

Local Names: CANADA and UNITED STATES: Atlantic hake, Hake, New England hake, Silver hake, Whiting; CROATIA: Ugotica; DENMARK: Kulmule; FINLAND: Hopekummeliturska; FRANCE: Merlan, Merlu argenté; GERMANY: Nordamerikanischer Seehecht, Silberhecht; ICELAND: Lysingur; ITALY: Nasello atlantico; NORWAY: Lysing; POLAND: Morszczuk srebrzysty; PORTUGAL: Pescada prateada; SPAIN: Merluza, Merluza atlántica, Merluza norteamericana.

Literature: Mitchill (1814); Günther (1862); Gill (1863 and 1872); Jordan and Evermann (1898); Miranda Ribeiro (1903 and 1915); Marini (1933); Ginsburg (1954); Inada (1981); Báez and Gómez-Larrañeta (1989); Inada *in* Cohen *et al.* (1990); Bolles and Begg (2000).

Merluccius capensis Castelnau, 1861

Fig. 26

Merluccius capensis Castelnau, 1861, *Mém. Poiss. Afr. Austr.*: 68-69 (type locality: South Africa).

Synonyms: *Gadus merluccius* (*non* Linnaeus, 1758): Pappe, 1854: 30 (Cape of Good Hope). *Merluccius vulgaris* (*non* Fleming, 1828): Gruvel, 1913: 14 *in* Maurin (1990), South Africa. *Merluccius capensis*: Gruvel, 1913: 153 *in* Maurin (1990), South Africa. *Merluccius capensis capensis*: Franca, 1960, *Mem. Junta Invest. Ultram.*, 2(18): 3 (Farta Bay, Angola, to Agulhas Bank, and Natal). *Merluccius merluccius capensis*: Franca, 1962, *Mem. Junta Invest. Ultram.*, 2(36): 25 (taxonomy). *Merluccius merluccius capensis*: Lozano Cabo, 1965, *Publ. Téc. Junta Estud. Pesca*, 4: 20 (from Farta Bay to Capetown). *Merluccius merluccius capensis*: Franca, 1971: 5 and 11 (Angola, southwest Africa, South Africa).

FAO Names: En – Shallow water Cape hake; Fr – Merlu côtier du Cap; Sp – Merluza del Cabo.

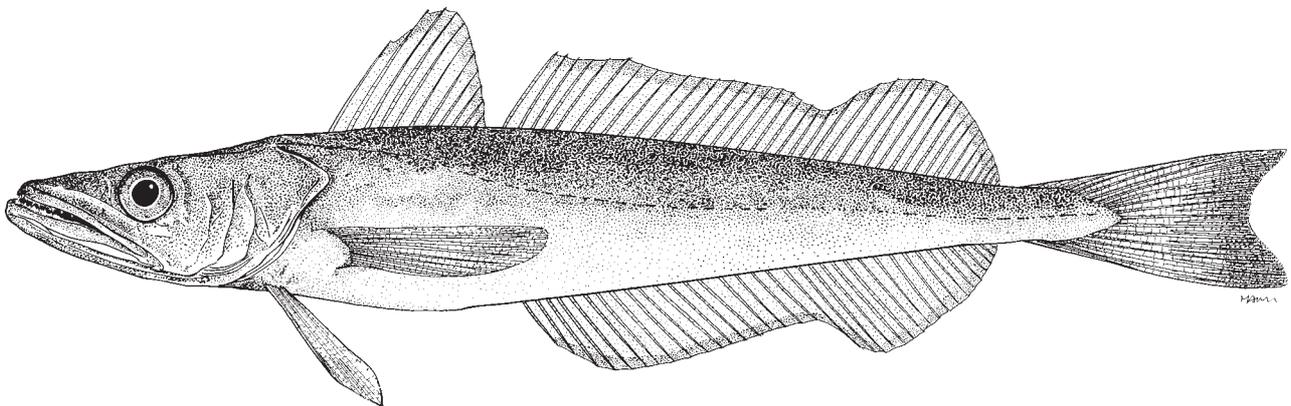


Fig. 26 *Merluccius capensis*

Diagnostic Features: Scales along the lateral line 120 to 153. Head 27.3 to 30.2% of standard length and snout 31.9 to 36.5% of head length. Scales on nasal membrane and lower part of cheek; no scales on lacrimal, lower part of preopercular and interopercular. Eye diameter 17.0 to 24.6% and interorbital space 24.1 to 28.6% of head length. Lower jaw rather prominent; strong teeth on jaw, premaxillary and vomer. Gillrakers on first branchial arch 15 (19-20) 20, 3 to 6 on upper limb and 11 to 15 on lower. 1D 9 (11) 12 rays; 2D 37 (39) 43 rays; A 36 (39) 41 rays. Pectoral fins with 14 (15) 16 rays, length 17.2 to 19.9% of standard length and reaching beyond the origin of anal fin. Ventral fins 14.2 to 17.1% of standard length. Posterior margin of caudal fin truncate or slightly concave. Number of vertebrae 48 (51-52) 53, 6 of which are cervical with 4 ribs. **Colour:** lead grey, darker on dorsum than on sides; whitish belly; greyish fins. No submandibular mark.

Additional Information: Different studies have shown similarities between *M. capensis*, *M. merluccius* and *M. senegalensis*. Similarities of these three species concern meristic, morphometric, and qualitative characters, amongst others (allozymes, Roldan *et al.*, 1999). With *M. capensis* and *M. senegalensis*, the *sagitta*, especially the sulcus (sulcus acusticus), are very similar, although the *sagitta* of the latter species is rather more curved and more fragile than that of *M. capensis*. *M. merluccius* is different from the other two species in having fewer gillrakers (8-11, as opposed to 13-21 in *M. senegalensis* and 15-20 in *M. capensis*); *M. senegalensis* shows a black mark on the submandibular fold that is lacking in *M. merluccius* and *M. capensis*. In the same way as *M. paradoxus*, they differ in their scale distribution pattern on the head.

Geographical Distribution: Southeastern Atlantic, from Farta Bay near Benguela ($12^{\circ} 30'S$) on the Namibian coast to the Cape of Good Hope; around the Agulhas Bank into the Indian Ocean to Natal at Cape Saint Lucia ($32^{\circ}E$). To the north towards Benguela, its distribution area overlaps with that of the Benguela hake (*M. polli*) and partially, in deep areas, with the South African deepwater Cape hake (*M. paradoxus*). Also found on the Valdivia Bank between 228 and 283 m depth (Fig. 27).

