

2.4 Key to Species and Subspecies of Genus *Merluccius* (the figures in brackets indicate modal values)

- A.** Scales on nasal membrane and lower part of cheek. Posterior edge (*postrostrum*) of sagitta, generally blunt. **Euro-African forms** characteristic of the eastern *Atlantic, Mediterranean, Red Sea and southwestern Indian Ocean* → **1**

- 1a.** Dark patch/mark, more or less widespread or very obvious in the submandibular fold. Scales on lower part of preopercular or interopercular → **2**
- 1b.** No dark patch on the submandibular fold. No scales on lower part of interopercular → **4**

- 2a.** Scales on lacrimal → **3**
- 2b.** No scales on lacrimal. First branchial arch with a total of 12 (15) 21 gillrakers. Oral cavity and tongue blackish ***Merluccius senegalensis***
(Eastern Atlantic: Morocco, Mauritania, Senegal)

- 3a.** First branchial arch with a total of 8 (10) 12 gillrakers. Buccal cavity and tongue blackish. Posterior edge of caudal fin with a whitish stripe ***Merluccius polli***
(Eastern Atlantic: Mauritania, Senegal, Angola, Namibia)
- 3b.** First branchial arch with a total of 17 (19 or 20) 23 gillrakers. Buccal cavity and tongue greyish. Posterior edge of caudal fin of a uniform colour, no whitish stripe ***Merluccius paradoxus***
(Eastern Atlantic: Namibia and western Indian Ocean: Madagascar)

- 4a.** Scales on lacrimal. Scales on lower part of preopercular. First branchial arch with a total of 8 (10) 12 gillrakers ***Merluccius merluccius***
(Eastern Atlantic: European coast, Morocco, Mediterranean, Red Sea)
- 4b.** No scales on lacrimal. No scales on lower part of preopercular. First branchial arch with a total of 15 (19 or 20) 20 gillrakers ***Merluccius capensis***
(Eastern Atlantic: from the south of Angola to Natal Province in the Indian Ocean)

- B.** No scales on the nasal membrane except some *Merluccius albidus* specimens where scales are present on the anterior part of the nasal membrane. No scales on lacrimal. No dark patch on the submandibular fold. Posterior edge (*postrostrum*) of sagitta, generally pointed. **American forms** characteristic of the eastern Atlantic, eastern and western Pacific → **1**

- 1a.** Scales on lower part of cheek and preopercular → **2**
- 1b.** No scales on lower part of cheek, preopercular or interopercular → **5**

- 2a.** Scales on lower part of interopercular. First branchial arch with a total of 8 (10) 11 gillrakers. Scales on body large, with 104 to 119 oblique series along the lateral line ***Merluccius albidus***
(Western Atlantic: United States, Mexico, Venezuela, Guyana)
- 2b.** No scales on lower part of interopercular. First branchial arch generally with 12 or more gillrakers. Scales on body rather small, with more than 120 oblique series along the lateral line → **3**

- 3a.** Upper edge of opercular parallel to the lateral line. Oblique series of 133 to 144 scales along the lateral line. First branchial arch with a total of 12 (13-14) 15 gillrakers. Silvery grey colour with golden shine on back, silvery white on the belly ***Merluccius hubbsi***
(Western Atlantic: Brazil, Uruguay, Argentina)
- 3b.** Upper edge of opercular diverging down from origin and away from lateral line. Oblique series of 123 to 186 scales along lateral line → **4**

- 4a. Body robust. Upper cephalic profile straight, without any depression. Lateral line clearly separated from the dorsal profile. Eyes relatively small. Second dorsal fin with 39 (42 or 43) 45 rays. Anal fin with 40 (42 to 44) 46 rays. Oblique series of 144 to 186 scales along lateral line. First branchial arch with a total of 11 (13) 15 gillrakers. Gillrakers and their base with small melanophores ***Merluccius australis***
(Japan, New Zealand, coasts of southern Chile and Argentina)
- 4b. Body slender. Upper cephalic profile with a depression before the eyes. Lateral line near the dorsal profile. Eyes large. Second dorsal fin with 37 (38) 38 rays. Anal fin with 37 (39) 39 rays. Oblique series of 123 to 126 scales along lateral line. First branchial arch with a total of 14 (14) 17 gillrakers. No melanophores on gillrakers or their base ***Merluccius patagonicus***
(Southwestern Atlantic: Argentina)
- 5a. Small melanophores on gillrakers and their base → 6
- 5b. No melanophores on gillrakers or their base → 7
- 6a. Head short, between 3.4 and 4.0 times in standard length. Silvery grey colour on upper half, white on lower half. First branchial arch with a total of 15 (17 or 18) 22 gillrakers ***Merluccius bilinearis***
(Western Atlantic: Canada and United States)
- 6b. Head long, between 2.9 and 3.8 times in standard length. Brownish blue on upper half, lower half with a yellow horizontal line. First branchial arch with a total of 17 (20 or 21) 25 gillrakers ***Merluccius gayi***
(Eastern Pacific: Chile and Peru)
- 7a. Head long, between 2.9 and 3.3 times in standard length. Scales on body rather long, with 121 to 134 oblique series of scales. First branchial arch with a total of 13 (16 or 17) 18 gillrakers ***Merluccius angustimanus***
(Eastern Pacific: from Colombia to the Gulf of California)
- 7b. Head short, between 3.4 and 4.0 times in standard length. Scales on body small, with 144 to 166 oblique series. First branchial arch with a total of 18 (22) 23 gillrakers ***Merluccius productus***
(Eastern Pacific: from Canada to southern Mexico)

<i>Merluccius</i> Rafinesque, 1810

Caratt. Gen. Spec. Sicil.: 25 (type: ***Merluccius smiridus*** Rafinesque, 1810, by monotypy).

