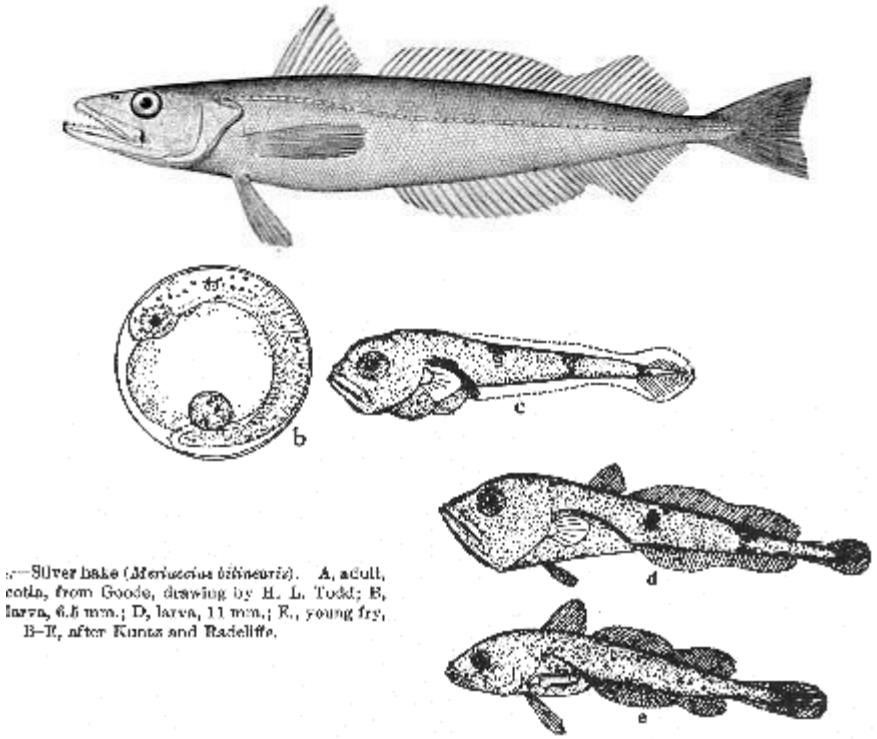
Silver Hake

Merluccius bilinearis (Mitchill) 1814
[Jordan and Evermann, 1896-1900, p. 2530.]



...—Silver hake (*Merluccius bilinearis*). A, adult, cotin, from Goode, drawing by H. L. Todd; B, larva, 6.5 mm.; D, larva, 11 mm.; E., young fry, B–E, after Kuntz and Radcliffe.

Figure 84 - Silver hake (*Merluccius bilinearis*).

A, adult, Nova Scotia, from Goode, Drawing by H. L. Todd;
B, egg;
C, larva, 6.5 mm.;
D, larva, 11 mm.;
E, young fry, 23 mm.
B-E after Kuntz and Radcliffe.

Description

The presence of two separate and well developed dorsal fins, both of them soft-rayed, the second much longer than the first, combined with the location of the ventrals on the chest, is sufficient field mark to distinguish the silver hake from all other Gulf of Maine fishes except for the true hakes (genus Urophycis, p. 221). And there is no danger of confusing it with any of the latter, for it lacks the chin barbels so characteristic of them, and its ventrals are of the ordinary finlike form, whereas those of the true hakes are altered into long feelers. It is a rather slender fish, about five to six times as long as it is deep, its body rounded in front of the vent but flattened sidewise behind it, with large flat-topped head occupying [page 174] about one-fourth of the total length; large eyes; and wide mouth armed with two or more rows of sharp recurved teeth, and with the lower jaw projecting beyond the upper.

The first dorsal fin (11 to 14 rays) originates close behind the gill openings, is roughly an equilateral triangle in shape, and is separated by a short space from the second dorsal. The second dorsal (38 to 41 rays) is about four times as long as the first dorsal, but hardly more than half as high, and is of distinctive outline, being deeply emarginate two-thirds of the way back, with the rear section the higher of the two. The anal fin (38 to 41 rays) corresponds in height and in shape to the second dorsal, under which it stands. The caudal fin is square tipped when widespread, but its rear margin is weakly concave, otherwise. The pectorals are rather narrow, their tips slightly rounded, and they reach back far enough to overlap the second dorsal a little. The ventral fins, situated slightly in front of the pectorals, are perceptibly shorter than the latter, with about half as many rays (7).

