Enchelyopus

GADI En

Genus with Reference : ***Enchelyopus*** Bloch & Schneider, 1801, Syst.Ichthyol., 950.

Diagnostic Features : See species.

Remarks : A single species.

Enchelyopus cimbrius (Linnaeus, 1776)

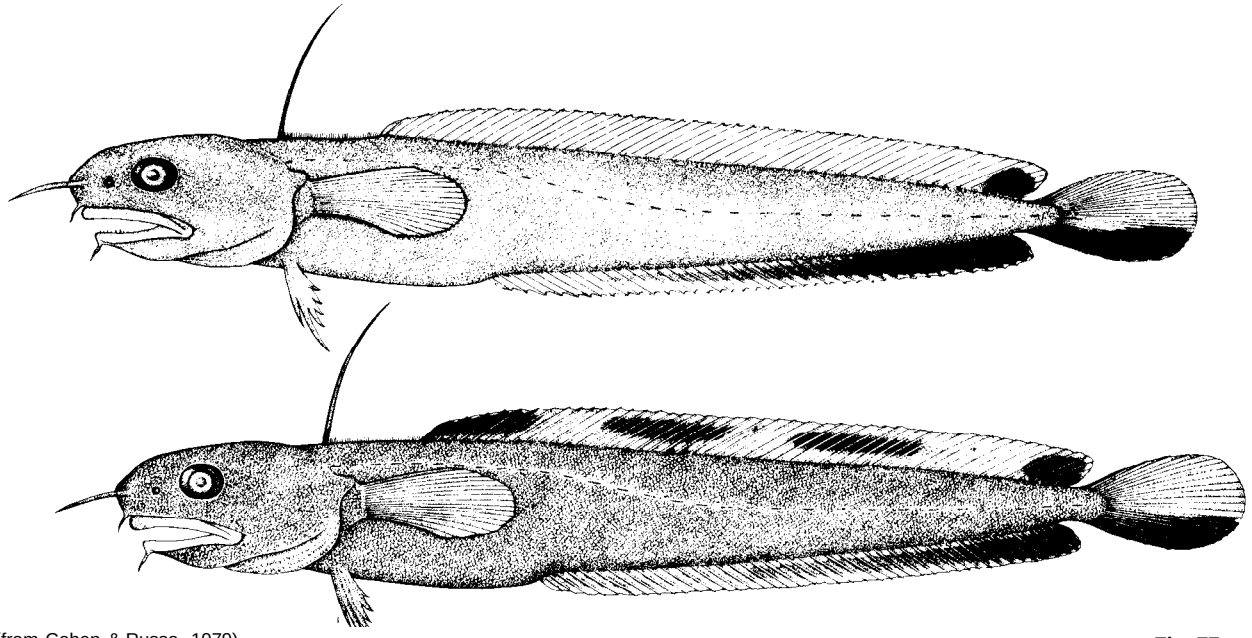
Fig. 77

GADI En 1

Scientific Name with Reference : ***Gadus cimbrius*** Linnaeus, 1776, Syst.Nat., ed 12:440

Synonyms : ***Motella cimbrica*** Nilsson, 1832; ***Motella caudacuta*** Storer, 1848; ***Rhinonemus caudacuta,*** Gill,1864; ***Couchia edwardii*** Couch, 1866; ***Rhinonemus cimbrius,*** Jordan, 1885; ***Gaidropsarus cimbrius,*** Collett, 1903.

FAO Names : **En -** Fourbeard rockling; **Fr -** Motelle à quatre barbillons.



(from Cohen & Russo, 1979)

Fig. 77

Diagnostic Features : One barbel present on chin, one on tip of snout, and one at each of the anterior nostrils. First dorsal ray followed by a row of small, fleshy filaments; anal fin single, not indented. Lateral line interrupted along its entire length. **Colour**: variable, dusky to pale. Fin pigment varying geographically in the western Atlantic, with more dark blotches on southern fishes, fewer on northern ones.

Geographical Distribution : Northern Gulf of Mexico to Newfoundland, western Greenland, coasts of Europe and the British Isles from the Barents Sea to the northern Bay of Biscay, one locality at Cape Blanc, Mauritania (Fig. 78).

Habitat and Biology : Adults are mainly sedentary bottom dwellers on muddy sand between patches of hard substrate, or on the soft, smooth ground of deep sinks on the continental slopes of both sides of the North Atlantic. Although quite often found in

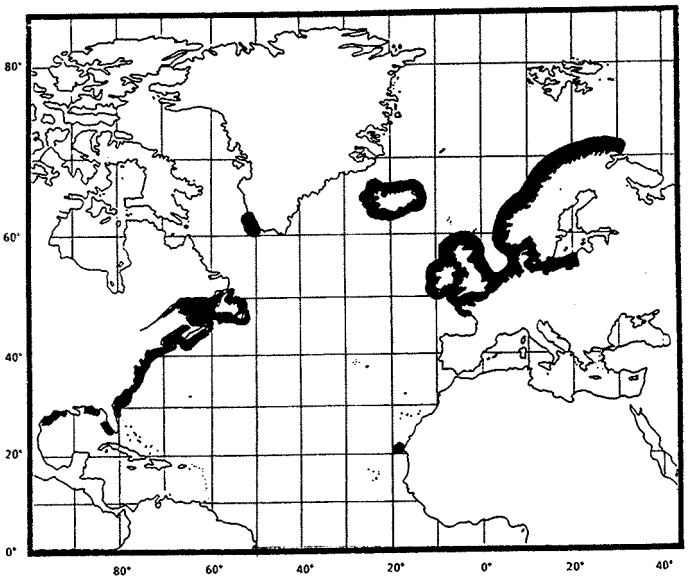


Fig. 78

very shallow water near the shore, its depth range extends from 20 to 650 m (most commonly from 20 to 50 m); it has once been reported from 1 325 m depth in the Gulf of Maine (Goode & Bean, 1896), but this record has not been verified by recent workers.

The presence of rockling in very shallow waters suggests that it migrates inshore in winter and autumn, and back to deeper waters in spring and summer. Apart from these small displacements, it seems to be a year-round resident wherever it is found, and there is no reason to suppose that adult fish ever rise far above the bottom.

First maturity is reached at 3 years (at about 15 cm total length). Depending on their size, females lay 5 000 to 45 000 eggs. The limits of the spawning season are not definitely known, but it seems to be very prolonged, from January to August) or even to September/October; on the coast of Canada, Norway, western Ireland and Iceland, it ranges from June to September inclusive; in the periphery of the Gulf of Maine, where Massachusetts is an important nursery, from May to October. Spawning has been recorded in waters less than 140 m deep. The silvery pelagic larvae are similar to those of ***Urophycis*** species.

Growth is relatively slow; at 3 years of age, total length is 15 cm, at 5 years, 20 cm, and at 7 years, 25 cm. Maximum age is 9 years (at about 29 cm length) in the eastern Atlantic, and at 30.5 cm in the western Atlantic.

Feeds on small fish (young flatfishes) and crustaceans (amphipods, decapods, copepods, mysids) in the eastern Atlantic, and in the western Atlantic mostly on shrimps, isopods and other small crustaceans, but less often on young fish.

Size : Reaches about 41 cm, but generally less than 30 cm.

Interest to Fisheries : Separate statistics are not reported to FAO. Taken with trawls, but it does not have great economical value since it is neither large, nor abundant. Used hot-smoked, in "Ukha" soups, and other products.

Literature : Bigelow & Schroeder (1953); Svetovidov (1948); Wheeler (1978); Cohen & Russo, (1979); Quero (1984).

Gadiculus

GADI Gadi

Genus with Reference : ***Gadiculus*** Guichenot, 1850, Explors.Sci.Algérie,Zool., 5: 101

Diagnostic Features : See species.

Remarks : A single species.