Habitat and Biology: Demersal and benthopelagic species which migrate seasonally and vertically (demersal during the day and nektonic during the night). Bathymetric distribution ranges between 50 and 500 m, but it is more frequently found between 50 and 400 m, overlapping with *M. paradoxus* between 200 and 400 m depth. Juveniles usually gather to the north of Walvis Bay (between Palgrave Point and Cape Cross) and feed mainly on pelagic crustaceans and myctophids. Adults are euryphagous and prey mainly on myctophids, horse mackerels, small sardines, macrourids, and fish of their own genus. Male sexual maturity is attained between 28 and 67 cm. According to Ritzhaupt (1969) and Botha (1971), *M. capensis* growth in comparison to *M. paradoxus* is more rapid, estimating it at 6 to 8 cm in 8 years; Botha (1971) points out that *M. paradoxus* grows steadily up to 6 years of age, slowing down thereafter. Spawning apparently takes place all year round, although there is controversy on this. According to Jones (1967) and Jones and Van Eck (1967), peak spawning in the Capetown region is between August and September (end of winter and beginning of southern spring). Pshenichnyy and Assarov (1969) believe the spawning period to extend from September to February (spring and end of the southern summer). The species is believed to live up to 11 years.

Size: Maximum known length 120 cm; common from 40 to 60 cm.

Interest to Fisheries: Like other hakes, shallow water Cape hake (*Merluccius capensis*) and deepwater Cape hake (*Merluccius paradoxus*) are caught using trawls operating on the bottom during the day and lifting away from bottom at night. In the southeastern Atlantic (FAO statistic area 47), the shallow water Cape hake is distributed along three coastal states (Angola, Namibia and South Africa), and fishery management differ in each of them. Shallow water Cape hake (*Merluccius capensis*) dominated Namibian catches and still dominates South African catches. Deepwater Cape hake (*Merluccius paradoxus*) is increasingly present in Namibian catches and dominates in those carried out on the western South African coast.

Given their similarity, catch reports of shallow water Cape hake (*Merluccius capensis*) combine this species with deepwater Cape hake (*Merluccius paradoxus*). South African trawlers began fishing in the 1920s. In 1962, foreign fleets joined South African, Namibian and Angolan fisheries and caught both species. Catches showed a marked increase during 1964-1972, reaching a total of 1 100 000 tonnes in 1975, forcing in 1972 the International Commission for South Eastern Atlantic Fisheries (ICSEAF) to introduce fishery management measures. This increase was a result of the activity of the Soviet Union fleet (655 000 tonnes) and to a lesser extent the Spanish fleets (130 000 tonnes), South Africa (118 000 tonnes), Japan (54 700 tonnes), Cuba (48 000 tonnes), and other countries. After this maximum, the catch dropped to a minimum of nearly 300 000 tonnes in 1981. Catches recovered to about 500 000 tonnes around 1985 and decreased again to 200 000 tonnes before Namibian independence. Namibian and South African fleet catches showed a slow recovery beginning from there on.

Resource management changed in 1977 with the declaration of a 200 mile EEZ for South Africa and its waters as well as for Namibia in 1990 after its independence. A large part of the fishing effort corresponding to foreign fleets was removed. While foreign fleet fishing was reduced drastically, TACs were introduced, which helped the recovery of resources at the end of the 1990s. The main reason for the delay in the resources responding to a reduction in fishing mortality was a result of anoxic conditions in 1993 and 1994, which led to very poor recruitment in hake populations.

Shallow water Cape hake is a high-quality product. It is marketed fresh, whole or in fillets, gutted and frozen in blocks, with or without skin. Most catches are exported to Europe, mainly to Spain.

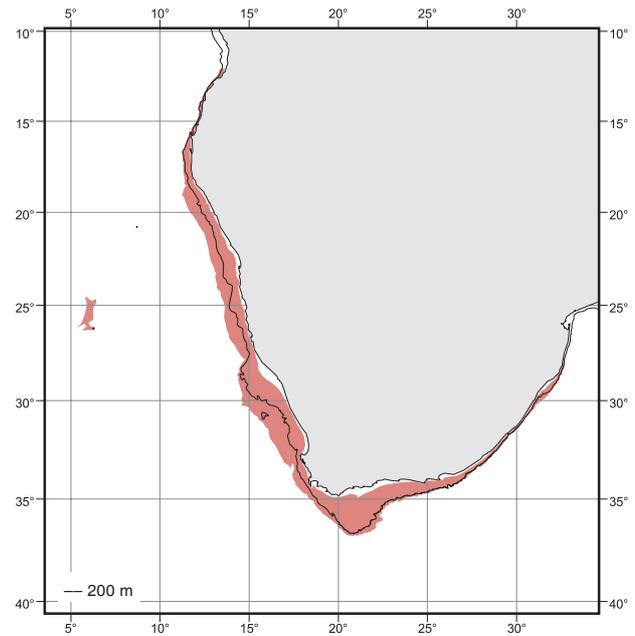


Fig. 27 *Merluccius capensis*
■ Known distribution

Local Names: ANGOLA: Marmota, Pescada, Pescada do reino, Pescada branca do Cabo, Pescada do África do Sul, Pescada do Cabo; FINLAND: Kapinkummeliturska; FRANCE: Merlu blanc du cap, Merlu côtier du Cap, Merlu du Cap, Merluce; GERMANY: Kaphecht; ITALY: Nasello del capo; NAMIBIA: Hake, Stokvis, Vlakwater stokvis; NETHERLANDS: Zuidafrikaanseheek; POLAND: Morszczuk kapski; PORTUGAL: Marmota, Pescada, Pescada do reino, Pescada branca do Cabo, Pescada do África do Sul; SOUTH AFRICA: Cape hake, Shallow water hake, Stockfish, Vlakwater stokvis; SPAIN: Merluza del Cabo, Cabezudo, Carioca, Pijota, Pitillos (juveniles); UNITED KINGDOM: Cape hake, Shallow water Cape hake; UNITED STATES: Cape hake, Hake, Shallow water hake, South African whiting, Stockfish, Whiting.