Color

The silver hake is dark gray above of brownish cast; but silvery-iridescent, as its name implies, or with golden reflections. The lower part of its sides and its belly are silvery. The inside of its mouth is dusky, the lining of its belly blackish. The fish is brightly iridescent when taken from the water, but fades soon after death.

Size

Maximum size about 2½ feet long and about 5 pounds in weight, but adults average only about 14 inches long.

Habits

Silver hake are strong swift swimmers, well armed and extremely voracious. They prey on herring and on any other of the smaller schooling fish, such as young mackerel, menhaden, alewives, and silversides. Probably a complete diet list would include the young of practically all the common Gulf of Maine fishes, for Vinal Edwards [page 175] recorded the following from silver hake taken at Woods Hole: alewife, butterfish, cunner, herring, mackerel, menhaden, launce, scup, silversides, smelt, also the young of its own species. A 23¼ inch silver hake, taken at Orient, N. Y., had 75 herring, 3 inches long, in its stomach.[22] And it is probable that the silver hake that frequent Georges Bank feed chiefly on young haddock. They eat squid when occasion offers. The small ones in particular prey regularly on large shrimp (Pandalus) in the deep troughs in our Gulf, where experimental trawlings by the Atlantis in the summer of 1936 took about four times as many silver hake at stations where these shrimps were abundant as at stations where shrimp were scarce.[23] they sometimes take crabs, and bite freely on almost any bait, such as clams or cut fish.

Though silver hake do not school in definite bodies, multitudes of them often swim together, and such bands sometimes drive herring ashore, and strand themselves, in the pursuit. Events of this sort are oftenest reported in early autumn when the spent fish are feeding ravenously after the effort of spawning, but this may also happen at any time during the summer. Thus, Prof. A. E. Gross saw the beach at Sandy Neck, Barnstable, Mass., covered with them on several occasions in June and July 1920.[24] Doctor Huntsman informs us that spent fish frequently strand on the beaches on both sides of the Bay of Fundy in September. We once saw an army of silver hake harrying a school of small herring on a shelving beach at Cohasset, Mass. We half filled our canoe with pursuers and pursued, with our bare hands.

It is said that European silver hake rest on the bottom by day and hunt by night, and it is usually at night that the American fish run up into the shallows and enter the traps. But strandings also take place by day. Silver hake, like many other rapacious species, are wanderers, independent of depth within wide limits, and of the sea floor. Sometimes they swim close to the bottom, sometimes in the upper levels of the water, their vertical movements being governed chiefly by their pursuit of prey. Their upper limit is the tide line; at the other extreme they have been trawled repeatedly as deep as 150 to 400 fathoms on the continental slope off southern New England, and as deep as 296 fathoms off North Carolina.[25] When they are on bottom they are caught indifferently on sandy or pebbly ground, or on mud (as in the deep trough west of Jeffreys Ledge, p. 175); seldom around rocks.

The lowest temperatures in which we have known of silver hake being taken have been between 38° and 40° F. (probably), in the bottom of the deep trough west of Jeffreys Ledge, August 1936,[26] about 40° F. (4.4° C.) at 28 fathoms off New York, February 28, 1929, and about 39.5° F. (4.2° C.) at 19 fathoms in the same general region, February 5, 1930.[27] And most of the winter and early spring records for it have been where the bottom temperature was warmer than about 43° F. (6° C.).[28] At the other extreme, we have never heard of them in any numbers where the water was warmer than about 64° F. (18° C.); the monthly catches made in Cape Cod Bay (see p. 180) are especially instructive in this regard.