Onus Rafinesque, 1810, *Ind. Ittiol. Sicil.*: 12 (type species: ***Onus riali*** Rafinesque, 1810; substitute for *Merluccius*).
Merlangus Rafinesque, 1810, *ibid.*: 67 (type species: *Gadus merluccius* Linnaeus, 1758, substitute for *Onus*).
Stomodon Mitchill, 1814, *Trans. Lit. Phil. Soc.*, 1: 7 (type species: *Stomodon bilinearis* Mitchill, 1814, by monotypy).
Hydronus Minding, 1832, *Naturg. Fische*: 83 (type species: *Hydronus marlucius* Minding, 1832, by monotypy). ***Merlus*** Guichenot, 1848, in Gay. *Hist. Física polit. Chile, Zool.*, 2: 328 (type species: *Merlus gayi* Guichenot, 1848, by monotypy). ***Polydatus*** Gistel, 1848, *Naturg. Thierreichs*: 105 (type species: *Polydatus lucius* Gistel, 1848 (= *Gadus merluccius* Linnaeus, 1758, by monotypy)). ***Merlucius*** Gronow, 1854, ed. Gray, *Cat. Fish.*: 129 (type species: *Merlucius lanatus* Gronow, 1854, by monotypy). ***Homalopomus*** Girard, 1856, *Proc. Acad. Nat. Sci. Philad.*: 132 (type species: *Homalopomus trowbridgii* Girard, 1856, by monotypy). ***Epicopus*** Günther, 1860, *Cat. Fish. Brit. Mus.*, 2: 232, 248 (type species: *Merlus gayi* Guichenot, 1848, substitute for *Merlus*). ***Trachinoides*** Borodin, 1934, *Bull. Vanderbilt mar. Mus.*, 1(4): 120 (type species: *Trachinoides maroccanus* Borodin, 1934, by monotypy). ***Huttonichthys*** Whitley, 1937, *Mem. Queensland Mus.*, 11(2): 122 (type species: *Gadus australis* Hutton, 1872, by monotypy).

Etymology: From the generic name ***Merlucci(us)*** + *idae*, from the Latin *maris lucius*: given by Belon (1553) (*De aquatibus*, p.121), which means "Sea pike".

Diagnostic Features: Same as for the subfamily.

Merluccius albidus (Mitchill, 1818)**Fig. 18**

Gadus albidus Mitchill, 1818, *J. Acad. Nat. Sci. Philad.*, 1: 409 (type locality: New York).

Synonyms: *Merluccius vulgaris* (non Fleming, 1828) Günther, 1862, *Catalogue of the fishes in the British Museum*, 4: 344. *Merluccius bilinearis* (non Mitchill, 1814): Norman, 1937, *Discovery Rep. Cambridge*, 16: 47. *Merluccius magnoculus* Ginsburg, 1954, *U.S. Fish Wildl. Serv., Fish. Bull.*, 96(56): 194 (Pensacola, Florida, depth 334 m).

FAO Names: En – Offshore silver hake; Fr – Merlu argenté du large; Sp – Merluza blanca de altura.

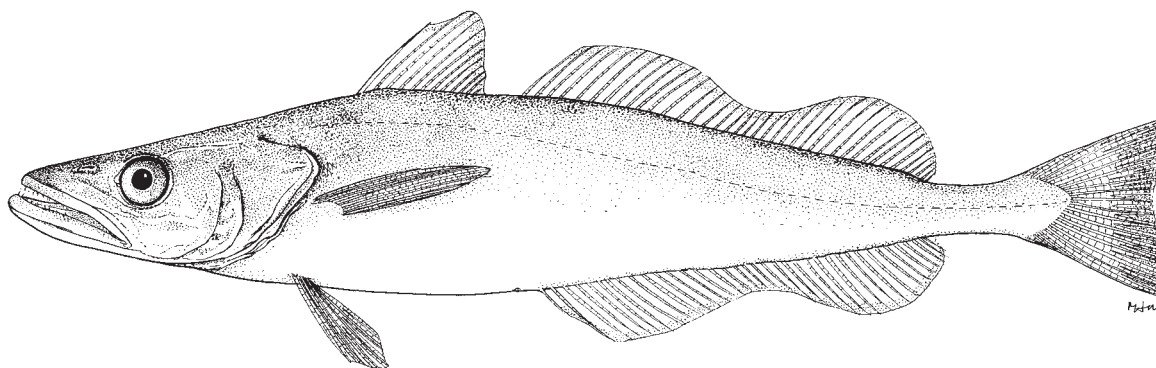


Fig. 18 *Merluccius albidus*

Diagnostic Features: Scales on the lateral line 104 to 119. Head 26.8 to 31.7% of standard length and snout 31.0 to 37.2% of head length. No scales on nasal membranes in most specimens; no scales on lacrimal; scales on lower part of cheek, preopercular and interopercular. Eye diameter 17.1 to 27.7%, interorbital space 20.8 to 26.5% of head length. Lower jaw slightly protruding; strong and conspicuous teeth on premaxillaries and mandibles; lower jaw slightly or not protruding. First branchial arch with 8 (10) 11 gillrakers: 1 to 3 on the upper limb and 7 to 9 on the lower limb. 1D 11 (11-12) 13 rays; 2D 35 (38-39) 40 rays. A 35 (39-40) 41 rays. Pectoral fins with 12 (13-15) 16 rays, their length 16.9 to 22.3% of standard length, posterior end reaching the level of anal-fin origin. Ventral fins 13.8 to 20.6% of standard length. Posterior margin of caudal fin, truncate in young individuals and slightly concave in adults. A total of 51 to 55 vertebrae, 5 or 6 of them being cervical with 3 or 4 ribs. **Colour:** preserved specimens present a pale yellow, uniform colouring.

Additional Information: Ginsburg (1954) accepted the validity of *M. albidus*, even though it was considered by other authors as a synonym of *M. bilinearis*, and described a new species, *M. magnoculus* from Pensacola (Florida). Karnella (1972) and Inada (1981) relegate *M. magnoculus* to the synonymy of *M. albidus*. Results of our analyses confirm differences which exist between *M. albidus* and *M. bilinearis*, found on the Atlantic coast of the United States. They are easily distinguishable by their differing number of gillrakers (8 to 13 on the first arch to 15 to 22 on the second), and because *M. albidus* possesses scales on the lower part of the cheek, preopercular, and interopercular. If, however, *M. magnoculus* is considered a synonym of *M. albidus*, we would find this species to have an inexplicable varying number of vertebrae, fin rays, and gillrakers. From our point of view, this shows the possible existence of a subspecies. Ginsburg (1954) himself points out that some *M. albidus* specimens possess a horizontal strip of scales on each side of the snout (supposedly referring to the lacrimal), while in our specimens they are lacking. Arai (1983) mentions *M. albidus* specimens in Suriname with a different number of cervical ribs than stated by Inada (1981b). In this study, specimens from the Gulf of Mexico have been observed as having few scales on the front part of the nasal membrane, whereas normally none are found in *M. albidus* specimens. All this as well as the differences in spawning periods makes the existence of a trinomen, *Merluccius albidus magnoculus* Ginsburg, 1954, plausible, and which we therefore propose for the hake population of the Gulf of Mexico.

Geographical Distribution: Western Atlantic: East coast of the United States from 40°N (Georges Bank, Long Island, Virginia, Florida), the Gulf of Mexico, and the Caribbean Sea to Suriname and French Guiana (5°N). *M. albidus* shares part of its geographical distribution (from Georges Bank to the coast of Virginia and perhaps to Florida) with *M. bilinearis* (Mitchill, 1814) (Fig. 19).