Literature: Pappe (1854); Castelnau (1861); Hickling (1927); Belloc (1928); Marini (1933); Norman (1935); Poll (1953); Franca (1962); Maurin (1963 and 1965); Lozano Cabo (1965); Jones (1967); Jones and Van Eck (1967); Pshenichnyy and Assorov (1969); Van Eck (1969); Botha (1971); Quéro (1973); Macpherson (1980); Inada (1981b and c); Lloris (1981 and 1982); Bianchi (1986); Botha (1986); Cohen (1986); Lloris (1986); Olivar *et al.* (1988); Punt and Leslie (1991); Inada *in* Cohen *et al.* (1990); Maurin (1990); Bianchi *et al.* (1993); Roldán *et al.* (1999).

Merluccius gayi (Guichenot, 1848)

Fig. 28

Merlus gayi Guichenot, 1848, *En: Gay, Hist. Fisica polit. Chil Zool.*, 2: 328 (type locality: Chilean coast).

Synonyms: *Merluccius gayi*: Kaup, 1858, *Arch. Naturg.*, 24(1): 87 (bibliography). *Merluccius gayi gayi*: Ginsburg, 1954, *Fish. Bull.*, 96(56): 202 (coast of Chile). *Merluccius gayi peruanus* Ginsburg, 1954, *Fish. Bull.*, 96(56): 202 (type locality: Paita and Callao, Peru).

FAO Names: En – South Pacific hake; Fr – Merlu du Pacifique sud; Sp – Merluza del Pacifico sur.

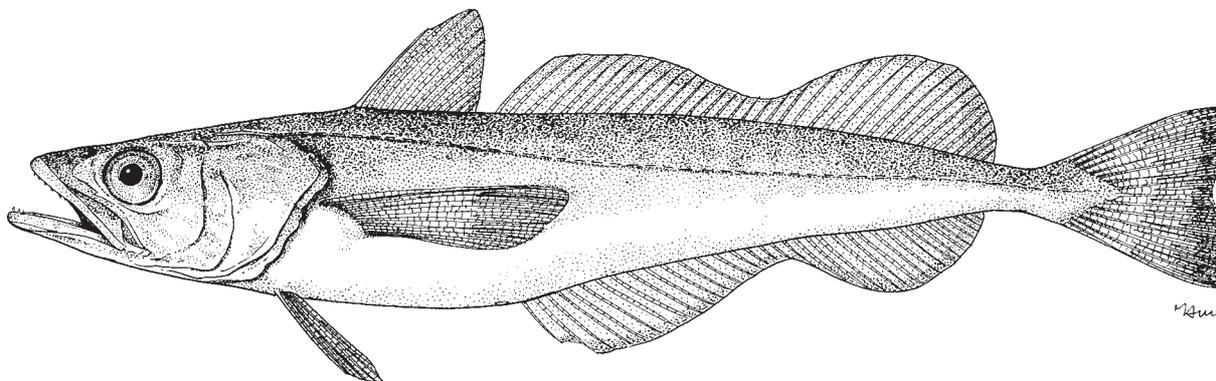


Fig. 28 *Merluccius gayi*

Diagnostic Features: Scales along the lateral line 106 to 144. Head 26.0 to 33.5% of standard length, snout 29.3 to 34.1% of head length. No scales on nasal membrane, lacrimal, lower part of cheek, preopercular, and interopercular. Eye diameter 16.9 to 22% and interorbital width 24.3 to 28.3% of head length. Gillrakers on first branchial arch 17 (20-21) 25, 3 to 6 on the upper limb and 13 to 19 on the lower. 1D 10 (10) 13 rays; 2D 34 (38-39) 42 rays. Pectoral fins with 15 (16) 18 rays, length 19.0 to 23.5% of standard length, its tip always reaching beyond anal-fin origin. Ventral fins 12.3 to 15.5% of standard length. Posterior caudal-fin margin usually concave. Vertebrae 48 to 53, 5 or 6 of them cervical with 3 or 4 ribs. **Colour:** grey-black on upper part of the body especially head and fins; middle part of sides with a horizontal orange stripe, belly always whitish. Gillrakers and their base with small melanophores.

Additional Information: Ginsburg (1938, *in* Leibe, 1979) considered that two populations, represented by adequate samples, have subspecific value when one or more characters overlap by 15 to 25%. Based on this criteria, Ginsburg (1954) divided *Merluccius gayi* into 2 subspecies, *M. gayi gayi* and *M. gayi peruanus*, living in Chilean and Peruvian waters, respectively. For there to be subspecific value, Mayr (1969) uses the 75% rule whereby a population is accepted as a valid subspecies if 75% of its individuals differ from all (= 97%) individuals of a previously valid subspecies. In *M. gayi* samples from Chile and Peru, Leibe (1979) proved that even in the number of anal-fin rays, the best diagnostic character between these 2 subspecies, only 60% of Chilean specimen differ from those of Peru. If we take into account that at least 1 300 km separate these populations, as well as being isolated for reproduction, they could be considered as different species, regardless of the overlapping meristic and morphometric characters. It is difficult to decide whether

they should be considered as subspecies or allopatric species. We follow the criterion of Mayr (1969), who recommends to consider the dubious allopatric populations as subspecies. Therefore, in theory, we accept with reservations the validity of the 2 subspecies, *M. gayi gayi* (Guichenot, 1848) and *M. gayi peruanus* (Ginsburg 1954), because if meristic characters (vertebrae, gillrakers and fin rays) are taken into account, *M. gayi peruanus* would resemble *M. angustimanus* more than *M. gayi gayi*. This shows once more that such differences are due to clinal variations influenced by the environment. It is worth pointing out that there is a marked colour difference between the upper and lower part of the body, similar to that observed in species with pelagic behaviour; this is possibly related with the anoxic environment of its habitat.

Merluccius gayi gayi (Guichenot, 1848)
(Chilean population)

1D. 10 (10) 13; **2D.** 34 (39) 42; **A.** 35 (39) 42; **P.** 15 (16) 18; **V.** 7; **Gr.** 18 (21) 25; **L.L.** 108-144;
TV. 49-53; **CV.** 6; **CC.** 4

Merluccius gayi peruanus Ginsburg, 1954
(Peruvian population)

1D. 10 (10) 13; **2D.** 36 (38) 40; **A.** 36 (38) 39; **P.** 15 (16) 18; **V.** 7; **Gr.** 17 (20) 23; **L.L.** 106-141;
TV. 48-53; **CV.** 5; **CC.** 3

Geographical Distribution: Two populations present off the South American Pacific coast between Peru and Chile, with a 1 300 km separation. In the north of Peru *Merluccius gayi peruanus* is distributed between Puntas Pariñas (4° 40'S) and Tambo de Mora (13° 56'S); the largest concentrations are found between 6° and 9°S. *M. gayi gayi* is distributed between Chañaral (26° 21'S) and the Chonos Archipelago (45° 10'S), although some samples were studied from further south (46° 22'S – 75° 27'W), largely concentrated between Coquimbo (29°S) and Arauco (47°S); to the south of 42°S, it shares part of its distribution area with *M. polylepis* Ginsburg, 1954 (Fig. 29).