Gadiculus argenteus Guichenot, 1850

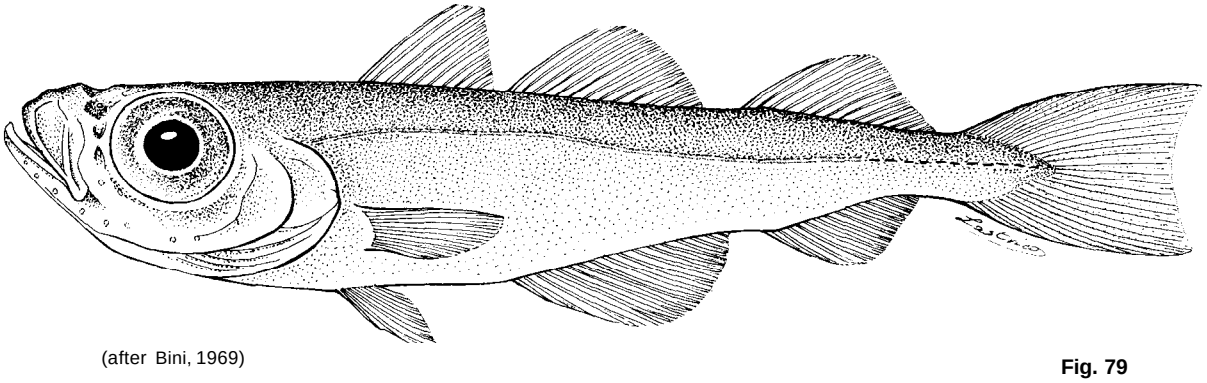
Fig. 79

GADI Gadi 1

Scientific Name with Reference : ***Gadiculus argenteus*** Guichenot, 1850, Explors.Sci.Algérie, 5: 102

Synonyms : ***Merlangus argenteus,*** Vaillant, 1888

FAO Names : **En** - Silvery pout; **Fr** - Merlan argenté; **Sp** - Faneca plateada



(after Bini, 1969)

Fig. 79

Diagnostic Features : Eye large, greater in diameter than length of snout. Mouth oblique. Chin barbel absent. Dorsal fins three, separate. Anal fins two, separate; base of first short, less than one-half of preanal distance; pectoral fin falling short of anal-fin origin; no long rays in pelvic fin. Lateral line continuous to middle of third dorsal fin; lateral-line pores present on head. **Colour**: pink to light brown dorsally, silvery on sides and ventrally

Geographical Distribution : Eastern Atlantic from North Cape (Norway) to Morocco, and western Mediterranean (Fig. 80).

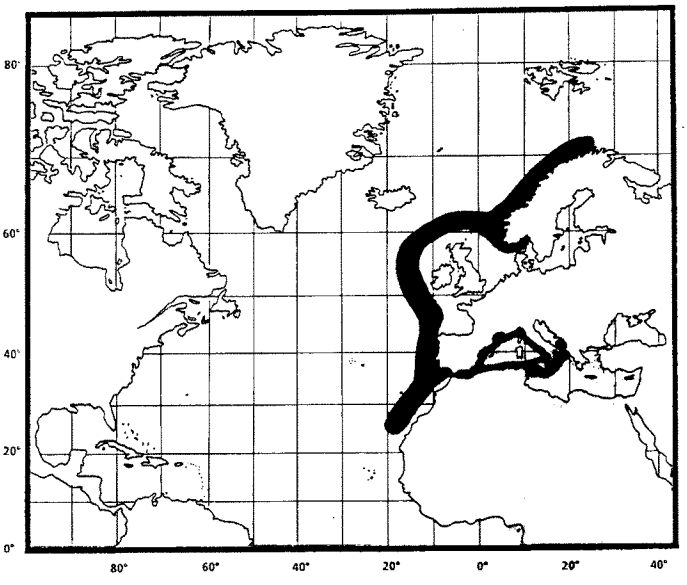


Fig. 80

Habitat and Biology : The silvery pout is a deep-water, open-sea epi- to mesopelagic fish common over the edge of the continental shelf. It occurs in large schools over mud, muddy sand, gravel and rock bottoms, from 110 to 1 000 m depth, but mostly from 200 to 400 m in the northern Mediterranean and from 300 to 600 m off Tunisia.

It breeds from December to January in the Mediterranean, and from mid-winter to spring in northern Europe. The major spawning grounds are located in the western part of the Mediterranean, on both sides of the Straits of Gibraltar, in deep water.

Silvery pout rarely lives up to 3 years, when it reaches a maximum length (15 cm); most commonly, it attains 13 cm in its northern distribution, and 7 to 10 cm in the Mediterranean Sea.

Feeds on small crustaceans and possibly on worms. It is preyed upon by a number of larger valuable fish.

Size : Reaches 15 cm total length, common from 7 to 10 cm

Interest to Fisheries : Silvery pout is of no particular economic importance and is usually by-caught in small-scale and artisanal bottom trawling fisheries off Spain and Sicily.

It is sold fresh (Moroccan markets); also or used for fishmeal or bait

Local Names : CYPRUS: Bacaliaraki; FRANCE: Gadicule argenté; GREECE: Gadíkoulos; ITALY: Pesce fico; MALTA: Nemusa; USSR: Bolsheglazaya tresochka; YUGOSLAVIA: Ugotica srebrenka.

Literature : Schmidt (1914); Svetovidov (1948); Bini (1969); Wheeler (1978)

Remarks : Divided into two subspecies, ***G. argenteus argenteus*** from the western Mediterranean and the Atlantic around the Straits of Gibraltar and to the south along the Moroccan coast, and ***G. argenteus thori*** from the Bay of Biscay to west of the British Isles and along the Scandinavian coast to North Cape.

Gadus

GADI Gadu

Genus with Reference : ***Gadus*** Linnaeus, 1758, Syst.Nat., ed X:251.

Diagnostic Features : Lower jaw shorter than upper; palatine teeth lacking. Chin barbel well developed. Three dorsal fins, two anal fins, all separate from each other; first anal fin base short, less than one-half of preanal distance; pectoral fins falling far short of anal fin origin; pelvic fins with a slightly elongated filament. Lateral line pale, continuous for at least mid-length of third dorsal fin, interrupted to end of caudal peduncle; lateral line pores present on head. Scales overlapping.

Habitat, Distribution and Biology : Benthic to benthopelagic at depths to 500 m. Some races tolerate low salinities. Circumboreal, extending into the Arctic to the north of Scandinavia and Europe.

Interest to Fisheries : Very important to fisheries. Reported landings for 1987 were 2 500 000 metric tons of which 2 054 72 1t were ***G. morhua.***

Remarks : The genus ***Gadus*** as originally used by Linnaeus (1758) and early ichthyologists contained numerous species. Through the years, many different genera were proposed for various of the ***Gadus*** species. The culmination of this shrinking of ***Gadus*** was reached in 1948 when Svetovidov, in his comprehensive monograph of the Gadidae, recognized only a single species in the genus, ***G. morhua.*** He was aware, however, that morphologically different populations existed in nature, and he treated some of them as six different subspecies. In general, Soviet ichthyologists have ollowed Svetovidov, while most others have tended to recognize at least some of his subspecies as full species. This is neither an appropriate place to discuss the theoretical differences between the two categories nor to analyze Svetovidov's subspecies in the light of theory. The present compilation agrees with Renaud (1989) in recognizing three full species, although the question is not yet completely settled. Additional information is presented in the diagnoses and remarks sections for the species.

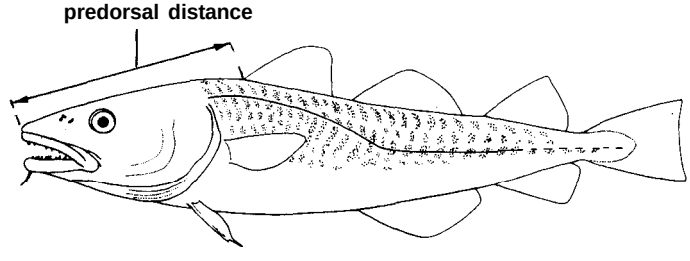
Key to species:

1a. Predorsal distance greater than about one-third of total length. Body generally spotted. Head relatively broad, interorbital space 18 to 25% of head length ..... **G. *macrocephalus*** (Fig. 81)

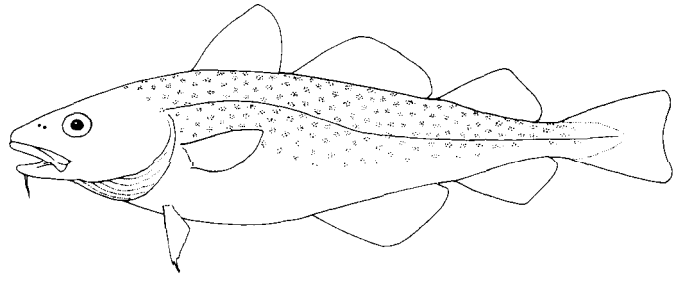
1b. Predorsal distance less than about one-third of total length