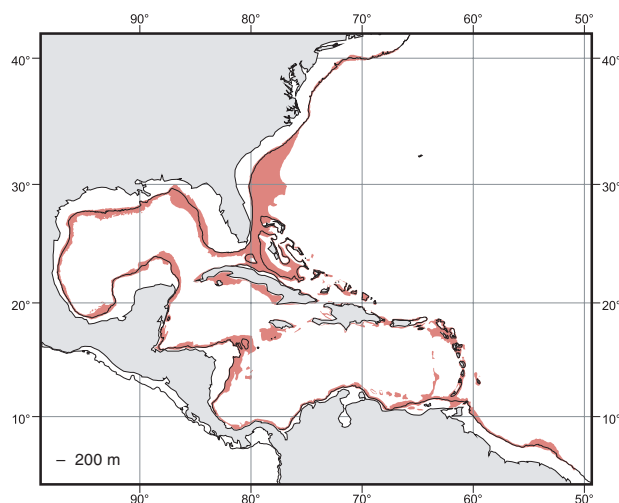


Fig. 19 *Merluccius albidus*
■ Known distribution

Habitat and Biology: Offshore silver hake inhabit soft grounds between 92 and 1 170 m, but they are more commonly found between 160 and 640 m. Since catches are similar during night and day, it is considered that this species does not perform vertical circadian migrations. Depth segregation takes place from 550 m by size and sex, where only large females are caught. Juveniles feed primarily on crustaceans; as they become adults they prey on *Steindachneria argentea*, Myctophidae, Stomiatoidei, Macrouridae, Trichiuridae, and juveniles of their own species. Lifespan is unknown, though it is thought that males rarely exceed 3 years of age; many females live at least 5 years. Spawning occurs near the bottom in depths between 330 m and 550 m from April to July in New England and from late spring to early autumn in the Gulf of Mexico and the Caribbean Sea. Fecundity is estimated at 340 000 eggs for a 68 cm standard length female.

Size: The largest recorded male and female measured 40 and 70 cm, respectively; common to 30 cm (males) and 45 cm (females).

Interest to Fisheries: Offshore silver hake (*Merluccius albidus*) are caught locally by fishing fleets from the United States and Cuba in the Gulf of Mexico. There are no fisheries targeting this species in the North Atlantic, however, they are caught in the bycatch of the silver hake (*Merluccius bilinearis*). No catches of this species reported to FAO.

Local Names: FRANCE: Merlu, Merlu argenté du large, Merlu blanc, Merlu du large; FRENCH GUIANA: Merlu; GERMANY: Seehecht; JAPAN: Ofushoa-heiku; MEXICO: Merluza; NICARAGUA: Merluza blanca; PORTUGAL: Pescada prateada do alto; SPAIN: Merluza, Merluza blanca, Merluza blanca de altura, Merluza norteamericana meridional; UNITED KINGDOM: Offshore hake, Offshore whiting; UNITED STATES: Offshore hake, Offshore silver hake, Offshore whiting; VENEZUELA: Merluza.

Literature: DeKay (1842); Günther (1862); Miranda Ribeiro (1903 and 1915); Ginsburg (1954); Karnella (1972); Inada (1981b); Arai *in* Uyeno *et al.* (1983); Inada *in* Cohen *et al.* (1990).

Merluccius angustimanus Garman, 1899

Fig. 20

Merluccius angustimanus Garman, 1899, *Mem. Mus. Com. Zool.*, 24: 183 (type locality: Gulf of Panama).

Synonyms: *Merluccius gayi* (*non* Guichenot, 1848) Norman, 1937, *Discovery Rep.*, 14: 48. *Merluccius angusticeps*: Hildebrand, 1946, *Bull. U.S. natn. Mus.*, 189: 159 (Peru). *Merluccius hernandezi* Mathews, 1985, *J. Nat. Hist.*, 19: 697-718 (Gulf of California).

FAO Names: En – Panama hake; Fr – Merlu du Panama; Sp – Merluza panameña.

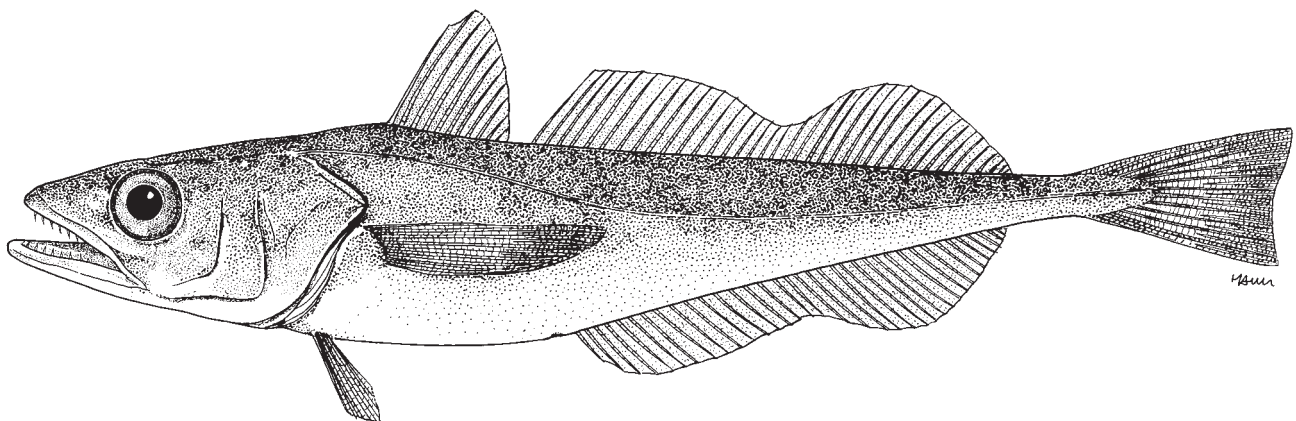


Fig. 20 *Merluccius angustimanus*

Diagnostic Features: Scales along the lateral line 121 to 134. Head rather large, 30.1 to 33.5% of standard length. Snout 27.8 to 34.2% of head length. No scales on nasal membrane, lacrimal, lower part of cheek, preopercular, and interopercular. Eye diameter 19.7 to 24.6% and interorbital width 25.4 to 29.4% of head length. Lower jaw slightly protruding. Gillrakers on first branchial arch 13 (16-17) 18, 2 to 5 on the upper limb and 11 to 14 on the lower. 1D 10 (12) 13 rays; 2D 36 (37) 40 rays; A 36 (38) 40 rays. Pectoral fins with 14 (16-17) 17 rays, 20.3 to 24.2% of standard length, always extending far beyond the origin of anal fin. Ventral fin 11.0 to 15.8% of standard length. Caudal-fin margin truncate in juveniles and slightly concave in adults. Total number of vertebrae 49 to 52, 3 of which are cervical with 3 ribs.