Habitat and Biology: The South Pacific hake lives in the Chilean-Peruvian countercurrent (Günther Current) characterized by low oxygen level and temperatures of 6° to 12°C. The Chilean subspecies is largely concentrated between 35° and 36°S and between 38° and 41°S, forming dense groups near the bottom between dawn and dusk and dispersing during the night between 50 and 150 m depth. During the summer they are found between the 10 and 50 m isobaths; in autumn they migrate to depths of approximately 300 m at the boundary between the continental edge and the slope. In winter and spring they move towards the coast at around 170 to 190 m depth. Spawning occurs at the end of the winter and during the southern spring and constitutes the most important latitudinal migration towards the north; in summer/autumn it returns south where prey are more abundant. Diet is not very well known but is generally made up of crustaceans (Euphausiacea and others) and fish (*Clupea bentincki* and *Engraulis ringens*), including their own species. Male gonad development begins when a total length of 30 to 34 cm or 2 years of age is attained. In females this process takes place at 35 to 39 cm (3 years of age). The subspecies spawns throughout its distribution area as well as on the coast and 90 miles offshore, with two main areas: the most important between 32° 15'S and 34° 45'S, and the second between 35° 15'S and 37° 15'S. In central Chile sexual maturity in females is attained at 37.9 cm, with the main spawning period from August to November and the second between December and February of the following year; average batch fecundity is of 143.397 ± 16.905 oocytes per female. Maximum age for males 9 years, and 12 for females.

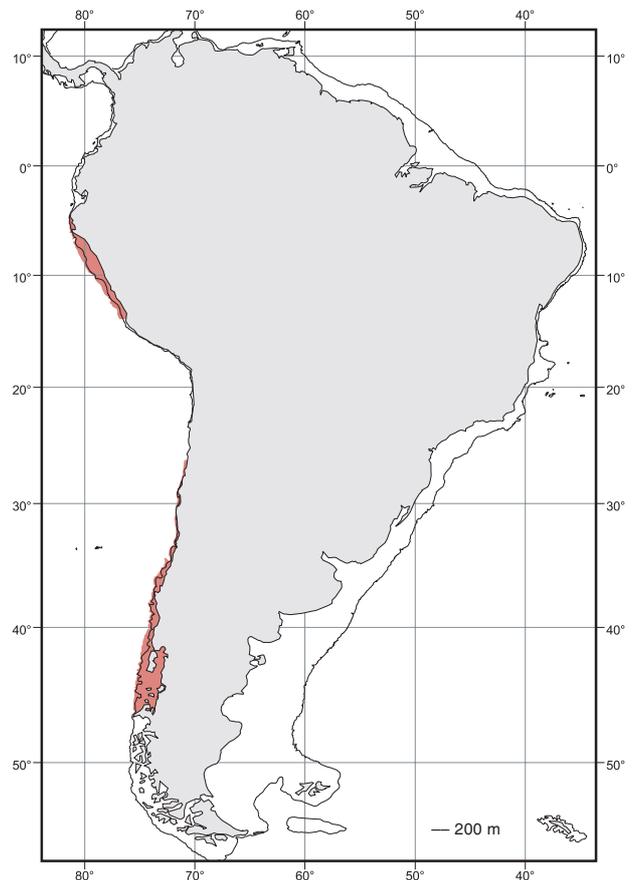


Fig. 29 *Merluccius gayi*
Known distribution

The Peruvian subspecies' habitat is determined by the southern branch of the Cromwell Current, which flows from north to south between 100 and 500 m depth and is characterized by a high oxygen level and high temperature. The current's southern limit is between 12° and 14°S in summer/autumn and between 6° and 8° S in winter/spring; however, during the

El Niño Southern Oscillation (ENSO), the current can exceed 18°S. This subspecies can resist temperatures between 10° and 22°C and low oxygen concentration. There is a latitudinal distribution by size: in the largest concentration areas, average size is 40 cm and 4 years of age; large specimens are usually found south of 6°S and move south when they detect the ENSO. Basic diet of specimens under 30 cm consists of crustaceans, particularly Euphausiacea; larger specimens feed mostly on sardines (*Sardinops sagax sagax*) and other fish (*Ctenosciaena peruviana*, *Engraulis ringens*, *Anchoa nasus* and others); consumption of the Peruvian anchoveta (*E. ringens*) increases when hake move south, where the anchoveta is more abundant; specimens measuring 50 cm and over (5 years of age onwards) have cannibalistic habits, making up 30 percent of the species' natural mortality rate. Sexual maturity is attained at 27.3 cm in males and 29.9 cm in females; spawning is fragmented; fecundity in females between 40 and 70 cm in length ranges between 78 000 and 174 000 oocytes per female. Spawning occurs all year round with a maximum during the southern winter (August/September) and another, less important, in summer.

Size: Maximum length: Chilean population 87 cm; Peruvian population 68 cm (males) and 115 cm (females). Common to 50 cm for both subspecies.

Interest to Fisheries: The South Pacific hake has been commercially exploited by Chilean fleets since 1940. Towards the mid-1950s, with the activity of European fleets, new technologies were introduced and a drastic drop in catch took place in 1969. Since then fishing has been carried out exclusively by local fleets with around 10 trawlers, some of them being rather large, and also a fleet of numerous artisanal longliners of less than 50 GRT.

In Peru, coastal trawler fleets as well as distant-water fleets of trawlers intensively exploited the local population of *Merluccius gayi* since 1970, exporting nearly all their catch. After this period of intense activity, a collapse in the fishery ensued in 1980, followed by a slight recovery before yet another decline in catch. After the last decline, exploitation was only carried out by local fleets.

Catches of *Merluccius gayi* reported to FAO are almost entirely caught by Chilean and Peruvian fleets operating along their respective coast, although at certain periods foreign fleets also exploited the resources. In the late 1970s the Cuban fleet captured between 30 000 and 40 000 tonnes; in 1973 the Soviet Union and in 1990 the Russian Federation fleets caught about 40 000 tonnes. Total maximum catch reported in 1978 amounted to over 380 000 tonnes, over 300 000 tonnes of which taken by Peru. The Peruvian catch has fluctuated since 1970, with annual catches ranging between the above-mentioned catch in 1978 and a minimum just over 5 000 tonnes in 1983. The Chilean catch has been steadier, in the range from 120 000 to 130 000 tonnes, with some peaks, as in 1978 and 2001, and the annual catch in the 1970s and 1980s ranged from 25 000 to 30 000 tonnes.