2a. Body generally spotted. Head relatively narrow, interorbital space 15 to 22% of head length ..... ***G. morhua*** (Fig. 82)

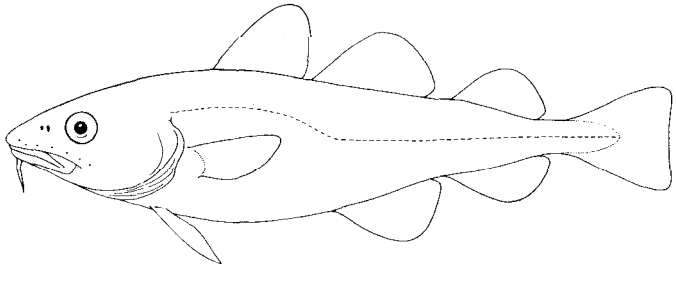
2b. Body unspotted. Head relatively broad, interorbital space 18 to 25% of head length ..... ***G.ogac*** (Fig. 83)



G. macrocephalus **Fig. 81**



G. morhua **Fig. 82**



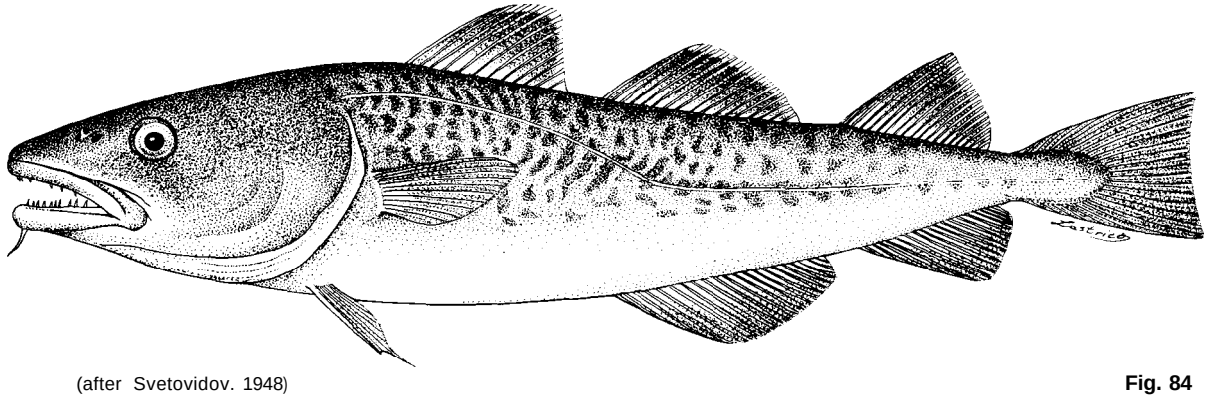
G. ogac **Fig. 83**

Gadus macrocephalus Tilesius, 1810 | **Fig. 84** | **GADI Gadu 1**

Scientific Name with Reference : ***Gadus macrocephalus*** Tilesius, 1810, Mem.Acad.Sci.Petersb., 2:350

Synonyms : ***Gadus pygmaeus*** Pallas, 1811; ***Gadus auratus*** Cope, 1873; ***Gadus brandti*** Hilgendorf, 1875; ***Gadus callarias macrocephalus***, Schmidt, 1904; ***Gadus morhua macrocephalus*** , Berg, 1933.

FAO Names : **En -** Pacific cod; **Fr -** Morue du Pacifique; **Sp -** Bacalao del Pacifico.



(after Svetovidov. 1948)

Fig. 84

Diagnostic Features : Head relatively broad; interorbital space 18 to 25% of head length. Predorsal distance more than about 33% of length; anterior part of swimbladder with 2 relatively short, horn-like extensions (Fig. 85). **Colour :** dorsally brown to grey with spots or vermiculations, ventrally paler.

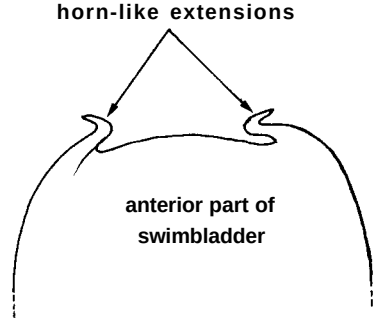


Fig. 85

Geographical Distribution : Found around the rim of the North Pacific, from the Yellow Sea to the Bering Strait, along the Aleutians, and south to about Los Angeles. Rather rare in the southern part of its range. (Fig. 86)

Habitat and Biology : Lives mainly along the continental shelf and upper slope of the North Pacific in the areas bordered by Korea and the western Chukchi Peninsula in the west, and Norton Sound and Oregon in the east. Its bathymetric range extends from shallow water (10 m) to about 550 m, but it is mostly between 100 and 400 m in the Gulf of Alaska and the Bering Sea. Some cod are assumed to be pelagic over deep water.

The distribution in the eastern Bering Sea varies between years and seasons within years. The driving environmental variable behind the changes in distribution appears to be water temperature, with such biological factors as year-class abundance and age composition, and probably spawning and feeding migrations also playing important roles.

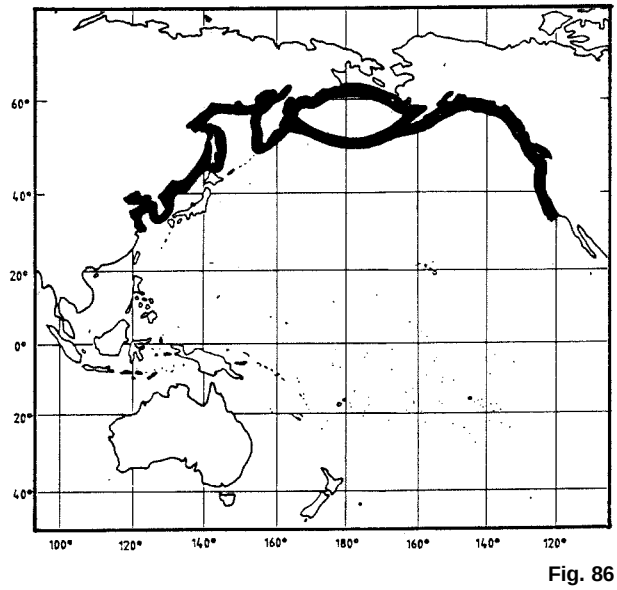


Fig. 86

Spawning migrations have been definitely linked to annual changes in temperature of the ocean in various parts of the geographical range. Pacific cod does not undertake migrations as extensive as the Atlantic species but moves only for short distances, such as to and from the shore, or from one bank to the other within a limited region. In summer, schools are small and distinct, contrarily to the large aggregations formed by the Atlantic cod. In the western Pacific, there appear to be two general types of schooling behaviour in cod of similar size and state of maturity: a school that is more or less permanent on the grounds and a school that moves continually. These two types of schools could be observed along the western shores of Kamchatka in two parallel rows, one at depths of l0-50 m, the other at 70-100 m. Near the end of September, or at the beginning of October, fish of the shallow row retreat to greater depths where they mix with those of the deeper row, and subsequently, they all proceed to 150-250 m depth where they remain for the winter.

In the eastern Bering Sea and regions of Kamchatka and the Sea of Okhotsk, Pacific cod move off the inner and central shelf regions as summer ends, concentrate in deeper water on the outer shelf and along the shelf edge during winter (in response to the autumn-winter drop in temperatures in the littoral waters), migrate back toward the inner shelf as the ice pack recedes northward in the spring (post-spawning/feeding migration), and are broadly dispersed over much of the inner and central shelf, as well as the outer shelf and along the continental slope, during the summer.

Age and size at first maturity vary with areas, the southern stocks maturing at an earlier age. They are,respectively,for males and females: 2-3 years and 40 to 44 cm off Washington, 3 years and about 50 cm in the Gulf of Alaska and in the Bering Strait, and 5 years and about 67 cm off Rebun Island, Hokkaido.

In the eastern Bering Sea, the proportion of females increases with size from 43.3% at 10 to 20 cm length to 61.6% at more than 60 cm. The overall sex ratio and size-specific differences for cod in the eastern Bering Sea are similar to those for the cod in the northwestern Bering Sea, where the sex ratio is nearly 1:1, with males dominating in the younger age groups, and females in the older age groups.