Colour: on small, preserved specimens, light grey with pale ventral region; large specimens brownish black.

Additional Information: To our mind, there are two problems with *M. angustimanus* which have not yet been resolved. First, its geographical distribution, and second, the validity of *M. hernandezii* Matthews, 1985.

As far as its geographical distribution is concerned, although Vrooman and Paloma (1977) as well as Ermakov (1983) remind us that Ahlstrom and Counts (1955) only found *M. productus* eggs and larvae and none belonging to *M. angustimanus* in California and Baja California, its presence is accepted in these latitudes. One of the specimens studied (CAS 117879), originating from the Gulf of California (Turtle Island: 27°4'N–112°W), has all the characteristics of *M. angustimanus*. After studying geographic and bathymetric distributions of other *Merluccius* species, 2 or 3 species can be observed along all the ocean coast where they are normally found. This happens along the African Atlantic coast with *M. merluccius* and *M. senegalensis*, and with the latter and *M. polli*; and also *M. capensis* and *M. paradoxus*. This also happens along the American Atlantic coast with *M. bilinearis* and *M. albidus*, and *M. hubbsi*, *M. patagonicus* and *M. australis polylepis*. In all the examples mentioned, they usually occur in different depth ranges with a certain degree of overlap. *M. productus* is distributed in the eastern Pacific from Canada, the United States, and the Mexican coast, occurring deeper and separating from the coast as its distribution extends southwards to the Gulf of Teuantepec (16°N). *M. angustimanus* is distributed from Colombia, Panama, and Mexico to the Gulf of California, in deep to coastal waters. Although the two species are quite easily distinguishable, they have been mistakenly identified with another, owing to the fact that they share a broad distribution. *M. angustimanus* possesses fewer gillrakers (13 (16-17) 18) than *M. productus* (18 (22) 23), fewer rays on the second dorsal fin (36 (37) 40 versus 37 (40-42) 44), fewer scales along the lateral line (121-134 versus 144-166), and a larger head (30.1 to 33.5% of standard length versus 24.7 to 28.9%). This would partly validate Vrooman and Paloma's (1977) and Ermakov's (1983) viewpoints, as larvae and egg identification of any Merlucciidae species is intrinsically difficult, especially if taking into account the knowledge of both species being present when Ahlstrom and Counts put forward their contradicting results in 1955, along with possible fluctuations of the thermal front in the region.

The second issue to be resolved is *M. hernandezii* Mathews, 1985, which neither Inada *in* Cohen *et al.* (1990) nor Inada (1995) shed light on its validity or the naming of other binomen currently accepted in their region of origin (Gulf of California). Mathews separates *M. hernandezii* from *M. angustimanus* by the former having a relatively lower number of vertebrae as well as rays on the second dorsal and anal fins. *M. hernandezii* can grow to 107 cm total length whereas the maximum length of *M. angustimanus* is 40 cm. Due to high variability and overlap in meristic characters, such argumentation is not very consistent, especially in a region of periodic hydrographic fluctuation (El Niño-La Niña), where temperature plays an important role in embryonic development of eggs and larvae, giving rise to apparently isolated populations. Comparing meristic characters of *M. angustimanus* in Ginsburg (1954), Testaverde and Artunduaga (1974), Inada (1981b) and Inada *in* Cohen *et al.* (1990) with those of *M. hernandezii* in Mathews (1985), there is much overlap in the number of gillrakers (13-18 versus 14-20), rays on the second dorsal fin (36-40 versus 36-42) and anal fins (36-40 versus 37-42), as well as scales along the lateral line (121-134 versus 130-139). As for the difference in size, the *M. angustimanus* specimen captured towards the interior of the Gulf of California (CAS 117879) measures 73 cm standard length; it has 4 + 13 = 17 gillrakers; 11 1D rays; 38 2D rays; 39 A rays. In relation to standard length: head length represents 33.5%; pectoral fins 20.5%, reaching the fourth anal-fin ray, and ventral fins 11.0%. In relation to head length: preorbital length represents 31.0% and eye diameter 14.2%. Therefore, after examining digitalized images of *M. hernandezii* paratypes, we propose *M. hernandezii* to become a synonym of *M. angustimanus* as it may constitute a part of *M. angustimanus* population.

Geographical Distribution: Eastern Pacific, from the Gulf of California (Turtle Island 27°04'N–112°W) to Ensenada de Tumaco (1°59.5'N–78°56.0'W) in Colombia (Fig. 21).

Habitat and Biology: The Panama hake is found in 80 to 500 m depths and also in midwaters of the open sea. Biological data on this species is sparse, possibly because it is not commercially exploited and most come from the southern part of the Gulf of California. It apparently lives 7 years with a maximum recorded length of 39 cm. Minimum

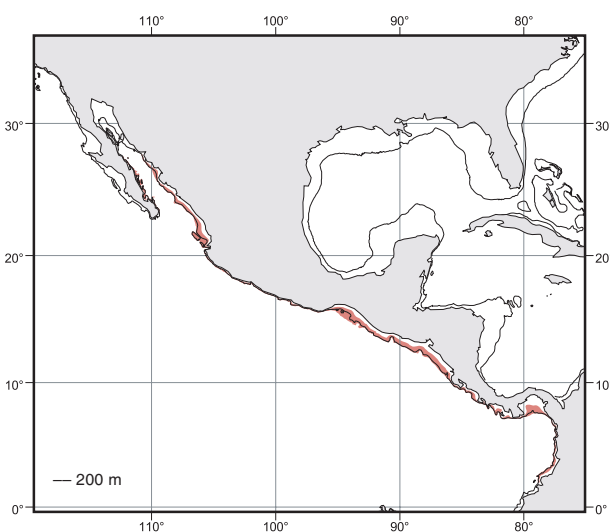


Fig. 21 *Merluccius angustimanus*
■ Known distribution

length of first sexual maturity is 18 to 19 cm for both sexes, and spawning takes place from April to June, or later. If *M. hernandezi* from the northern part of the Gulf of California, and measuring as much as 107 cm, is a synonym of *M. angustimanus*, the few biological data attributed to the Panama hake would need to be reconsidered.

Size: Maximum known length was 40 cm, common up to 32 cm, but one of the specimens studied measures 73 cm standard length. If *M. hernandezi* is accepted as a synonym of *M. angustimanus* its maximum length would be 107 cm.

Interest to Fisheries: This hake is only captured locally in small quantities in trawls; no catches reported to FAO.