South Pacific hake is preferably marketed frozen, although in the past it has also been used for fishmeal when it was caught in the pelagic fisheries.

Local Names: CHILE: Maltona, Merluza, Merluza común, Pescada; DENMARK: Kulmule; FINLAND: Perunkummeliturska; FRANCE: Merlu du Chili, Merlu du Pacifique sud; GERMANY: Chilenischer Seehecht, Seehecht; GREECE: Bakaliáros; ICELAND: Lysingur; ITALY: Nasello dei Chile; JAPAN: Chiri-heiku; NETHERLANDS: Chileense heek; PERU: Huaycuya, Merlango, Merluza, Peje-palo, Pescada, Pescadilla; POLAND: Morszczuk chilijski; PORTUGAL: Pescada chilena, Pescada do Chile; SPAIN: Merluza, Merluza chilena, Merluza común chilena, Peje palo, Pescada; UNITED KINGDOM: Chilean hake, Pacific hake, Silver hake, South Pacific hake; UNITED STATES: Chilean hake, Chilean whiting, English hake, Hake, Peruvian hake, Peruvian whiting, Whiting; YUGOSLAVIA: Oslic.

Literature: Guichenot (1848); Kaup (1858); Günther (1860); Cunningham (1871); Fowler (1945); Ginsburg (1954); Poulsen (1957); de Buen (1958); López (1963); Del Solar (1965); Mayr (1969); Arana (1970); Martínez and Leible (1974a and 1974b); Boerema (1977); Leible (1979); Inada (1981b and c); Inada *in* Cohen *et al.* (1990); Alarcón and Arancibia (1993); Espino, Castillo and Fernández (1995).

***Merluccius hubbsi* Marini, 1933**

Fig. 30

Merluccius hubbsi Marini, 1933, *Rev. Physis*, 11: 322 (type locality: province of Buenos Aires, Patagonian coast).

Synonyms: *Meluccius gayi* (non Guichenot, 1848): Cunningham, 1971, *Trans. Linn. Soc. London*, 27: 472 (eastern entrance of the Strait of Magellan). *Merluccius bilinearis* (non Mitchell, 1814): Miranda Ribeiro, 1915, *Arch. Mus. Nac.*: 1-2, Fig. , (from North America to Río de Janeiro). *Merluccius gayi hubbsi*: Mann, 1954, *Invest. Zool. Chil.*, 2(5): 83 (Patagonia). *Merluccius merluccius hubbsi*: Angelescu *et al.*, 1958, *Sec. Mar., Buenos Aires*: 164 (biology and taxonomy).

FAO Names: En – Argentine hake; Fr – Merlu d'Argentine; Sp – Merluza argentina.

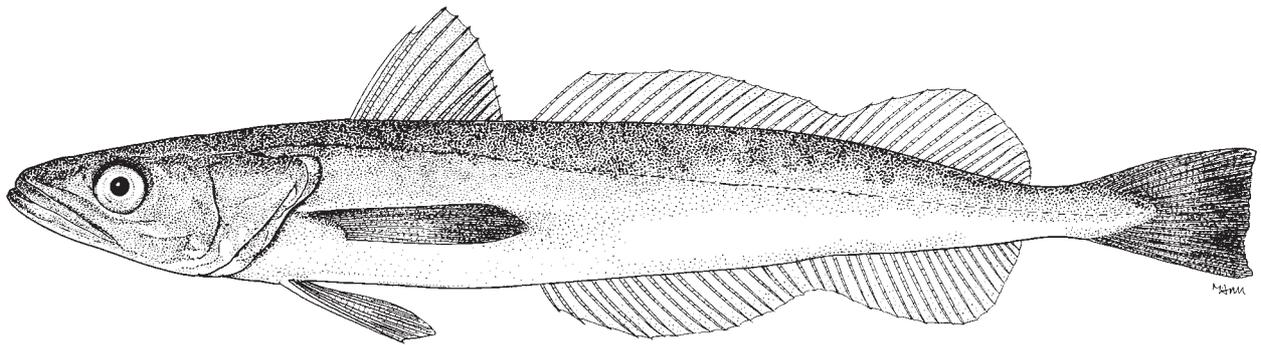


Fig. 30 *Merluccius hubbsi*

Diagnostic Features: Scales along lateral line 133 to 144. Head 24.4 to 28.0% of standard length. Snout 31.0 to 35.1%, eye diameter 16.8 to 22.5%, and interorbital 24.0 to 28.2% of head length. No scales on nasal membrane, lacrimal, and lower part of interopercular; scales on lower part of cheek and preopercular. Lower jaw very slightly prominent. Gillrakers on first branchial arch 12 (13-14) 15, 2 to 4 on the upper arm and 10 or 11 on the lower. 1D 10 (12) 12 rays; 2D 36 (38) 38 rays; A 38 38-(39) 41 rays. Pectoral fins with 14 (15) 15 rays, length 15.1 to 21.2% of standard length; pectoral-fin rays do not normally reach the anal-fin origin. Ventral fins 11.3 to 16.1% of standard length. Posterior margin of caudal fin usually truncate in adults, sometimes convex in juveniles. Vertebrae 50 to 53, 5 or 6 of them cervical with 3 or 4 ribs. **Colour:** greyish on dorsal region and silvery white on belly.

Additional Information: According to Inada (1981b), *M. hubbsi* has 3 or 4 cervical ribs although on page 91, Fig. 42 only 3 are indicated. The material examined by Inada (page 49, Table 15) comes from an area situated south of parallel 43°S and west of 59°W, where according to our data, *Merluccius patagonicus* are also present.

