples, it was fished with "nasse" (traps similar to lobster traps - translator's note) on the rocky bottoms, 20 to 80 m down and also in the waters of Messina between depths of 150 and 250 meters, all year round. Further out to sea, it is caught with trawl nets by motorized fishing boats.

SIZE

Apparently, its maximum length does not exceed 30 cm. Those observed by me were about 15 cm. long.

GEOGRAPHICAL DISTRIBUTION

Known in the eastern Atlantic, and in the waters of Madeira and recently reported by Poll (1953) in the waters of the Congo and Portuguese Angola. Reported by Maurin in the Iberian-Moroccan Atlantic region, and in the Spanish Sahara and in the Mediterranean for the Spanish and Algerian coasts. In our waters, it has been found on the Sardinian coasts by Maurin, in the waters of Sicily, near both Messina and Liguria

and in the Gulf of Naples. It has been also caught in the Adriatic by the research ship "Hvar" at a depth of 215 meters.

(Page missing)

(Physiculus dalwigkii 50 mm (from De Gaetani)

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but included slightly more than 5 times in the standard length and very narrow caudal peduncle, covered inside by small scales which also extend over the entire head, except for the lips. The large head is longer than the maximum height of the body and included about 4 times in the length of the body, without the caudal part. The snout is rounded, the eyes quite large, their major diameter about equal to the preorbital length and one fourth the length of the head. The interorbital space is flat and broad - slightly less than the vertical diameter of the eye. The operculum has a short scarcely visible horizontal spine in the posterior margin. Two other small spines face outwards from the sides of the neck; they, too, are not very visible, because they are covered by skin. The mouth is fairly large, the posterior margin of the jaw reaches approximately to the centre of the eye and has small, villiform teeth arranged in bands on the jaw. They are completely absent on the vomer and on the palatines. Under the anterior symphysis of the mandible, there is a small hook, the length of which is one half to two thirds the diameter of the eye.

The dorsal fins are two; the first, which is very short and subtriangular, begins above the base of the pectoral fins and is higher than it is long and is immediately followed by the second which is of uniform height, slightly lower than the first and as long as the anal fin, which is situated symmetrically, but has lower rays and ends on

the caudal peduncle slightly before the termination of the second dorsal fin. The caudal fin is small with a rounded posterior margin. The insertion of the pectoral fins are in the middle of the sides, these fins are about two thirds the length of the head and their base is above the anal opening. The narrow ventral fins have a filamentous, elongate outer ray, which however does not reach to the origin of the anal fin. D: 7; D: 67; A. 69; P. 25/26; V. 5.

REPRODUCTION

Must take place in spring, since all the known larval stages have been caught at the end of March or the beginning of April. The egg, which has an oily droplet, breaks a few hours before the emergence of the larva, which also prefers dark areas and deep waters. All the stages are known, from the egg up to the 50 mm specimen, which can already be considered a juvenile specimen because of its external morphology, which is very similar to that of the adult.

DIET

Probably feeds on crustaceans, worms and other marine invertebrates.

FISHING

Totally irregular, with trawl nets.

SIZE

The specimen described by Guenther was 216 mm long, and apparently it can reach 300 mm.

GEOGRAPHICAL DISTRIBUTION

Known up to now only for the eastern Atlantic, at Madeira and along the coasts of Mauritania. Further south, Poll (1953) found some specimens of a species of the same genus (P. ludoti). For the moment, in the Mediterranean, it is reported only for the Gulf of Naples and the western coasts of Sicily.