Fecundity ranges from 860 000-6 400.000 eggs per individual, depending also on environmental conditions: in the far eastern areas, the range is 1 400 000-6 400 000 eggs; in Hokkaido waters, 3 000 000-4 000 000 eggs; in Mutsu Bay (northernmost Honshu), 1 500 000-2 000 000 eggs. In the Straits of Georgia (southern British Columbia), females of 60-78 cm produce 1 200 000 to 3 300 000 eggs; in the Gulf of Alaska the fecundity ranges from 860 000-3 000 000 eggs, and in the Bering Sea, from 1 000 000-2 000 000 eggs. Females spawn only once each season. The eggs are demersal and slightly adhesive.

The spawning season extends from winter to early spring. In the western Pacific, around the Commander Islands and along the coast of Siberia, spawning occurs from January to May. Spawning time differs between Japan and the Sea of Okhotsk because of differences in the cycles of the oceanographic climate: in the warmer regions such as Japan and Korea, the fish remain at greater depths during summer (up to 200 m), and when temperatures drop during autumn, they move into shallow water, and spawn during winter; in more northern regions, such as the Sea of Okhotsk, where the temperatures of littoral waters are very low during winter, cod move to considerable depths for over-wintering and spawn in March-April. Off West Kamchatka, cod move away from the ocean floor at the approach of the spawning period and concentrate at an intermediate depth. Spawning in the eastern Bering Sea is expected to take place within the period of January to April, when water temperature is higher than 0°C; the optimum temperature for hatching and survival is considered to be 5°C. Along the Alaska Peninsula and westward, spawning takes place in the warmer waters of the outer continental shelf and slope or in protected bays and adjacent ice-free waters. Off British Columbia and Washington, spawning areas in shallow water are located at about 53ºN, where seasonal minimum bottom temperatures occur on inshore banks during winter. However, reproduction may be adversely affected by the relatively frequent occurrence of warm winters in this area. In the Gulf of Alaska, cod spawn from January to March along the continental slope of Alaska Peninsula.

It is hypothesized that spawning of Pacific cod must take place over a shorter period of time than that of the Atlantic species because of the greater instability in the Pacific marine temperatures.

Growth of Pacific cod is rapid during early stages. In the eastern Bering Sea, it has not been well identified because of problems in ageing the fish in the region. The southern Pacific stocks grow substantially faster than stocks of the colder regions of the North Pacific (such as the Bering and Okhotsk Seas), and growth is continuous throughout the year. Southern Pacific cod also mature at an earlier age and have a shorter life span (6-7 years). In Hecate Strait (northern British Columbia) cod length at age 1 is 23 cm; at age 2 it is about 44 cm; and the theoretical maximum length is 94 cm. Corresponding lengths, in the Straits of Georgia are 26,49, and 76 cm; in the Bering Sea, 27.5,43, and 84.5 cm (age 8), and in the Gulf of Alaska, 28.5,47, and 85.5 cm. Although the fish usually grow to a maximum length of 85 cm, the greatest recorded length is 120 cm. The life span is normally 8-9 years, although in the western Pacific, they can live up to 12 years.

Pacific cod appear to be indiscriminate predators upon dominant food organisms present. They evidently feed very little when they are close to spawning.

The diet of adults includes fish, octopuses, and large benthic and bentho-pelagic crustacea such as the Kamchatka crab and shrimps. The fish species consumed include saffron cod, pollock, smelt, and herring, as well as flounders, cottids. salmon and sardines.

Size : Reaches 1 m total length.

Interest to Fisheries : The total catch reported in the FAO Yearbook of Fishery Statistics for 1987 totalled 441 107 metric tons. The Japanese catch, which had traditionally accounted for the largest component of the total landings of this species, has decreased substantially (because of intense exploitation) since the mid seventies, while the USSR catch has shown a rapid increase in recent years. It should be noted that the abundance of Pacific cod has increased substantially since 1977 as a result of the recruitment of the exceptionally strong year classes fo 1977-1978 and the good year classes of 1982 to 1985.

Combined catches of Pacific cod by the USA trawl fishery and joint-venture fisheries increased from less than 1 000 metric tons in 1979 to nearly 91 000 metric tons in 1984. In 1987, landings in the eastern North Pacific amounted to 207 490 metric tons (of which 136 900 t were taken by USA) and in the western portion, to 233 617 t (of which 175 271 t were taken by the Soviet Union).

Fishing fleets exploiting this species in decreasing order of catch are: USSR, USA, Japan, Canada and Republic of Korea. Pacific cod is often taken incidentally to pollack and flatfish fisheries, and in Korea it is exclusively a by-catch of other commercial fisheries.

Pacific cod is now the most important of the trawl-caught bottom fishes of British Columbia. In Canada and the northeastern Pacific, the major types of gear used are trawls, but also longlines, troll and handlines. It should be noted that although pollock, Pacific herring and smelt are chief food items for cod, these are reputedly worthless as bait. In Japan and Bering Sea, also Danish seines, and pair and stern trawls are used.

In all areas, the importance of cod in the catches declines with depth. Depths of greatest cod occurrence were generally between 91 and 273 m. There are higher proportions of large fish in the British Columbia and southeastern Alaska regions than in the Gulf of Alaska and the Bering Sea.In the eastern Bering Sea, cod are taken primarily on the outer continental shelf (about equally divided between the areas southeast and northwest of the Pribilof Islands), with highest catches occurring near the shelf edge.

Pacific cod has a high growth rate and high-natural mortality and can support heavy exploitation. The catch is used mostly for filleting for subsequent production of fish sticks and fillet blocks.

Local Names : CANADA : Pacific cod; JAPAN: Ma-dara; USA : Pacific cod; USSR : Tikhookeanskaya treska.

Literature : Schultz & Welander (1935); Svetovidov (1948); Andriashev (1954); Wise (1961, 1963); Quast (1970); Hart (1973); Bulletin of Fisheries Resources Bd (1973); Niggol (1982); International North Pacific Fisheries Commission (1987); Fredin and Natural Resources Consultant (1985).

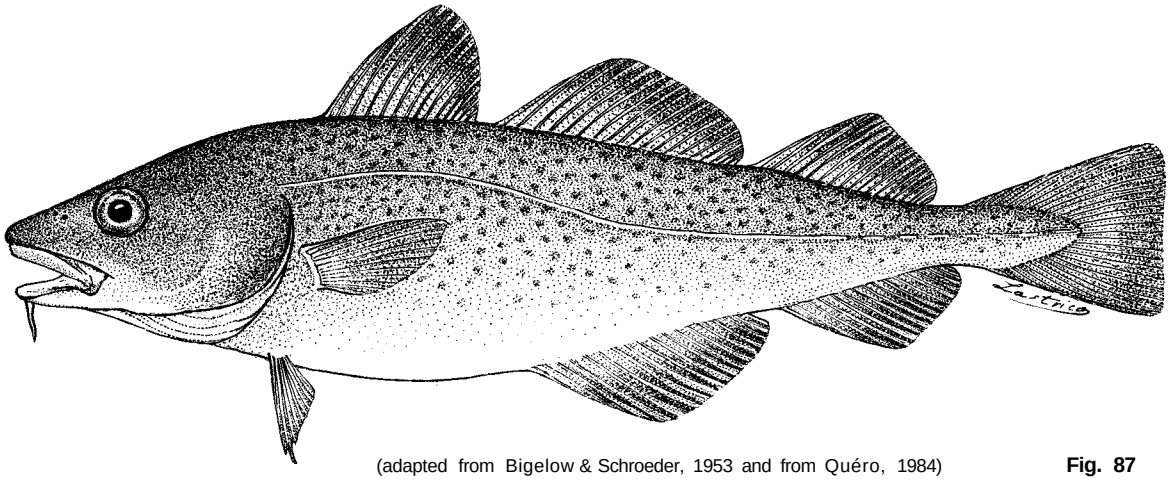
Remarks : Although the Pacific cod comprises a number of populations with different behaviour patterns, it is overall a biological species quite distinct from the Atlantic cod.

Gadus morhua Linnaeus, 1758 **Fig. 87** **GADI Gadu 2**

Scientific Name with Reference : ***Gadus morhua*** Linnaeus, 1758 Syst.Nat., ed. X:252

Synonyms : ***Gadus callarius*** Linnaeus, 1758**;** ***Gadus vertagus*** Walbaum,1791**;** ***Gadus heteroglossus*** Walbaum, 1792; ***Gadus ruber*** Lacépède, 1803**;** ***Morhua vulgaris*** Fleming, 1828 ***Gadus arenosus*** Mitchill, 1815; ***Gadus rupestris*** Mitchill, 1815; ***Morhua punctata*** Fleming, 1828; ***Gadus nanus*** Faber, 1829**;** ***Morrhua americana*** Storer, 1858; ***Gadus callarias kildinensis*** Derjugin, 1920; ***Gadus morhua kildinensis,*** Berg, 1933**;** ***Gadus morhua morhua,*** Svetovidov, 1948. The species name ***morhua*** is incorrectly spelled as ***morrhua*** by many authors.