Geographical Distribution: Southwestern Atlantic, from parallel 21°30'S to 49°S. To the south and east of the Argentinian coast, *M. hubbsi* overlaps with *M. patagonicus*, and to a lesser extent, with *M. australis polylepis* near Beagle Channel and the eastern coast of Tierra del Fuego. Two of the specimens studied (MNHN 1999-0376 and MNHN 1999-0377) were caught between 262 and 248 m off Rio de Janeiro (21°35'S – 40°06.16'W). Seret and Andreata (1992) note that another specimen caught at 785 and 750 m depth (21°31.42'S – 40°06.83'W) was assigned to this species, establishing the northernmost record of *M. hubbsi* (Fig. 31)

Habitat and Biology: Argentine hake undertakes migrations associated with high-production oceanic fronts in the area between 34° and 44°S; it migrates north from the continental shelf to deeper waters in summer/autumn and returns at the beginning of spring. Larvae feed almost entirely on copepods; larger fish feed mainly on Argentinian squid (*Illex argentinus*), small anchovy, Myctophidae (*Gymnoscopelus* spp., *Myctophum* spp. and *Lampanyctus* spp.), as well as fish of their own species. The species carries out daily vertical migrations in relation to feeding. In the common Argentinian-Uruguayan fishing area, first sexual maturity is reached at 34 cm in females and 30 to 39 cm in males; in the Isla Escondida area, sizes are 30 cm for females and 39 cm for males. Spawning occurs partially and successively at various times and in different areas, which leads us to believe the existence of various reproductive groups, although it is unknown to what degree they mix. Egg laying takes place in different areas all year long, mainly concentrating in the south (42°S and 44°S) during the summer and to the north of 39°S in autumn and winter. Isla Escondida is another main springtime spawning area.

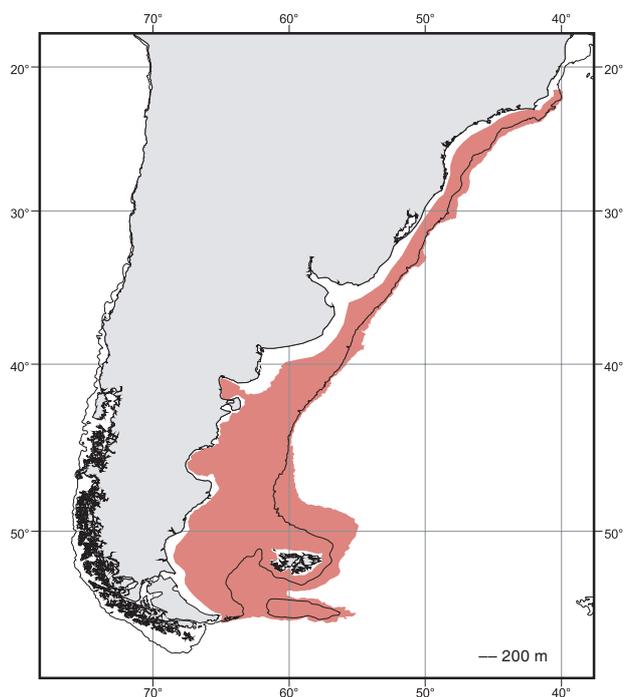


Fig. 31 *Merluccius hubbsi*
■ Known distribution

Biological data referenced to Argentinian or "bonaerense" hake should be dealt with cautiously, so as not to confuse it with *M. patagonicus*, and to a lesser extent, with *M. australis polylepis*.

Size: Maximum recorded length is 95 cm; males common to 50 cm, females to 60 cm.

Interest to Fisheries: Demersal resources, and in particular hake, constitute the main fishery production of the South American Atlantic coast. Argentine hake (*Merluccius hubbsi*) is the principal target fishery in the Rio de La Plata area as well as on the Patagonian Shelf; despite the decrease in recorded catches in the last few years, it remains the main species in terms of landing. It is worth mentioning, however, that catches of southern hake (*Merluccius australis*) have probably been recorded as Argentine hake.

Argentine hake is an important constituent in the fisheries of Argentina and Uruguay. Argentinian trawlers began fishing in 1950 and continued to develop during the 1960s, with the addition of Uruguayan trawlers and foreign fleets. In the mid-1970s, following the creation of joint Spanish-Argentinian companies new technologies were introduced and the Spanish market started to develop. This resulted in a notable increase in production where the Argentinian fleet catches dominated. Fishing continued to develop to the end of the 1990s, reaching 680 000 tonnes in 1997; thereafter, catches declined drastically to less than 300 000 tonnes in 2000 and 2001.

This species, along with southern hake (*Merluccius australis*), has been caught in the Falkland Islands since 1970, where a fishing protection area was set up in 1986 and extended in 1990 in order to avoid overexploitation of resources. Argentine hake is marketed fresh in Argentina and Uruguay, and is exported frozen whole and gutted or in fillets primarily to the European Union and the United States.

Local Names: ARGENTINA: Merluza argentina, Merluza bonaerense, Merluza común; JAPAN: Aruzenchin-heiku; SPAIN: Merluza, Merluza Argentina, Merluza hubbsi; UNITED KINGDOM: Argentine hake.

Literature: Angelescu *et al.* (1958); Miranda Ribeiro (1903 and 1915); Fowler (1945); Ginsburg (1954); Rojo (1976); Inada (1981); Menni *et al.* (1984); Inada *et al.* (1986); Podestá (1989); Inada *in* Cohen *et al.* (1990); Séret and Andreatta (1992); Ehrlich and Ciechowski (1995); Ruíz and Fondacaro (1997); Cousseau and Perrotta (1998).

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

Fig. 32

Gadus merluccius Linnaeus, 1758, *Syst. Nat.*, ed. X: 254 (type locality: 'Habitat in Oceano').

Synonyms: *Gadus ruber* Lacépède, 1803, *Hist. Nat. Poiss.*, 5: 671, & 673 (Scotland, Fécamp, Dieppe, Boulogne). *Merluccius smiridus* Rafinesque, 1810, *Caratt. Gen. Spec. Sicil.*: 25 (Sicily). *Onus riali* Rafinesque, 1810, *Ind. Ittiol. Sicil.*: 12 (Sicily). *Merluccius esculentus* Risso, 1826, *Hist. Nat. Eur. Mérid.*, 3: 220 (Nice). *Merluccius vulgaris* Fleming, 1828, *Hist. Brit. Anim.*: 195 (southeastern coast of England and Ireland). *Hidronus marlucius* Minding, 1832, *Naturl. Fische*: 84 (North Sea, Mediterranean). *Merlucius sinuatus* Swainson, 1838, *Nat. Hist. Fishes*, 1: 319, Fig. 73 (Mediterranean). *Merlucius ambiguus* Lowe, 1840, *Proc. Zool. Soc. London*, 8: 37 (Madeira). *Merlucius lanatus* Gronow, 1854, ed. Gray, *Cat. Fish.*: 130 (Mari Gallico, Mediterranean). *Merluccius argentatus* Günther, 1862, *Cat. Fish., Brit. Mus.*, 4: 346 (Iceland). *Merluccius linnei* Malm, 1877, *Göteb. Bohsul. Fauna*: 489 (Göteborg, Vinga). *Onus guttatus* Collet, 1890, *Bull. Soc. Zool. Fr.*, 15: 105 (Fayal, Azores). *Trachinoides maroccanus* Borodin, 1934, *Bull. Vanderbilt mar. Mus.*, 1(4): 120 (Casablanca).