Local Names: COLOMBIA: Merluza; FRANCE: Merlu Panaméen, Merlu du Panama; MEXICO: Merluza, Merluza bajacalifornia, Merluza panameña; NICARAGUA: Merluza panameña; PANAMA: Merluza; PORTUGAL: Pescada do Panamá; SPAIN: Merluza panameña; UNITED KINGDOM: Hake, Panama hake; UNITED STATES: Dwarf hake, Hake, Panama hake.

Literature: Garman (1899); Marini (1933); Norman (1937); Hildebrand (1946); Ginsburg (1954); Lozano Cabo (1965); Testaverde and Artundage (1974); Vrooman and Paloma (1977); Inada (1981b); Ermakov (1973); Mathews (1985); Inada in Cohen *et al.* (1990); Inada (1995).

***Merluccius australis* (Hutton, 1872)**

Fig. 22

Gadus australis Hutton, 1872, *Fish. New Zeal.*, :45 (type locality: Cook Strait – New Zealand).

Synonyms: *Merluccius gayi* (non Guichenot, 1848): Günther, 1880, *Rept. Voy. Challenger*, 1(6): 22 (Gray Harbor, Straits of Magellan). *Merluccius australis*: Norman, 1937 (*partim*), *Discovery Rept.*, 16: 48. *Merlangius (Huttonichthys) australis*: Whitley, 1937, *Mem. Queensland Mus.*, 11(2): 122. *Merluccius polylepis* Ginsburg, 1954, *Fish. Bull. U.S.*, 96: 195, Fig. 2 (type locality: Castro, Chiloé, Chile). *Merluccius gayi australis*: Mann, 1954, *Invest. Zool. Chil.*, 2(5): 81 (subantarctic to Talcahuano). *Merluccius gayi hubbsi* (non Marini, 1933): Mann, 1954, *Invest. Zool. Chil.*, 2(5): 81 (from Cape Horn to Puerto Montt). *Merluccius gayi polylepis*: Angelescu *et al.*, 1958, *Sec. Mar.*, Buenos Aires: 155. *Merluccius hubbsi* (non Marini, 1933): Lloris and Rucabado, 1991.

FAO Names: En – Southern hake; Fr – Merlu austral; Sp – Merluza austral.

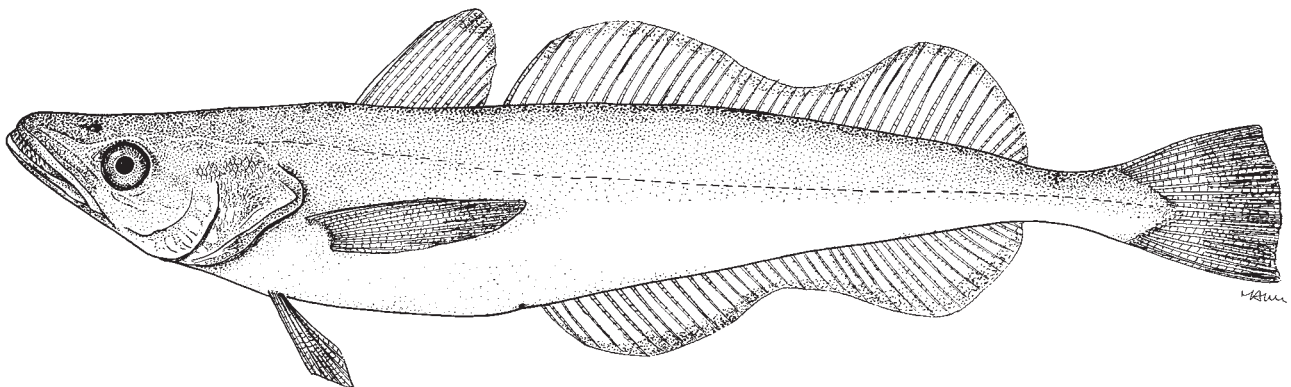


Fig. 22 *Merluccius australis*

Diagnostic Features: Body robust. Lateral line clearly separated from the dorsal profile, with 144 to 186 scales. Head dorsal profile straight. Head length 24.9 to 28.3% of standard length, snout 33.2 to 39.0% of head length. No scales on nasal membrane, lacrimal, and lower part of interopercular; scales on lower part of cheek and preopercular. Eye diameter 13.8 to 21.9% and interorbital space 24.7 to 30.5% of head length. Lower jaw slightly protruding with large visible teeth, as those in the premaxillaries. Gillrakers on first branchial arch 11 (13) 15, 2 to 4 on upper arm and 9 to 12 on the lower. 1D 10 (11) 13 rays; 2D 39 (42-43) 46 rays; A 40 (42-44) 46 rays. Pectoral fins with 13 (14) 16 rays, length 16.7 to 22.5% of standard length, reaching the origin of anal fin. Ventral fins 11.0 to 15.7% of standard length. Caudal-fin margin truncate in adults, convex in juveniles. Vertebrae 53 (56) 58, 5 or 6 of which are cervical, with 3 or 4 ribs. **Colour:** steel grey with tinges of blue on dorsum, lighter on sides and white on belly; dark fins. Gillrakers and their bases with small melanophores.

Additional Information: Based on specimens from New Zealand, Hutton (1872) described *Gadus australis* with 41 rays on the second dorsal and anal fins. Günther (1880) assigned specimens captured in the Magellan Straits to *Merluccius gayi*, with 43 or 44 rays in 2D and 43 rays in the anal fin. Waite (1911) assigned 36 rays for both second dorsal and anal fins to *M. australis* from New Zealand. After studying three specimens from New Zealand, Norman (1937) compared them with Günther's (1880) specimen from the Magellan Strait, and finding no difference between them, identified them all as *M. australis*, attributing to this species 36 to 43 rays in 2D and 36 to 42 rays in the anal fin.

Ginsburg (1954) considered specimens from the Chilean Pacific as different from those from New Zealand. Based on four specimens captured in Chiloé (Chile), he described *M. polylepis* having 43 to 45 rays in 2D and 42 to 45 rays in the anal fin, and 182 to 186 lateral-line scales. According to him, *M. polylepis* differs from *M. australis* in the number of rays on the 2D (43 to 45 in the former and 36 to 41 in the latter) and the anal-fin rays (42 to 45 in *M. polylepis* and 36 to 41 in *M. australis*). Ginsburg also included the specimen from the Magellan Strait studied by Günther (1880) in *M. polylepis*.

Inada (1981a and b) compared specimens of *M. australis* from New Zealand waters, with others from Chilean Patagonia and Argentina, which he believed to belong exclusively to *M. polylepis*. After establishing that specimens from both regions have similar meristic and morphometric characters, he placed *M. polylepis* in the synonymy of *M. australis*, while accepting that two populations exist.