FAO Names : **En -** Atlantic cod; **Fr -** Morue de l'Atlantique; **Sp -** Bacalao del Atlántico.



(adapted from Bigelow & Schroeder, 1953 and from Quéro, 1984) **Fig. 87**

Diagnostic Features : Head relatively narrow, interorbital space 15 to 22% of head length. Predorsal distance less than about 33% of length; **Colour** : variable, brownish to greenish or grey dorsally and on upper side, pale ventrally. Peritoneum silvery.

Geographical Distribution : Cape Hatteras to Ungava Bay along the North American coast; east and west coasts of Greenland, extending for variable distances to the north, depending upon climate trends; around Iceland; coasts of Europe from the Bay of Biscay to the Barents Sea, including the region around Bear Island (Fig. 88).

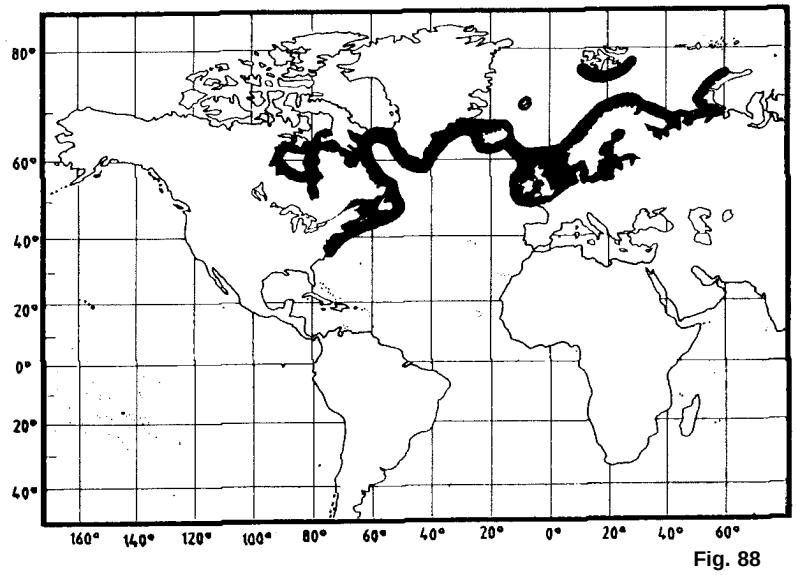


Fig. 88

Habitat and Biology : The Atlantic cod is generally considered a demersal fish, although its habitat may become pelagic under certain hydrographic conditions, when feeding or spawning. The presence of cod usually depends on prey distribution rather than on temperature. However, whatever the reason, larger fish are found in colder waters in most areas (0-5° C). It lives in almost every salinity from nearly fresh to full oceanic water, and in a wide range of temperatures from nearly freezing to 20°C.

This species is widely distributed in a variety of habitats from the shoreline to well down the continental shelf, to depths over 600 m, but is mostly found within the continental shelf areas from 150-200 m. Tagged cod at Jan Mayen, which have been recaptured on the spawning grounds around Iceland, indicate that these fish must have crossed in water over 1000 m deep. It is unlikely that cod swim as deep as this; although, they have been trawled in depths up to 460 m. While Atlantic cod is essentially a fish of the open sea, it appears regularly in various river mouths in Maine and Massachusetts during late autumn and winter. Cod are gregarious during the day, forming compact schools that swim between 30 and 80 m above the bottom, and scatter at night. To the south of its range, cod is found in shallow water only during the winter and there, as elsewhere, it is the younger smaller fish that live close inshore.

Although some groups of small cod are relatively stationary, individuals or groups may perform astonishingly long migrations. Some individuals migrate from native waters never to return, and movements of migrating individuals may be of the order of 5 km per day. A speed as high as 25.7 km/day for nearly a month has been calculated for a fish moving from east to west Greenland. Greenland cods have been observed to perform migrations over 1000 km, northeastern Atlantic cod, 800-900 km, while cod of the North Sea, the Channel, and the Irish Sea undertake migrations of lesser magnitude. In the Baltic, there is a tendency to migrate toward the Bornholm Basin (spawning and feeding ground). Arcto-Norwegian cod spends most of the year in the Barents Sea, but migrates seasonally to the Norwegian coast for spawning. In the western Atlantic, Gulf of Maine, cod may be driven out of the southernmost part of its range in summer and early autumn by increased water temperatures to waters of the polar current along the eastern coast of Labrador, which they leave again later in autumn to pass winter and spring either more southward or in deep waters.

Very little is known about the movements of young cod in their early years on the nursery grounds. There is a possibility that they undertake a seasonal migration to shallow water during the summer and return to deeper water in winter, although there is no evidence to support this. Movements seem to be restricted to feeding. The 3 and 4 year old immature cod move about in the Barents Sea when they follow the spawning capelin to the coast in March and April, and in the summer, they leave the coastal area and disperse, feeding on capelin and herring over the Barents Sea. When they are older, the young cod join the mature fish and make their first full spawning migration.

The earliest reported maturities for the Atlantic cod are at 2 years in its eastern (Oslofjord) and at 4 years in its western distribution. Although this fish has separate sexes, hermaphrodite specimens have been reported. The sex ratio is nearly 1:1, with a slight predominance of females. This is one of the world's most fecund fishes, with an average production of 1 million eggs per female. A 5 kg female produces approximately 2.5 million eggs; a 10 kg female 5 million and a 15 kg female, 7.5 million. The maximum production recorded is 9 millions eggs of a 34 kg fish. The eggs and the larvae up to 2.5 months are pelagic; subsequently the postlarvae settle to the bottom.

Although the spawning period varies among the North Atlantic subpopulations, most cod in the eastern and western parts of this ocean spawn from December to June, i.e., Norwegian coast, from February to April; Baltic Sea, April to July; North Sea, December to May; Gulf of Maine, November to April; Newfoundland, April to June; West Greenland, March to June; and southwestern Gulf of St. Lawrence, May to September. Usually the cod spawn at or near the bottom. There is some evidence that cod leave the bottom and school pelagically to spawn in preferred temperatures when bottom temperatures are unsuitable.

The maximum range of temperature for spawning is from below 0°C to about 12ºC, with most spawning taking place over the lower half of this range. The Gulf of Maine stock spawns in colder waters than the other stocks. The distribution of spawning stocks widely depends on the oxygen content of the bottom water but on the whole, cod are rather local in their choice of spawning grounds in the Gulf of Maine as well as in Norwegian waters.

The major spawning area in the eastern Atlantic is the North Sea, generally at depths of less than 50 m and never beyond 200 m, especially in the Bornholm basin (Denmark) where the egg density appears to be rather high (late April, end of May). The most productive spawning ground in the western Atlantic is the eastern half of Georges Bank and the area south of the Grand Banks (Newfoundland). The second largest ground is the southwestern part of the Gulf of Maine, between Nantucket Shoals and Bay of Fundy. The Atlantic cod spawns once a year.

The growth rate is rather high, the females growing slightly faster than the males. It also varies from one area to another: for example, it is known that fish from the English Channel and the North Sea grow faster than those living at higher latitudes. Three-year-old fish average 56 cm (males) and 59 cm (females); 5-year olds, 81 cm (males) and 85 cm (females). The species lives up to 20 years.

The Atlantic cod is a voracious and omnivorous species. Larvae and postlarvae feed on plankton, juveniles mainly on invertebrates, and older fish on invertebrates and fish, including young cod. Small crustaceans are of oustanding importance (90%) in the food of juveniles (up to 25 cm length). They are progressively replaced by decapods of medium and large size. Fish become more important than crustaceans in the diet of older individuals. Other systematic groups play a smaller role as forage organisms: polychaetes (less than 10%); echinoderms and other benthic organisms (minor quantities); and occasionally seaweeds (Irish moss - ***Chondrus crispus***) and others. While the proportion of benthic organisms shows hardly any change throughout the year, fish consumption varies seasonally. Deep-water cod show preference for herring throughout the summer and autumn (peak June-July), but in winter and during the spawning period, they sustain themselves on mixed food in coastal areas. Feeding occurs at dawn and dusk, but small fish (of less than 20 cm) feed continuously**.**

Size : The various races reach different sizes, the oceanic cod often reaches 1 m and is known to attain a length of 2 m. Local races have smaller fish.