Breeding habits

The silver hake is the most important summer spawner among Gulf of Maine fishes that are important commercially, just as the haddock is for spring and the pollock for autumn. The Gulf is probably its most prolific nursery, too, and it spawns over the outer part of the Nova Scotia Banks also, as far east as Sable Island, Dannevig[29] having recorded large egg catches in the offing of Halifax. But this is probably its eastern breeding limit, for the Canadian Fisheries Expedition found no silver hake eggs or fry on Banquereau or Misaine Banks; in the Laurentian Channel; or on the Newfoundland Banks. In the opposite direction, eggs in fair numbers have been taken in the tow nets off Woods Hole in July and August; the Albatross II has found them and the resultant larvae near shore off Long Island in June and July, with eggs as far south as the offing of Cape May; and the young fry have been caught off New York[30] from spring to autumn.

We have no evidence that silver hake commence to spawn before June, north of Cape Cod, our earliest egg record having been for the 11th of that [page 176] month; in our Gulf, egg production (as evidenced by the numbers of eggs taken in our tow nets) is at its height in July and August and continues through September, though less freely, with October 22 as our latest date. Similarly, the Canadian Fisheries Expedition found no silver hake eggs in Nova Scotia waters east of Cape Sable in May, but many in July.

It is impossible to establish the exact temperature at which silver hake are spawning at any particular station without knowing at what level ripe fish are in the water, which may be anywhere between the surface and the bottom with this species. It may be definitely stated, however, that they never spawn in as cold water as cod and haddock usually do in the western Atlantic. In 1915, for example (a representative season), it was not until the entire column of water was slightly warmer than 41° F. at the locality in question that we found the first silver hake eggs in our Gulf. And if the parent fish were in the upper water layers, as they may have been, all the rich spawnings we encountered in the Gulf during that year, and during the next, took place in temperatures considerably higher still. Similarly, the silver hake eggs towed off Halifax by the Canadian Fisheries Expedition in July 1915, and off Shelburne, Nova Scotia, by the Grampus on September 6 of that same year may have been spawned in water warmer than 50° F., there being no need to assume that the parent fish were lying in the colder bottom stratum. As the spawning season draws to its close, in September and October, the minimum temperatures for most of our egg stations have been higher than 46°, with one (our latest record for the season) as warm as 57° F. at all depths. These data point to 41° to 45° F. as the lowest temperature limit for the spawning of the silver hake, with most of the eggs produced at 45° to 55° F.

In the case of any fish producing buoyant eggs the tendency of the latter to rise (unless counteracted by active vertical circulation of the water) insures that their development shall take place at the temperature of the upper stratum of water, not at that of the deeper levels where they were spawned. And the silver hake is no exception to this rule. While we have towed its eggs in June, when the surface was still only about 42° F., most of the egg records, and all our rich catches, were all made where the upper 5 fathoms or so were warmer than 50° and usually warmer than 55° F., with the temperature of the immediate surface 60° or higher in most cases. Similarly, silver hake eggs taken off Halifax by the Canadian Fisheries Expedition in July 1915, and off Shelburne, Nova Scotia, by the Grampus on September 6 of that year, may well have been in water at least as warm as 53° F., there being no reason to suppose they were far below the surface.[31] All this suggests that incubation does not proceed normally in water cooler than about 50°, and that it is most successful in temperatures as high as 55° to 60° F. This evidence that while the eggs of the silver hake may be spawned in low temperatures, a comparatively warm surface layer is necessary for their later development, offers a reasonable explanation for the failure of this fish to breed successfully along the New Brunswick shore of the Bay of Fundy, where active vertical circulation maintains surface temperatures as low as 50° to 55° F. throughout the summer, at least in most years. At the other extreme, the failure of the eggs that had been fertilized artificially to develop in the hatchery at Woods Hole in August temperatures points to 65° to 70° F. as the upper limit to successful incubation.