In the present study, a paratype (USNM 157765) of *M. polylepis* from Puerto Montt (Chile) was studied as well as samples from the Chilean Pacific (46° 22'S–75° 27'W) and two specimens from the Beagle Channel (IIPB 92 and 93/1987, Ushuaia Bay, 54° 48.9'S – 68° 14.8'W, between 135 and 150 m depth). Meristic data of these specimens (13 to 15 gillrakers, 2D: 41-43 and A: 41-43) fit the original description of *M. polylepis*.

The validity of *M. australis* was accepted after taking into account Ginsburg's (1954) meristic data of *M. polylepis*, meristic and anatomical data from Inada (1981a and b) and Inada in Cohen *et al.* (1990), and our own data. Seeing as how the urohyal and the hyomandibular of Patagonian specimens are slightly different from those from New Zealand, two trinomena have been proposed: *Merluccius australis australis* for New Zealand waters, and *M. australis polylepis* for the southern coast of Chile, including Tierra del Fuego channels and southern Argentina.

Merluccius australis australis (Hutton, 1872)
(New Zealand)

1D. 10 (11) 13; **2D.** 39-45; **A.** 36-45; **P.** 13 (14) 15; **V.** 7; **Gr.** 11-14; **L.L.** 144-169

Merluccius australis polylepis Ginsburg, 1954
(southern coast of Chile, Magellan Strait, Beagle Channel and southern Argentina)

1D. 10 (11) 12; **2D.** 39-45; **A.** 38-45; **P.** 14; **V.** 7; **Gr.** 12-15; **L.L.** 174-186

Geographical Distribution: One can describe, with some precautions, the existence of 2 populations, one from New Zealand and another from the southern point of South America (Chile and Argentina). The New Zealand population (*M. australis australis*) is distributed south of the 40°S parallel (Challenger Plateau), bordering the islands and reaching Campbell Plateau and Chatham Rise. The South American population (*Merluccius australis polylepis*) can be found on the southeastern Pacific slope (Chile), from the Chiloé Island (40°S) to 57°S, including Diego Ramirez Island bordering Cape Horn, and reaching to the southwestern Atlantic slope (Argentina) (Fig. 23).

According to the present data, it is unknown whether the distribution of the species progresses northwards to around latitude 38°N and gradually moves away from the coast following the continental slope and under the influence of the Falklands Current.

Apart from regions already mentioned, Abe and Funabashi (1993) reported the first *Merluccius australis* specimen, measuring 79 cm, in the northwestern Pacific at 500 m from Japan (36° 23'N – 141° 02'E). As it was impossible to study that specimen, we have reservations on this recording, as it was caught very far from its distribution area. However, judging from the photographs, the head scales conform to those of the *M. australis* group.

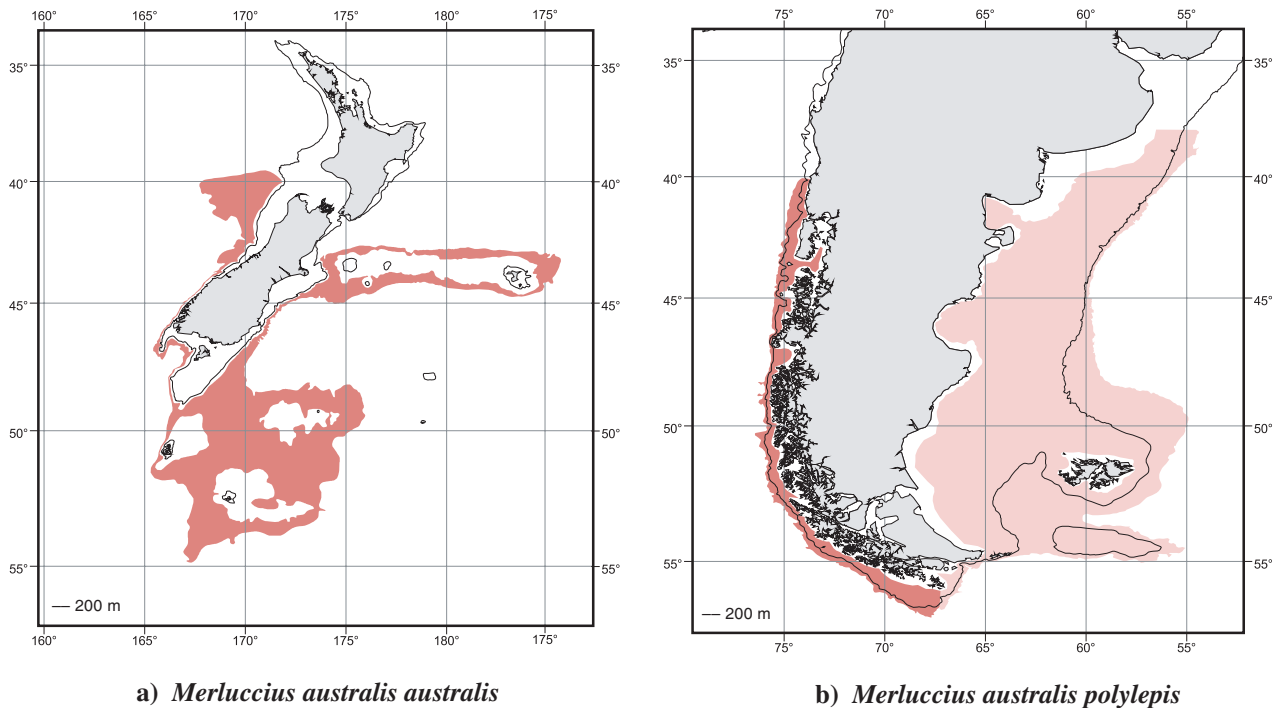


Fig. 23 *Merluccius australis*

■ Known distribution and ■ probable presence

Habitat and Biology: The New Zealand subspecies occurs south of 40°S and between 500 and 900 m, except on the Chatham Rise where it is found at 400 to 450 m. The species feeds mainly on fishes, primarily blue grenadier (*Macruronus novaezelandiae*), Macrouridae, and Myctophidae. Sexual maturity is attained at 6 years of age, or for males at 65 cm and females around 70 cm; at 10 years of age, all specimens are sexually mature, attaining up to 28 years, although few females surpass 23 years of age and males 21 years. The fact that three spawning areas are known and hake along the western coast are smaller than those along other areas of New Zealand, sheds doubt on the southern hake's identity (see additional information). Spawning takes place from August to September on the western coast of South Island, from September to November in the northern part of the Campbell Plateau, and between November and January on Chatham Rise.