Interest to Fisheries : Among the most important of all commercial fishes, cod has been called "beef of the sea". The Atlantic cod has been exploited ever since man began to fish in the seas of Europe. Its value as a prime food-fish is enormous, and when salted and dried, it keeps for winter-time use or export**.**

This species accounts for nearly 30% of the world's total groundfish catch. Although landings in 1983 reached their lowest level in the eastern Atlantic, the stock is recovering and catches are again increasing.

The world catch reported for 1987 in the FAO Yearbook of Fishery Statistics totalled 2 054 721 metric tons. Of this total, 1 471 933 metric tons were taken in the northeastern Atlantic (Fishing Area 27), mainly by Iceland (ca 390 000 t), Norway (ca. 300 000 t), USSR (ca. 244 000 t), Denmark (ca. 150 000 t), UK (ca. 112 000 t) and others; and 582 788 metric tons in the northwestern Atlantic (Fishing Area 21), mainly by Canada (ca. 455 000 t), Spain (ca. 31 000 t), France (ca. 30 000 t) , USA (ca. 27 000 t) , Portugal (ca. 20 530 t) and others.

The Atlantic cod is caught mainly with bottom otter trawls and pelagic trawls. Devices such as handlines and cod traps are being recently replaced by gillnets (especially in Newfoundland). Other types of gear used are longlines, Danish seines, purse seines, twin beam trawls, light trawls, shrimp trawls and pound nets.

The Atlantic cod is fished throughout the year in the Gulf of Maine, large catches are made on rock and pebble grounds but also on soft bottoms. The major fishing grounds are boreo-arctic, mostly around Iceland, in the Barents Sea, off Newfoundland and West Greenland, in the Norwegian Sea, off Spitzbergen, and around Bear Island.

It is marketed fresh, chilled or frozen as fillets or whole, salted or sugar-salted, dried and salted, dried and unsalted, in brine, or smoked. Other products obtained from cod are salted cheeks, Liver oil and eggs (smoked or as frozen roes).

Local Names : CANADA: Cod; DENMARK : Torsk; FRANCE: Morue; GERMANY: Dorsch, Kabeljau; NETHERLANDS: Kabel-jauw; NORWAY : Skrei, Torsk; SCANDINAVIA: Torsk; UK, USA: Cod; USSR: Treska.

Literature : Svetovidov (1948); Bigelow & Schroeder (1953); Andriashev (1954); Wise (1961, 1963); Harden Jones (1968).

Remarks : ***G. morhua*** includes a number of races that are characterized by size, colour, swimbladder morphology, temperature and/or salinity preferences, migratory behaviour and geographical distribution. Taxonomically named populations include ***G. morhua callarias,*** a low salinity, non-migratory race restricted to parts of the Baltic, ***G. morhua kildinensis,*** restricted to a small lake on an island near the entrance to Kola Bay, and ***G. morhua morhua*** natio ***hiemalis,*** a race that migrates in and out Kandalaksha Bay.

Gadus ogac Richardson, 1836 **Fig. 89**

GADI Gadu 3

Scientific Name with Reference : ***Gadus ogac*** Richardson, 1836, Fauna Boreal.Americana, 3:246.

Synonyms : ***Gadus ovak*** Reinhardt, 1838; ***Gadus ogat*** Kröyer, 1847; ***Gadus callarius maris-albi*** Derjugin, 1920; ***Gadus morhua maris-albi*** Berg, 1933; ***Gadus morhua ogac,*** Svetovidov, 1948.

FAO Names : **En -** Greenland cod; **Fr -** Morue ogac; **Sp** - Bacalao de Groenlandia.

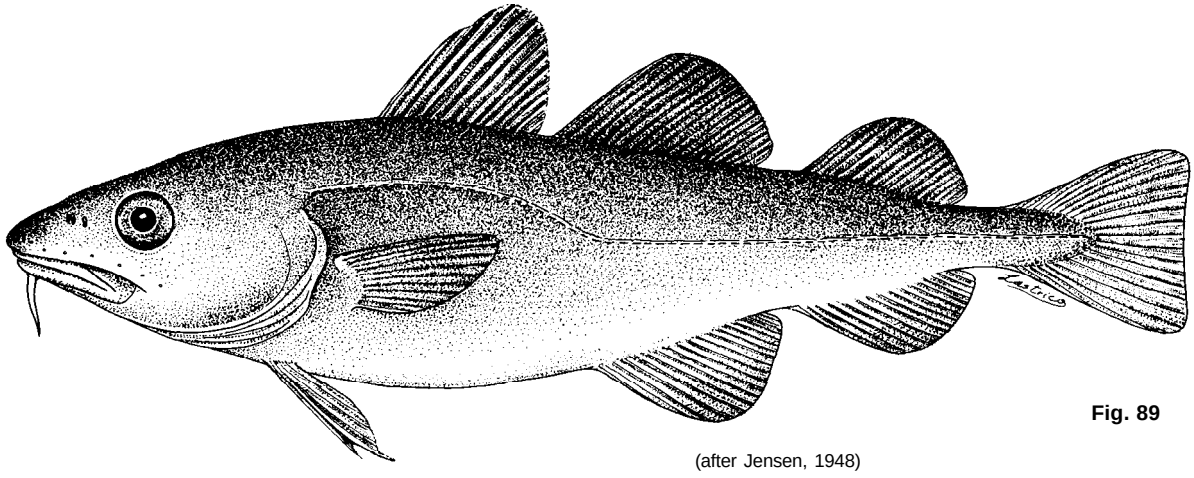


Fig. 89

(after Jensen, 1948)

Diagnostic Features : Head relatively broad, interorbital space 18-25% of head length; Predorsal distance less than about 33% of length. **Colour:** generally dark shading to paler ventrally, indistinct spots dorsally and on sides. Peritoneum dark.

Geographical Distribution : Port Barrow, Alaska to West Greenland; south along Canadian coast to the Miramichi, Gulf of St. Lawrence and Cape Breton Island; a disjunct population in the White Sea (Fig. 90).

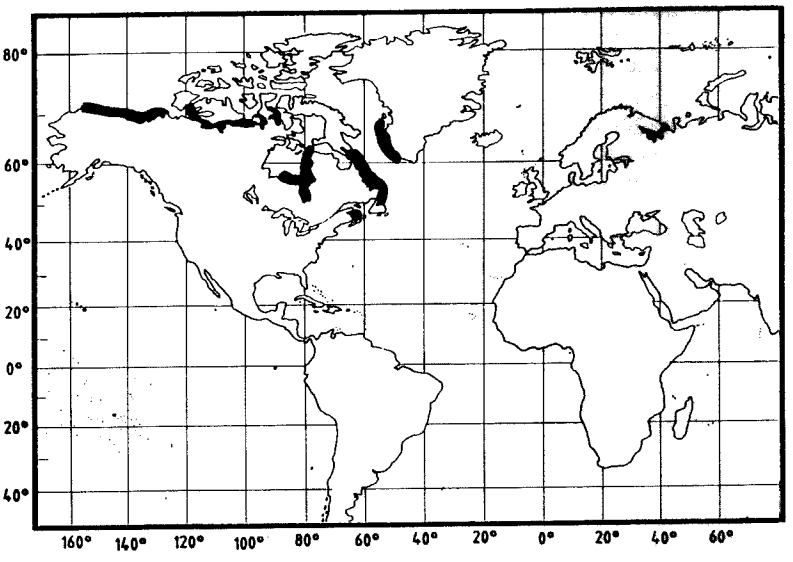


Fig. 90

Habitat and Biology : Usually lives close to the coast, from 0 to 200 m depth, and is rarely found offshore, in deeper water. It tolerates low salinities, but there is no evidence that it enters fresh-waters. It matures at 3 to 4 years of age and spawns in shallow waters frorn February to May. The eggs sink to the bottom after spawning. Fish aged 5 to 6 years attain lengths of about 50 cm; seldom lives beyond 9 years and rarely exceeds 60 cm total length. In Greenland waters, the maximum age is about 11 years. The food of the Greenland cod is very similar to that of the Atlantic cod, and includes capelin, small flounders, polar cod, shrimps, crabs, euphausiids, squids, polychaetes, and echinoderms.