According to Kuntz and Radcliffe[32] only part of the eggs mature at one time, but we know of no estimate of the number of eggs a single female may produce. The eggs are buoyant, transparent, about 0.88 to 0.95 mm. in diameter, with a single yellowish or brownish oil globule of 0.19 to 0.25 mm. Incubation is rapid; Kuntz and Radcliffe assumed a duration of 48 hours at Woods Hole, but it has not been determined for the cooler waters in the Gulf of Maine. The larvae are about 2.8 mm. long at hatching, slender, with small yolk sac, and they are made recognizable by the fact that the vent is located on one side, near the base of the larval fin fold, as is the general rule in the cod family, not at its margin as in most larval fishes, and that the trunk behind the vent is marked with two black and yellow cross bars. The dorsal and anal fins and the caudal fin have all assumed their definite outlines by the time the little fish is 10 to 11 mm. long, and fry of 20 to 25 mm. begin to resemble their parents in general appearance.

Evidently the young silver hake take to the deeper water layers toward the end of their first summer or that autumn, when about 1 to 3 inches long, for fry as small as this have been trawled in good numbers off southern New England at 150 fathoms and deeper at that season during the early explorations of the U. S. Fish Commission,[33] by the Albatross II off Rockaway and off Long Beach, N. Y., in November 1928. By February they may be anywhere from 1¼ to 5 inches long, depending on how early they are hatched, on when they take to bottom, and on the feeding conditions they find there.[34] they may be anywhere from about 2 inches long to about 6½ inches long by April.[35]

The sizes of the many small silver hake that we have collected at different times of the year, both within the Gulf of Maine and southward as far as the offing of Chesapeake Bay, suggest that they reach an average length of 5½ to 7½ inches when 1 year old, and of about 9½ to 11 inches at 2 years of age, i.e., in their third summer.[36] Fish of 11 to 14 inches that dominated the pound-net catches made near Provincetown, August 1939,[37] were three-year-olds, probably. The rate of growth has not been traced for the older fish, nor can it be deduced from that of the European silver hake for the latter grows to a considerably greater length, averaging as much as 30 inches at 8 years in the extreme northerly part of its range (Iceland) and considerably larger still, in the southern part (Gulf of Gascony and off Morocco).[38] But it is reasonable to assume that the growth of the American fish varies similarly with the latitude (i. e., that it is most rapid in high temperatures) and that the American female, like the European, grows faster than the male. The European Merluccius matures at 2 years, which is probably true of the American species as well.

General range

Continental shelf of eastern North America, northward to the Newfoundland Banks, southward to the offing of South Carolina;[39] most abundant between Cape Sable and New York. It is represented farther offshore and in the Gulf of Mexico by forms, the relationship of which to the Merluccius of our northeastern coast has not yet been determined. The silver hake is represented in Europe by a close relative, the European hake (Merluccius merluccius), an excellent account of the natural history and migrations of which is given by Le Danois.[40]

Occurrence in the Gulf of Maine

Silver hake are familiar fish all around the coasts of the Gulf of Maine from Cape Cod to the Bay of Fundy and to the west coast of Nova Scotia. But it has long been a matter of common knowledge that their chief center of abundance is in the southwestern part of the Gulf. Thus in 1945 (most recent year for which detailed regional statistics are available), the reported landings were between 46 and 47 million pounds[41] from off eastern Massachusetts in general, including the shores of Cape Cod out to the western slope of the so-called South Channel, contrasting with only about 4 million pounds for the western and central coasts of Maine, and with only about 6,500 pounds for eastern Maine. Silver hake, it is true, are said to be common in the Passamaquoddy region (more so in some years than in others), also around Grand Manan at the mouth of the Bay of Fundy. And they are reported at various localities along the Nova Scotia side of the Bay and along western Nova Scotia. But they are not mentioned in the statistics of the Canadian catches for these waters, hence cannot be very plentiful there.