FAO Names: En – European hake; Fr – Merlu européen; Sp – Merluza europea.

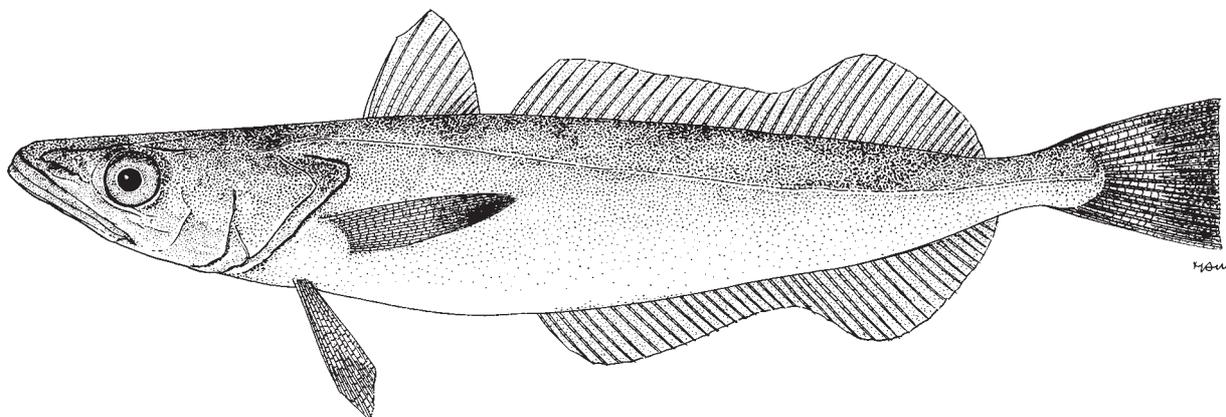


Fig. 32 *Merluccius merluccius*

Diagnostic Features: Scales along lateral line 127 to 156. Head 25.1 to 30.5% of standard length. Snout 30.2 to 34.5% of head length, eye diameter 16.0 to 21.0%, and interorbital 21.5 to 28.4%. Scales on nasal membrane, lacrimal, lower part of cheek, and preopercular; no scales on lower part of interopercular. Gillrakers on first branchial arch 8 (10) 12, 1 to 3 on upper arm and 7 to 9 on the lower. 1D 8 (10) 11 rays; 2D 35 (38-39) 40 rays; A 36 (38) 40 rays. Pectoral fins with 10 (14) 15 rays, length 14.1 to 18.7% of standard length, tips of pectoral fins reaching to level of anal-fin origin in small fish (less than 20 cm standard length). Ventral fins 14.0 to 19.1% standard length. Posterior caudal-fin margin usually truncate, becoming progressively concave with growth. Vertebrae 49 (51-52) 54, 5 or 6 being cervical with 3 or 4 ribs. **Colour:** dark silvery grey on back, lighter on the sides, white on belly; rainbow-hued on some specimen. No submandibular mark.

Additional Information: Part of the material used by Inada (1981b), attributed to the trinomen *Merluccius merluccius smiridus* (set out in Table 2, page 10), correspond to nine specimens from a Tunis (Mediterranean) market. The other part (USNM 219331, 219332 and 219333) originated from the Atlantic, as the longitudes and latitudes indicated correspond to a series of geographical points west of San Vicente Cape (Portugal).

Maybe this is the reason why the entity labelled by the trinomen *Merluccius merluccius smiridus* Rafinesque, 1810 possesses characters specific to both Atlantic and Mediterranean subspecies.

Two, possibly three, subspecies can be distinguished in the western Mediterranean:

Merluccius merluccius merluccius (Linnaeus, 1758)

(European Atlantic, Bay of Biscay, Portugal, north of Morocco and southwestern Mediterranean)

Pectoral fins larger than ventral fins

1D. 9 (10) 11; **2D.** 35 (38-39) 40; **A.** 36 (38) 40; **P.** 10 (14) 15; **V.** 7; **Gr.** 8 (10) 12; **L.L.** 127-156;
TV. 49 (51-52) 52; **CV.** 6; **CC.** 4

Merluccius merluccius smiridus Rafinesque, 1810

(northwestern Mediterranean)

Pectoral and ventral fins of equal size

1D. 8 (10) 11; **2D.** 35 (38-39) 40; **A.** 36 (38) 40; **P.** 10 (14) 15; **V.** 7; **Gr.** 8 (10) 12; **L.L.** 133-143;
TV. 49 (51-52)-54; **CV.** 6; **CC.** 4

One of the specimens examined (**MNHN** 1966-0435) coming from the Red Sea (20°00'N – 39° 00'E), is the first record of *Merluccius* in this sea; thus it would be antillessepsian. The trinomen *Merluccius merluccius lessepsianus* is therefore proposed here, despite there being only one specimen, as it is the only one with pectoral fins smaller than the ventral fins.

Geographical Distribution: Eastern Atlantic, from the coast of Norway and Iceland to the Mauritanian coast (Cape Blanc, 21°N), where it is quite rare. There are 3 specimens (**MNHN** 1956 0019) from the Azores in the Muséum National d'Histoire Naturelle de Paris, which we have not examined. The species shares its distribution area along the coast of Morocco with *M. senegalensis* (Fig. 33).