There is little information on the biology of the Patagonian subspecies, especially around the southwestern Atlantic. It lives in sub-Antarctic waters drifting from the Chilean Pacific carried by the Cape Horn current, that becomes the Falkland current in the southwestern Atlantic. Along the Chilean coast it feeds mainly on demersal fishes such as blue grenadier (*Macruronus novaezelandiae magellanicus*), southern blue whiting (*Micromesistius australis*), and pink cusk-eel (*Genypterus blacodes*). Sexual maturity is reached at 65 cm in males and 72 cm in females; spawning takes place during a short but intense winter period of 3 to 4 months (July - September). Three reproduction areas have been pointed out, the main one is Guamblin Island (44° - 46°S), while Guafo Island to the north, and the area between 52° and 54°S are less important. Spawning areas are situated in fjords and canals. Given the females' large size, fecundity levels are rather high (estimated at 430 000 eggs); specimens smaller than 60 to 70 cm have a fecundity similar to that of *M. gayi gayi*. It has the longest lifespan of the genus; maximum age recorded in males and females is 30 years, with females generally living longer, and are larger (to 155 cm total length), than males.

Size: Maximum recorded length 130 cm in New Zealand, 155 cm in Chile and Argentina; common length is 30 to 100 cm.

Interest to Fisheries: The geographical distribution of southern hake (*Merluccius australis*) overlaps in the Atlantic with that of the Argentine hake (*Merluccius hubbsi*), which also causes an overlap in fishery catches. However, the southern hake extends further south beyond Cape Horn and is also found along the Chilean coast. In New Zealand the southern hake (*Merluccius australis*) is a secondary fishery, as it is caught as bycatch with blue grenadier (*Macruronus novaezelandiae*).

In Argentina, the southern hake has constituted a target fishery since 1980, as well as a bycatch of other fisheries. It is fished by freezer factory-trawlers of more than 45 m length and other trawlers of smaller tonnage operating far from the coast as well as by fleets of small 25 m trawlers fishing near the coast. It is also caught around the Falkland Islands by fleets targeting Argentine hake (*Merluccius hubbsi*). In Chile in 1976, a Japanese factory trawler was the first to operate; afterwards, Chilean fleets continued to exploit this resource. In the mid-1980s, refrigeration was introduced, favouring the apparition of an artisanal fleet and other factory longliners also targeting this species. South American

catches, carried out exclusively by Chilean and Argentinian fleets (except for some catch carried out by the Republic of Korea, between 1987 and 1992), totalled a maximum of 110 993 tonnes in 1987. Since then, catches have decreased and are stable, between 3 000 and 4 000 tonnes in the Atlantic and around 25 000 tonnes in the Pacific. Owing to its excellent commercial characteristics, this species sells at a higher price than other hake species and is preferably marketed fresh and whole. It has also been marketed frozen and used for fishmeal. The New Zealand product is preferably marketed gutted, whole and frozen.

In New Zealand, Japanese trawlers began fishing in 1975, but in 1978 a TAC (Total Allowable Catch) system was introduced whereby fishing was reserved for New Zealand fleets and joint ventures with local fleets. Target fishing of this species also takes place in the sub-Antarctic area of New Zealand. New Zealand has been reporting catches since 1980, and in recent years, so have the Republic of Korea, Ukraine, the Russian Federation and Norway. Catches have gradually increased to more than 15 000 tonnes in annual catch for New Zealand and to around 20 000 tonnes in total annual catch. The New Zealand product is preferably marketed gutted, whole and frozen.

Local Names: CHILE: Maltona, Merluza austral, Merluza española; FRANCE: Merlu austral; JAPAN: Hitachi, Hitachi dara, Nyujirando-heiku; NEW ZEALAND: Hake, Whiting; SPAIN: Merluza austral, Merluza del sur, Merluzón; UNITED KINGDOM: Chilean hake, Patagonian hake, Southern hake.

Literature: Hutton (1872); Günther (1880); Waite (1911); Norman (1937); Graham (1953); Ginsburg (1954); Mann (1954); Cousseau and Cotrina (1980); Gosztanyi (1981); Inada (1981a and b); Ayling and Cox (1982); Menni *et al.* (1984); Inada *et al.* (1986); Ojeda and Aguayo (1986); Csirke (1987); Inada *in* Cohen *et al.* (1990); Abe and Funabashi (1993); Balbontín and Bravo (1993); Aguayo (1995); Colman (1995); Cousseau and Perrotta (1998).

Merluccius bilinearis (Mitchill, 1814)

Fig. 24

Stomodon bilinearis Mitchill, 1814, *Trans. Lit. Phil. Soc.*, 1: 7 (type locality: New York).

Synonyms: *Merluccius vulgaris* (non Fleming, 1828) Günther, 1862, *Catalogue of the fishes in the British Museum*, 4: 344. *Merluccius bilinearis*: Gill, 1863, *Proc. Acad. Nat. Sci. Philad.*: 247 (Eastern North American coast, Virginia).

FAO Names: En – Silver hake; Fr – Merlu argenté; Sp – Merluza norteamericana.

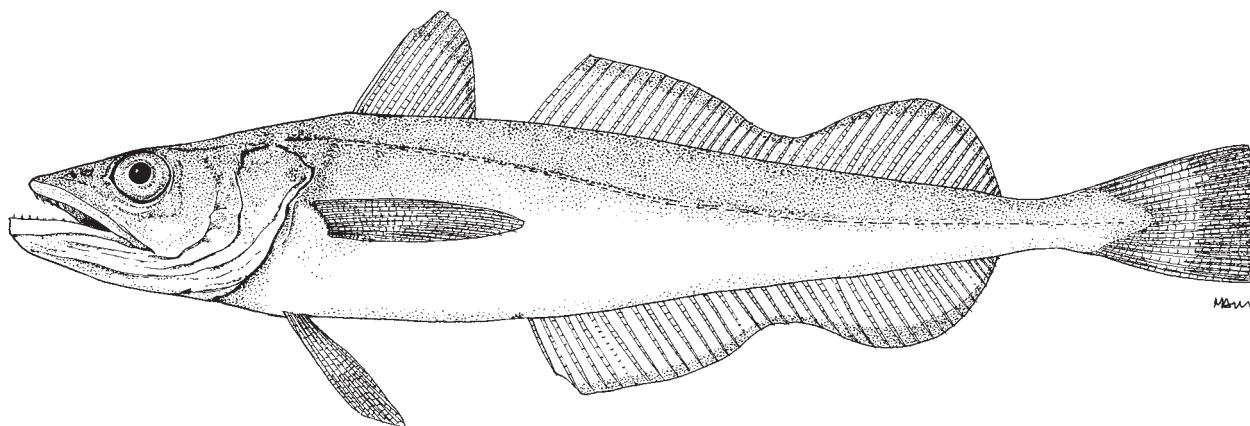


Fig. 24 *Merluccius bilinearis*

Diagnostic Features: Scales along the lateral line 101 to 130. Head 24.4 to 27.4% of standard length and snout 31.2 to 35.1% of head length. No scales on nasal membrane, lacrimal, lower part of cheek, preopercular and interopercular. Eye diameter 16.4 to 23.8% and interorbital width 24.0 to 29.8% of head length. Lower jaw slightly protruding. Gillrakers on the first branchial arch 15 (17-18) 22, 2 to 6 on the upper arm and 11 to 17 on the lower arm. 1D 11 (12) 14 rays; 2D 37 (40) 42 rays; A 37 (41) 42 rays. Pectoral fins with 13 (14-15) 17 rays, length 18.1 to 24.1% of standard length, in juveniles reaching beyond anal-fin origin. Ventral fins 14.0 to 19.6% of standard length. Caudal-fin margin truncate in juveniles and slightly concave in adults. Vertebrae 53 to 57, 6 of which are cervical with 4 ribs. **Colour:** in preserved specimens silvery grey, dorsum slightly darker. Gillrakers and their base with dark conspicuous spots (melanophores).