Size : Reaches about 70 cm; somewhat smaller in the White Sea.

Interest to Fisheries : Presently only of small, local importance. The catch reported for 1987 in the FAO Yearbook of Fisheries Statistics is 4 017 metric tons. It used to be rather abundant in coastal waters of Greenland, but the stock has been strongly reduced in recent years. There is probably competition between this species and the Atlantic cod.

Local Names : CANADA: Greenland cod, Ogac; GERMANY : Fjord-dorsch, Grönland-dorsch.

Literature : Svetovidov (1948); Andriashev (1954); Backus (1957); Leim & Scott (1966).

Remarks : According to Svetovidov (1948), ***ogac*** is similar to ***Gadus marisalbi*** and Walters (1955) believes they are the same species. Although ***ogac*** and Atlantic cod ***(G. morhua)*** have different habitat preferences, they are sometimes found together and are able to maintain their separate identities.

Gaidropsarus

GADI Gaidr

Genus with Reference : Gaidropsarus Rafinesque, 1810, Indice Ittiol.Sicil.:11,51

Diagnostic Features : Barbel present on chin, and one barbel at each anterior nostril on the snout. First dorsal ray followed by a row of small, fleshy filaments; anal fin one, not indented. Lateral line interrupted along its entire length.

Habitat, Distribution and Biology as applicable : Bottom-living fishes found from the intertidal to the deep sea, mostly around the rim of the North Atlantic but recorded also from Japan, New Zealand, Kerguelen and South Africa. Larvae and juveniles known so far are silvery-sided pelagic fishes.

Interest to Fisheries : A few species are of small to minor interest, and appear as bycatch in trawl and longline fisheries.

Remarks : Additional taxonomrc study is required to evaluate the minor differences between many of the described species, which have at one time or another been included in at least half a dozen nominal genera; hence, a key and a complete list of species are not feasible at present. Thirteen names are listed below on the basis of Svetovidov (1986), and accounts are presented for the 4 species known to be occasionally landed by fishing boats.

Tentative List of Species :

Gaidropsarus argentatus (Reinhardt, 1837) - North Atlantic, deep sea
Gaidropsarus biscayensis (Collett, 1890)- Northeast Atlantic including Mediterranean
Gaidropsarus capensis (Kaup, 1858) -South Africa
Gaidropsarus ensis (Reinhardt, 1837) - Northwest Atlantic, deep sea
Gaidropsarus granti (Regan, 1903) - Canary and Azore Islands
Gaidropsarus guttatus (Collett, 1890) - Madeira and Azore Islands
Gaidropsarus insularum Silvertsen, 1945 - South Africa, Tristan da Cunha, St. Paul, Amsterdam, and Gough Islands
Gaidropsarus macropththalmus (Günther, 1867) - Northeast Atlantic
Gaidropsarus mediterraneus (Linnaeus, 1758) - Northeast Atlantic including Mediterranean
Gaidropsarus novaezelandiae (Hector, 1873) - New Zealand, Tasmania
Gaidropsarus pacificus (Temminck & Schlegel, 1842) - Japan
Gaidropsarus parini Svetovidov, 1986 -Southeast Pacific and possibly South Atlantic
Gaidropsarus vulgaris (Yarrell, 1836) - Northeast Atlantic including Mediterranean

Gaidropsarus biscayensis (Collett, 1890)

Fig. 91

GADI Gaidr 3

Scientific Name with Reference : ***Onus biscayensis*** Collett, 1890, Bull.Soc.Zool.France, 15: 107

Synonyms : ***Motella megalokynodon*** Kolombatovic, 1894:32; ***Gaidropsarus barbatus*** de Buen, 1934:502; ***Antonogadus megalokynodon,*** Wheeler in Svetovidov, 1973.

FAO Names : **En -** Mediterranean bigeye rockling; **Fr -** Motelle; **Sp -** Barbada.

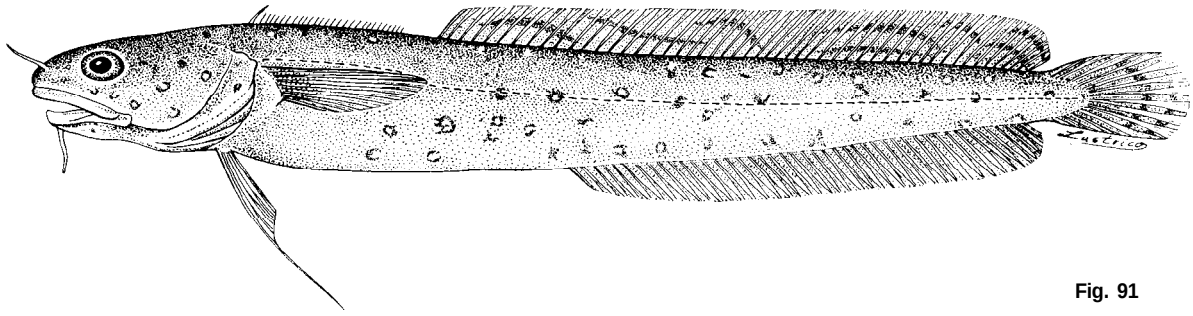


Fig. 91

Diagnostic Features : Two fang-like teeth at symphysis of upper jaw. First dorsal fin ray shorter than eye diameter; pectoral fin rays 17 to 19. **Colour**: brownish with dark brown sports; sides reddish, belly pink.

Geographical Distribution : Western Mediterranean and northern part of central Mediterranean; in the eastern central Atlantic, from Spain and Portugal to Morocco, and on Madeira Islands (Fig. 92).

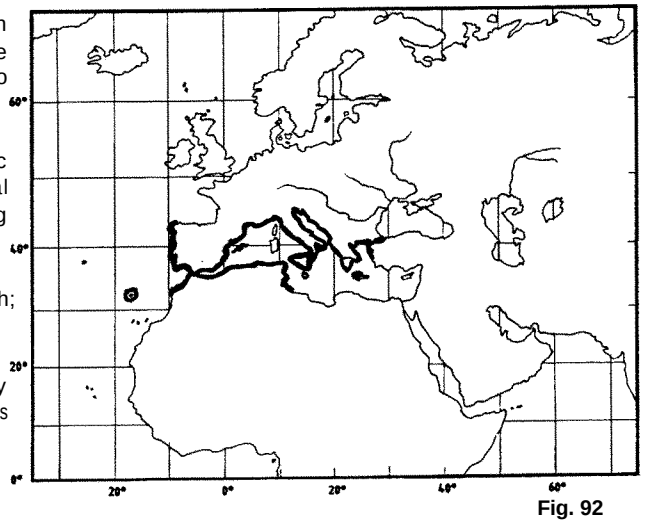


Fig. 92

Habitat and Biology : A demersal and bathypelagic species found in offshore waters on mud, shell and coral bottoms, at depths between 80 and 600 m. Spawning occurs in February. Feeds on crustaceans.

Size : Reaches exceptionally to about 40 cm total length; common size 8 to 15 cm.

Interest to Fisheries : Of minor importance, especially in view of its small size. No statistics are reported for this species. Taken as bycatchwith bottom trawls; also on line gear. Occasionally present in markets in the Mediterranean.

Gaidropsarus macrophthalmus (Günther, 1867)

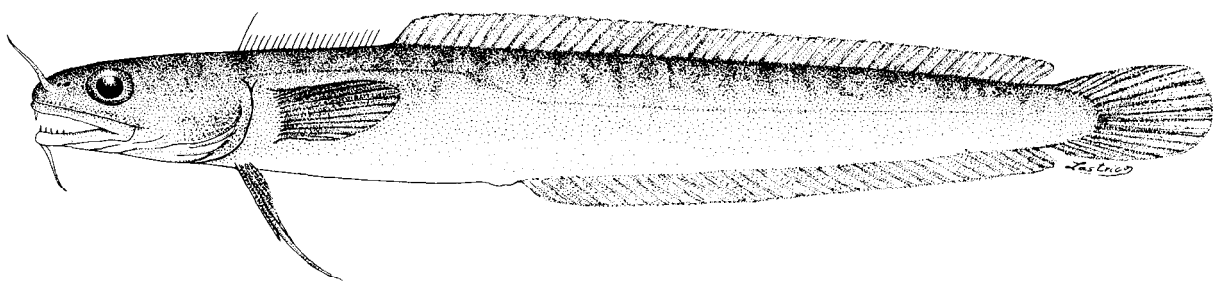
Fig. 93

GADI Gaidr 4

Scientific Name with Reference : ***Motella macrophthalmus*** Günther, 1867, Ann.Mag.nat.Hist., (3)20:290.