Silver hake are numerous over the west-central deeps of the Gulf also; in fact we found this the most plentiful fish at 70 to 90 fathoms in the basins off Cape Cod in the southwestern part of the Gulf and off Mount Desert in the northeastern, in August 1936; also in the trough west of Jeffreys Ledge, where the catches of them averaged 292 fish (maximum 840, minimum 1) as reduced to the common standard of one hour's trawling with an 82-foot shrimp trawl. And it is interesting that the catch there averaged about four times as great [page 178] (494 fish) at the stations where shrimp (Pandalus) were plentiful as at the stations where these were scarce (114 fish), evidence that silver hake congregate where feeding conditions are good.[42]

Reported landings throw little light on the numbers of silver hake that frequent the offshore rim of our Gulf, both because the otter trawls used there are so large-meshed that many pass through, and because most of those that are caught on Georges and Browns Banks are thrown overboard when the price is low.[43] Experimental trawling, however, on Georges Bank, April to September 1913, yielded about one-seventh as many silver hake on the average (about 1,800 fish) as haddock (about 14,000 fish) per trip, and the Albatross III caught an average of about 150 silver hake, running about one-half pound in weight, per trawl haul, in 250 hauls on various parts of Georges Bank, July, August, and September of 1948, 1949, and 1950. Thus they are moderately plentiful at least over Georges Bank as a whole, and there is no reason to doubt that this applies to Browns Bank equally.

These catches do not suggest any definite concentration on any one part of the bank, at least for summer, except that the largest that were made on its northern part were in hauls from shoaler than 30 fathoms, whereas the largest catches on the southern part were in hauls from deeper than 60 fathoms, a difference which may well have been a matter of the food supply.[44] In April, however, of 1950, the silver hake were not only more plentiful along the northern edge of the bank (average 305 per haul) than on the southern part (average 77 per haul) but so strictly confined to the deeper levels that the total yield of 66 trawl hauls at shoaler than 60 fathoms was only 11 fish, contrasting with an average catch of 232 fish per haul at 60 fathoms and deeper (25 hauls).[45]

Silver hake spawn along the entire coastal zone from Cape Cod to Grand Manan, as proved by the locations of the egg catches (fig. 85). The sloping sandy bottom around the northern extremity of Cape Cod and off the eastern slope of the Cape evidently is an important center of reproduction. Thus we found an abundance of eggs off Race Point on July 7, 1915; our tow nets yielded many eggs at two stations off the outer shore of the Cape on July 22 of the following year, when a 15-minute tow there at 20 fathoms, with a net one meter in diameter, produced approximately 25,000 larvae of 3 to 7 mm., the richest haul of young fish we have ever made in our Gulf. And the fish were still spawning there a month later, as proved by the presence of eggs.

Other occasions when we have taken silver-hake eggs in large numbers have been off Duck Island near Mount Desert on July 19 and on August 18, 1915; near Monhegan Island, August 4, 1915; off Wooden Ball Island near the mouth of Penobscot Bay on August 6, 1915; and off Rye, N. H., on July 23 of that same year. But we have never found them in any number in Massachusetts Bay though some eggs have been taken there on several occasions (fig. 85).

Unfortunately, no quantitative hauls were made at any of the more productive egg stations, hence the number of silver-hake eggs present in the water cannot be approximated. But the vertical net yielded about 190 eggs per square meter of sea surface at one station in the eastern basin.

Apparently the silver hake does not breed successfully in the northern side of the Bay of Fundy for neither its eggs nor its fry have ever been found there. But the capture of a few eggs in Petit Passage in our tow nets on June 10, 1915, suggests that it may spawn on the southern side of the bay as the cunner does (p. 478). And it may be expected to do so along the west coast of Nova Scotia, for the Canadian Fisheries Expedition found eggs at several stations off outer Nova Scotia, eastward to the longitude of Canso.

The presence of silver hake on Georges Bank throughout the summer is presumptive evidence of local spawning, though we have taken no silver hake eggs or larvae there.

The locations where we have found its eggs suggest that the silver hake, in the Gulf of Maine, spawns chiefly in water shoaler than 50 fathoms. But we have made one rich haul of its eggs in the center of the eastern basin. And the discovery of its eggs over the continental slope off Nova Scotia [page 179] by the Canadian Fisheries Expedition,[46] with the presence of ripe fish as well as of spent, in depths as great as 150 fathoms and more off southern New England[47] proves that it spawns over deep water also. The European silver hake usually spawns in 50 to 100 fathoms.