Habitat and Biology: A demersal and benthopelagic species. Lives on muddy or mud-sand grounds on the continental shelf and slope, in depths between 50 and 370 m, although it can also be found in depths of 30 m as well as 1 075 m. In the north and northeast of the Iberian Peninsula (Galicia and Bay of Biscay), *M. merluccius* feeds on crustaceans and fish. Specimens smaller than 15 cm feed mainly on euphausiids, which are present in 85% of stomachs. Larger specimens gradually feed more on fish, mainly blue whiting (*Micromesistius poutassou*), which are present in all stomachs of specimen more than 50 cm in length. In the Mediterranean and especially in the Adriatic, juveniles of 13-cm length consume mainly Amphipoda, Mysidae, *Pomatoschistus*, and decapods of the genus *Processa*; adults feed mainly on clupeiforms. In Atlantic

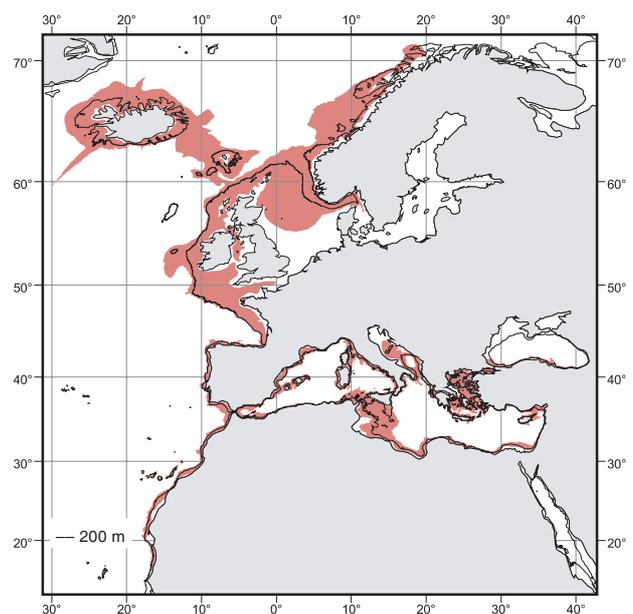


Fig. 33 *Merluccius merluccius*
Known distribution

populations, age/size relation to sexual maturity is 57 cm and seven years for females, 40 cm and five years for males. In the Mediterranean females reach maturity at 36 to 40 cm and males at 26 to 27 cm. The spawning period is long and varies according to population; four or five spawnings occur without an ovary resting period, with approximately 20% of the oocytes per emission. Small oocytes remain after the last emission and degenerate when the ovary enters the resting period. In the Mediterranean, spawning fluctuates between December and June; from February to May in the Bay of Biscay; from April to July in Iceland; and from May to August to the west of the British Isles. In the western Mediterranean, there are two recruitments per year, in the spring and in autumn at between 50 and 250 m depths, with relatively stable oceanographic conditions. Fecundity is estimated at between 2 and 7 million oocytes per female.

Size: Maximum recorded length in the Atlantic is 140 cm and 15 kg, rarely exceeds 100 cm and 10 kg; minimum size in Mediterranean 89 cm and 6 kg, common up to 60 cm.

Interest to Fisheries: European hake has been a traditionally important food for the population of western Europe. It is primarily caught with trawls but also with longlines, both techniques being the most commonly used for this species. Also used are bottom-set gillnets and Danish seines. European hake is a target species for many European fisheries, as well as an important component of multispecific fisheries carried out by all coastal countries, from North Africa to Iceland, with the main fisheries in northern and western Scotland, west and southern Ireland, Bay of Biscay, and the coasts of Spain, Portugal and Morocco.

European northern Atlantic populations are generally exploited by fleets with large-sized vessels, allowing them to reach distant fishing grounds situated on the continental margin and depths of over 200 m. Ships exploiting southern European populations are usually smaller and operate on the narrow continental shelf and return to the harbour daily.

On western African fishing grounds, from the Strait of Gibraltar to Senegal, large foreign fleets have traditionally operated together with fleets of coastal countries. At the beginning of the twentieth century, Spanish sailing trawlers along with artisanal gillnetters and longliners caught hake in these fishing grounds. After 1910, these fleets became more numerous and motorized. Later, Portuguese, Soviet Union and Polish fleets joined the fisheries. Hake is caught as target species and as a bycatch of other trawl fisheries targeting cephalopods and shrimp, as well as by gillnets. Before the EEZ declaration in the 1970s, catch regulations were rather loose and fishing was generally operated through bilateral agreements. After the EEZ declaration, foreign fleet restrictions were slowly introduced, and by 2000, European fleets no longer operated in Moroccan fishing grounds. In Morocco hake is caught by traditional trawlers and multipurpose vessels using trawls, purse seiners and longlines, which in the last few decades, developed at the same time that foreign fleets decreased during the period 1981-1983.

In the Mediterranean, hake is mainly caught with trawls, and to a lesser extent, with longlines and gillnets; in this multispecific trawl fishery, hake is one of the target species.

Since 1950 in the northeast Atlantic, catches have been dominated by Spanish, French, and Portuguese fleets. In the Mediterranean catches are made by European Union countries. In the eastern central Atlantic up until 2 000, most catches were made by Spanish and Moroccan fleets. The largest catches come from the northeast Atlantic, where catches registered a maximum of 160 000 tonnes before a steady decline, reaching under 40 000 tonnes in 2001. Catches in the Mediterranean and Black Sea progressively increased, reaching around 50 000 tonnes in 1985, and then dropped by half ten years later. After various years of annual catches totalling between 10 000 and 14 000 tonnes, eastern central Atlantic catches have decreased, recording a recent drop to 5 000 tonnes.

European hake, for its quality, is almost entirely marketed fresh, whole or filleted, to specialized restaurants or retail markets.

Local Names: DENMARK: Kulmule; FINLAND: Kummeli; FRANCE: Brochet de mer, Merlu, Merluce, Merluchón; GERMANY: Hechtdorsch, Seehecht; ICELAND: Lysingur; NETHERLANDS: Stockvisch heek; NORWAY: Lysing; POLAND: Morszczuk; PORTUGAL: Marmota, Pescada, Pescadinha; SPAIN: Carioca, Merluza, Pescada, Pescadilla; SWEDEN: Kummel; UNITED KINGDOM: Hake.

Literature: Linnaeus (1758); Lacépède (1803); Rafinesque (1810); Risso (1826); Fleming (1828); Minding (1832); Swainson (1838); Lowe (1840); Gronow (1854); Pappe (1854); Günther (1862); Malm (1877); Vaillant (1888); Marini (1933); Borodin (1934); Hart (1948); Cadenat (1950); Maurin (1952); Maurin (1954a and b); Franca (1952); Letaconnoux (1953); Franca (1956a and b); Angelescu *et al.* (1958); Doutre (1960); Lozano Cabo (1960); Franca (1962); Lozano Cabo (1965); Maurin (1965 and 1968); Larrañeta (1970); Froglija (1973); Inada (1981b); Sarano (1984); González *et al.* (1985); Orsi Relini *et al.* (1989); Inada *in* Cohen *et al.* (1990); Casey and Pereiro (1995); Ramos and Fernández (1995); Recasens *et al.* (1998).