Synonyms : ***Onus macrophthalmus,*** Günther, 1887; ***Onus carpenteri*** Günther, 1887; ***Antonogadus macrophthalmus,*** Wheeler, 1969, 1978.

FAO Names : **En** - Bigeye rockling.



(after Bini, 1969)

Fig. 93

Diagnostic Features : Eye large, more than half the snout length. Several large canine teeth at front of upper jaw.

Geographical Distribution : Bay of Biscay and northwards along the west coast of the British Isles to the Faeroe Islands (Fig. 94).

Habitat and Biology : Benthic at depths from 150 to 530 m.

Size : Reaches possibly 25 cm total length.

Interest to Fisheries : Very minor; taken occasionally as bycatch in bottom trawls.

Literature : Bini (1969); Svetovidov (1986).

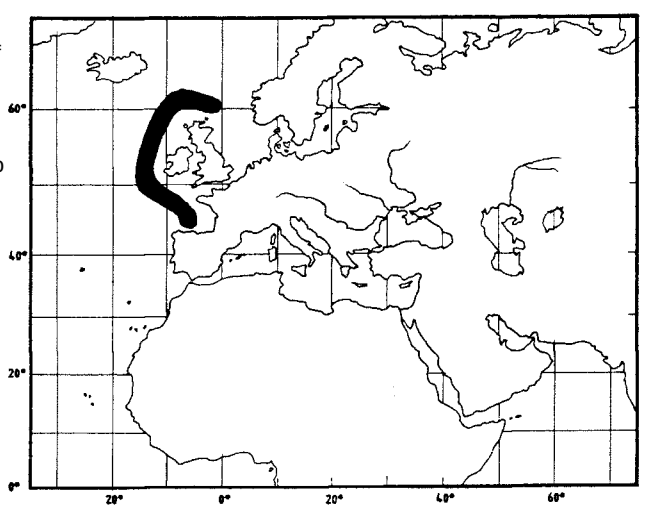


Fig. 94

Gaidropsarus mediterraneus (Linnaeus, 1758)

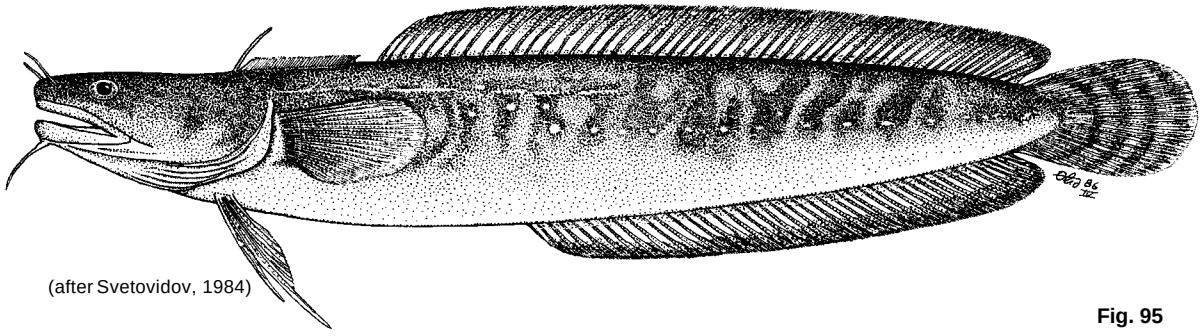
Fig. 95

GADI Gaidr 1

Scientific Name with Reference : ***Gadus mediterraneus*** Linnaeus, 1758 Syst.Nat., ed. 10:255.

Synonyms : ***Gadus tricirratus*** Brünnich,1768; ***Enchelyopus mediterraneus,*** Bloch & Schneider, 1801; ***Gaidropsarus mustellaris*** Rafinesque, 1810; ***Gadus fuscus*** Risso, 1810; ***Gadus jubatus*** Pallas, 1811; ***Gadus argenteolus*** Montagu, 1818; ***Onos mustella,*** Risso, 1826; ***Onos fusca,*** Risso, 1826; ***Mustela fusca,*** Cuvier, 1829; ***Merlangus communis*** Costa, 1844; ***Motella communis,*** Canestrini, 1863; ***Motella fusca,*** Moreau, 1881; ***Motella mediterranea,*** Lütken, 1882; ***Onos mediterraneus,*** Collett, 1892; ***Gaidropsarus mediterraneus,*** de Buen, 1934; ***Onos sellai*** Cipria, 1939.

FAO Names : **En -** Shore rockling; **Fr -** Motelle de Méditerranée; **Sp -** Bertorella.



(after Svetovidov, 1984)

Fig. 95

Diagnostic Features : First dorsal ray short, equal to or shorter than snout. Pectoral fin rays 15 to 18. No greatly enlarged teeth. **Colour** : variable; dorsally brown, sometimes reddish and with a vermiculated or mottled pattern. Paler ventrally, median fin borders dark.

Geographical Distribution : From southern Norway, around the western shores of the British Isles to the southwest and south coasts of Europe, into the Black Sea, and on the northwest African coast (Fig. 96).

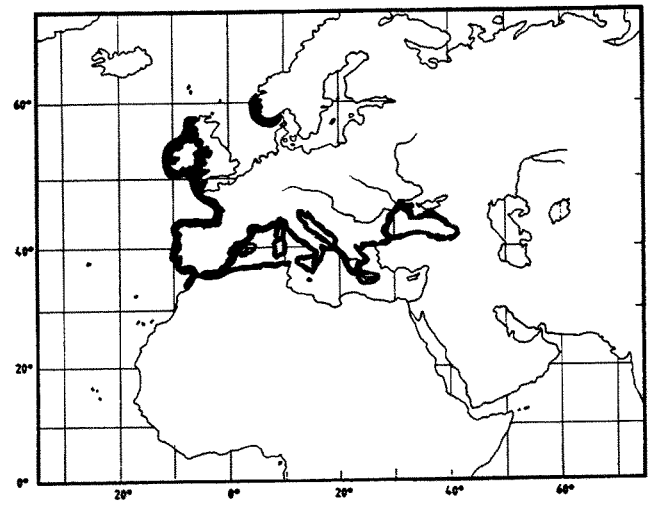


Fig. 96

Habitat and Biology : Lives generally at shallow depths near the shores on rocky bottom with aquatic vegetation to about 60 m depth. Also found at greater depths (200 to 450 m) on the north African coast Spawns from September to March in the Mediterranean and Black Sea and from April to September in the northeastern Atlantic. Eggs and larvae are pelagic. It grows fast: at 1 year, 10 cm; at 3 years, 20 cm; at 6 years, 30 cm. Feeds on fish, crustaceans, worms and algae.

Size : Reaches to 50 cm total length.

Interest to Fisheries : No statistics are reported for this species. Taken as bycatch in small-scale and artisanal fisheries using trawls, gill nets, longlines, traps and handlines. Marketed fresh, but mostly as fish meal.

Local Names : ALBANIA: Motele me mustaqe; BULGARIA: Galja; FRANCE: Motelle à trois barbillons; GREECE: Gaidouropsaro; ITALY: Motella mediterranea; PORTUGAL : Laibeque; ROMANIA: Galea; SPAIN: Bertorella; TURKEY: Gelincik; UK: Shore rockling; USSR: Morskoy nalim, Sredizemnomorskiy trekhusiy nalim.

Literature : Svetovidov (1948, 1986) [Black Sea Fishes]; Bini (1969); Fischer, Bauchot & Schneider (1987)

Gaidropsarus vulgaris (Cloquet, 1824)

Fig. 97

GADI Gaidr 2

Scientific Name with Reference : ***Mustela vulgaris*** Cloquet, 1824, Dict.Sci.Nat., 33:456

Synonyms : ***Gadus tricirratus*** Bloch ,178s; ***?Onos maculata*** Risso, 1826:214; ***Motella tricirrata***, Nilsson, 1832; ***Motella vulgaris***. Yarrell, 1836; ***Onos vulgaris***, Collett, 1890; ***Onos tricirratus***, Smitt, 1893; ***Gaidropsarus tricirratus***, de Buen, 1934; ***Gaidropsarus vulgaris,*** Svetovidov, 1948.

FAO Names : **En -** Three-bearded rockling; **Fr** - Motelle commune; **Sp** - Lota.