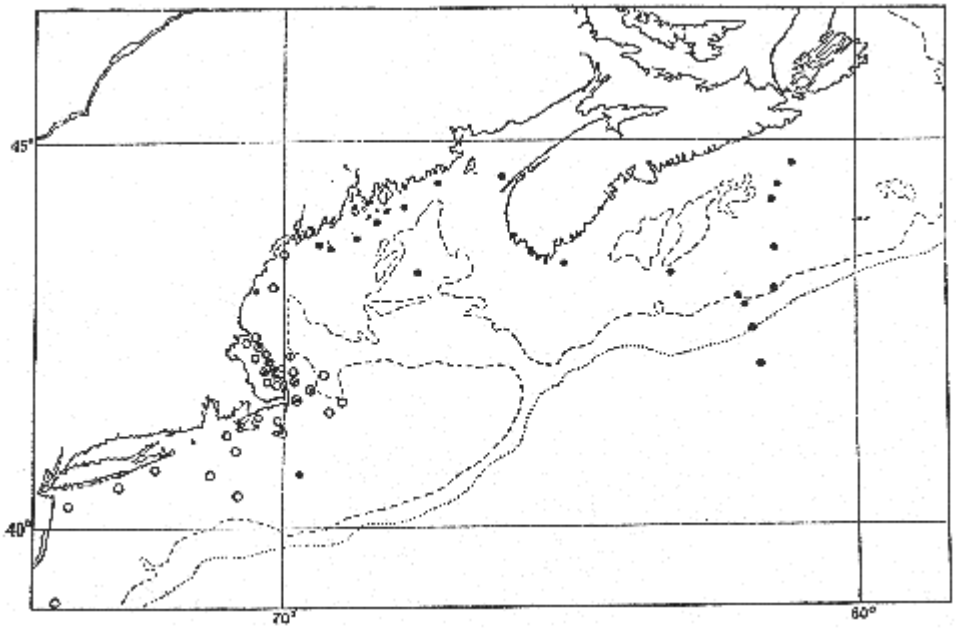


Figure 85.—Localities where eggs ●, and larvae ○ of silver hake, or both ⊙ have been taken.

All our records for the free-drifting larvae of the silver hake in the Gulf, unlike those for its eggs, have been in the southwestern part. And we have towed along the coast of Maine so often in August, September, and October (when the larvae spawned from June to August might have been expected) that our failure to find them east of Cape Elizabeth seems sufficient evidence that they actually are limited, in their regular occurrence, to the southwestern part of the Gulf (they parallel the pelagic stages of the cod, the haddock, and the flatfishes in this) and to the waters westward from Cape Cod. Dannevig, too, has called attention to the absence of larvae of the silver hake in Nova Scotia waters, contrasted with the presence of their eggs there.[48]

One possible explanation for this contrast between larvae and eggs is that it may mirror the relative percentage of eggs that hatch in the regions in question. A more likely explanation we think, when taken with other similar facts of distribution, is that it results from a peripheral drift around the shores of the Gulf from northeast to southwest, in which the eggs take part first and then the resultant larvae.

This type of circulation, in fact, has been established so well for our Gulf by hydrographic evidence, that some such involuntary migration is inevitable, not only for various buoyant fish eggs and larvae that are produced near the coast line, but likewise for the drifting communities of invertebrates, and of plants.

It is now known that large numbers of the silver hake that descend to the deeper water layers in the southwestern part of the Gulf during their first autumn remain there during the following [page 180] year, some of them still longer. Thus our experimental trawlings, in August 1936, yielded large numbers of the 1-year-olds at 70 to 90 fathoms in the deep basins off Cape Cod and west of Jefferys Ledge; also off Mount Desert.[49] And nearly all of the silver hake that come close enough inshore to enter the traps in the southwestern part of the Gulf, or to strand on the beaches there, are good sized individuals of 9 inches and larger. In fact, the only instance that has come to our notice of any considerable inshore catch of one-year-old fish (about 6 to 8 inches long) in the Cape Cod Bay region was near Provincetown, August 1939, when about 1,900 of them were taken during a 14-day period.[50] Huntsman, however, reports all sizes near shore from yearlings on, in the Passamaquoddy region to the northeast, and in the neighboring parts of the Bay of Fundy.