Additional Information: Miranda Ribeiro (1903-1915) widened the distribution of *Merluccius bilinearis* in the western Atlantic, recording them from Belle Island in North America to Rio de Janeiro in South America without even considering *M. albidus* (Mitchill 1818) and *M. hubbsi* for description. Differences from *M. albidus*, which are also found along the American coast, are described under *M. albidus*.

Geographical Distribution: Atlantic coast of Canada and the United States from Belle Isle Strait (52°N) to the Bahamas (24°N); most common from southern Newfoundland to South Carolina (Fig. 25).

Habitat and Biology: The silver hake is one of the most important species on the continental shelf and the North American continental slope, both as predator as well as prey. Demersal, it can be found between 55 and 914 m depth. There are two populations: one to the north, from the Gulf of Maine to the northern part of Georges Bank, characterized by a slower growth than the southern population, and another which occurs from the southern part of George Bank to the southernmost point of the species' distribution. During winter and spring most adults are found on the continental edge and slope, mainly gathering on the Scotian Shelf, the Gulf of Maine, and the slope from Sable Island Bank to Cape Hatteras. In summer and autumn, they migrate to shallower waters. Juveniles show a similar seasonal distribution pattern to the adults, only gathering in shallower waters. The smallest specimens feed mostly on crustaceans to the age of six, when they then feed on fishes (clupeids, *Scomber scombrus*, *Urophycis chuss*, *Gadus morhua*); they also show cannibalistic habits. There is a positive correlation between the abundance of *Scomber scombrus* and the recruitment of silver hake in the area. The first sexual maturity is similar in males and females, between 2 and 3 years (29 to 33 cm length) on Georges Bank and 1 to 2 years (females 26 to 27 cm length; males 23 to 24 cm length) on the Scotian Shelf. Recent studies have shown a drop in age and size at first maturity. Variations occur in spawning and takes place, according to area and population, from May to November. Spawning occurs in June – July in the mid-Atlantic region; July – August in the Gulf of Maine and to the north of Georges Bank, and August – September on the Scotian Shelf. Little is known about the species' fertility but it is believed to be as high as that of other species of the genus. Females grow faster, live longer, and are larger than males; maximum size of females is 76 cm and live up to 15 years of age. Maximum size and age of males are 41 cm and 9 years of age. In the last few years silver hake from the United States waters rarely exceed 6 years of age.

Size: Maximum recorded length is 76 cm; common to 37 cm (males) and 65 cm (females).

Interest to Fisheries: The silver hake fishery is one of the largest and oldest fisheries in the world. It is mainly concentrated off the coast of Nova Scotia, Gulf of Maine and Georges Bank. It is one of the most abundant demersal species in the region, and after the intense fishing pressure of the 1960s and 1970s exerted by the Soviet Union, the species is now exploited by the United States, Canada and Cuba. Up until the 1940s, when trawl fleets and low-temperature preservation were introduced, United States fishermen had fished this species near the coast since the middle of the nineteenth century, the artisanal fleets using nets and traps, and the recreational vessels using hooks. In the 1950s the use of trawls in the fishing area increased, and annual catches totalled over 50 000 tonnes. From 1960, foreign fleets with 500 to 1 000 GRT (Gross Registered Tonnage) trawlers joined local fleets and contributed to an increase in fishing effort that until then had been exerted by local fleets with trawlers of less than 300 GRT. In 1950, owing to intense fishing pressure from foreign fleets, the ICNAF (International Commission for the North Atlantic Fisheries) was created, bringing restrictions and technical measures to achieve rational fishing exploitation. As a result, foreign fleets decreased and the United States fleet grew in number and capacity. Today the resource is also exploited by Canada, Cuba and the Russian Federation under joint ventures. Silver hake is of great commercial interest and is mostly marketed fresh in the Russian Federation. It is also marketed frozen, gutted, whole or in fillets, and was occasionally used for fishmeal in the past.

At the beginning of the twentieth century, United States fleets caught around 3 000 tonnes per year, but by 1951 catches totalled over 50 000 tonnes, this level was maintained throughout the 1950s. In the 1970s the Soviet Union fleets joined the fisheries, thus contributing to a large increase in fishing effort, their annual catch twice totalling over 350 000 tonnes. Shortly after both occasions, a rapid decline in annual catch to under 100 000 tonnes was recorded. In the 1980s, and particularly in the 1990s, catches slowly and steadily declined to about 30 000 tonnes.

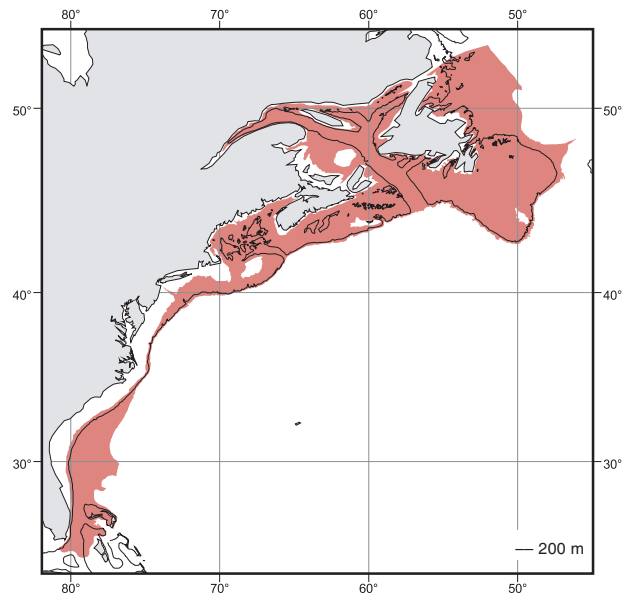


Fig. 25 *Merluccius bilinearis*
■ Known distribution