The silver hake 3 years old and older, that provide the commercial catches, sometimes appear in the Cape Cod Bay-northern Massachusetts region as early as the last week in March, regularly by May. Welsh saw some fish, for example, in Ipswich Bay in March and April in 1913 (a fairly representative season), considerable numbers in May, and an abundance in June. And this may be taken as typical for the whole coast line of the Gulf south of Portland; also for Georges Bank, where the first silver hake were taken by the otter trawlers from April 27 to 29 in 1913, and on almost every trip thereafter. We have not been able to learn how early silver hake appear on the coast of Maine east of Portland, or off western Nova Scotia, where it is only within the past few years that any attention has been paid them.

Around Cape Cod Bay, silver hake are usually the most plentiful in June; disappear more or less during August and September; and reappear in numbers in October, though far fewer then than in June, as is illustrated by the average monthly catches made by a set of eight traps at North Truro, for the years 1946-1947 and 1950:[51] June, 185,200 pounds; July, 36,700 pounds; August, 1,206 pounds; September, 1,780 pounds, and October, 10,852 pounds.

Whether their withdrawal thence in summer is a matter of food, or whether they move deeper to escape the heat of summer is a question for the future. Farther offshore in the western side of the Gulf, and to the northward, silver hake are about as plentiful in July and August as they are in June, as indicated by the vessel landings at Boston and Gloucester; somewhat less so in September and October. And what little information we have suggests that summer is the season of greatest plenty for them in the Bay of Fundy region, though there are far fewer of them there.

The great majority of the silver hake vanish from the inshore waters of the Gulf during the late autumn, November seeing the last of them in Massachusetts and Cape Cod Bays, according both to our own observations and to general report. The latest catches made on Georges Bank during the experimental trawlings of 1913 were on December 3 and 12. And though a few are brought in from the grounds off Massachusetts and Cape Cod during January, February, and March, the catches average less than 1/170 as great for those months as for the period May through October, as illustrated by the monthly landings by trawlers at Boston and Gloucester for 1947:[52]

January	1,400	July	4,444,000
February	2,255	August	4,879,000
March	1,700	September	1,974,000
April	7,540	October	2,381,000
May	860,000	November	438,000
June	1,158,000	December	207,000

It is probable that the fish of the year and those that are only 1 year old winter in the deeper depressions near where they first took to the bottom. It is unlikely that fish as small fish as those we have trawled in these situations, in August, can travel far.

The wintering ground of the Gulf of Maine population of larger silver hake is not known. Many of them may winter near the sea floor in the deep open troughs of the Gulf,[53] where the bottom water at 75 to 100 fathoms and deeper continues warmer than 39° F. (4° C.) even at the coldest time of year. Evidence in this direction is that it is only deeper than 60 fathoms that good April catches have been reported on Georges Bank (p. 180). It is also possible that part of them move out to the shelf off southern New England to winter, or [page 181] even to the continental slope as the European silver hake do. Scattered catches, in fact, of half-grown silver hake and larger are made by otter trawlers off southern New England, and off New York in January and February.[54] But it seems more likely that these are fish that either remain there throughout the year or that visit the coasts of New York and of southern New England at other times of year, than that they come from the Gulf of Maine.

Fluctuations in abundance in the Gulf of Maine

Every shore fisherman in the Massachusetts Bay-Cape Cod region knows that silver hake vary widely in abundance from year to year. Catches by one set of six pound-nets at North Truro on Cape Cod yielded about 60,000 pounds in 1946; 237,000 pounds in 1948; 232,000 pounds in 1949; and only about 10,000 in 1944; but about 458,000 pounds in 1950. Yearly fluctuations of this sort are to be expected at any given locality, in the case of any predaceous wanderer. And there is nothing in the available record to suggest that a major alteration has taken place in the numbers of silver hake in its center of abundance in the Gulf, whether upward or downward, since it has been an important fish on the market.

Occurrence to the westward and eastward of the Gulf of Maine

Silver hake are described as abundant from October to December as far westward as New York, sometimes in May also, though few are seen there in summer. And yearly catches of some 2 to 5 million pounds of "whiting" by pound nets[55] suggest that the beaches of New Jersey rival those of the Cape Cod Bay region in the seasonal abundance of silver hake. But we have not heard of any great numbers of them close in shore beyond Cape May, though pound nets do take a few as far south as the mouth of Chesapeake Bay. Farther out on the shelf, silver hake of all sizes are to be found at all times of the year, from the offing of southern New England, westward and southward, in numbers large enough for otter trawlers to land 3 to 5 million pounds yearly in New York and New Jersey,[56] and smaller amounts in Delaware.

Eastward from our limits we find the silver hake described as abundant[57] in outer Nova Scotian waters generally. But we have no clue as to their actual numbers there, relative to the Gulf of Maine, for they are not yet important enough commercially to be included in the Canadian fisheries statistics. The experimental cruises of the Newfoundland Fisheries Research Commission took them on Banquereau and Misaine Banks; in the northern side of Cabot Straits; on the southern part of the Grand Banks; and at Bay Bulls on the east coast of the Avalon Peninsula, which is the most northern record for them of which we chance to know. But it seems they are not known anywhere in the Gulf of St. Lawrence.[58]

Importance

Silver hake are as sweet a fish as one could ask, if eaten fresh or if slack salted over night and used for breakfast next morning. But they soften so fast that there was no regular market demand for them of old, and most of those that were caught incidentally were thrown overboard. In fact, we can remember seeing them used locally for fertilizer. Thus only some 37,000 pounds were saved in Maine and Massachusetts combined, even as recently as 1895. But improved methods of freezing fish were followed by landings of about two million pounds by 1902; of between four and five million pounds in 1905, rising through the years of the first world war to more than 14 million pounds in 1919.[59] the yearly landings then fell off, for some reason, to only about 6 million to 9 million pounds for the period 1924 to 1933, which was far less than the potential catch. But the landings then increased again, as frozen whiting became more popular in the Middle West, to about 15 million pounds in 1935, to about 40 million pounds by 1940, with from 46 million to 74 million pounds during the 6-year period 1942 to 1947.[60]

All but a small part of the Maine and Massachusetts landings, recorded in the following table, are from within the limits of the Gulf of Maine.

The silver hake now ranks fourth or fifth among Gulf of Maine fishes in amount landed. But it [page 182] ranks only about seventh in value. In 1945, the year when the catch was largest, its value was $1,736,200. Its rank is low as a sportsman's fish, for while it bites greedily, it puts up only a feeble resistance when hooked.

Year	Catch to nearest 1,000 pounds	Year	Catch to nearest 1,000 pounds
1919	14,607,000	1938	24,851,000
1924	6,377,000	1939	27,539,000
1929	7,875,000	1940	39,900,000
1930	7,943,000	1942	45,900,000
1931	6,936,000	1943	48,460,000
1932	6,379,000	1944	47,373,000
1933	8,678,000	1945	73,866,000
1935	15,420,000	1946	48,844,000
1937	21,038,000	1947	58,936,000

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[22] Nichols and Breder, Zoologica, N. Y. Zool. Soc., vol. 9, 1927, p. 163.

[23] For details, see Bigelow and Schroeder, Biol. Bull., vol. 76, 1939, p. 315.

[24] the Auk, vol. 40, 1923, p. 19.

[25] Goode and Bean, Smithsonian Contrib. Knowl., vol. 30, 1895, p. 387.

[26] No temperature was taken, but 38.6° F. (3.66° C.) was recorded there at 85 fathoms, on August 15, 1914, and 39.8° F. (4.33° C.) at 72 fathoms on August 15, 1913.

[27] Specimens trawled by Albatross II.

[28] Albatross II trawled a considerable number at stations scattered along the continental slope, from the offing of southern New England to the offing of Chesapeake Bay, in February 1929 and 1930, and in April 1930.

[29] Canad. Fish. Exped. (1914-1915), 1919, p. 27.

[30] Nichols and Breder, Zoologica, New York Zool. Soc., vol. 9, 1927, p. 163.

[31] these catches were all made either at the surface or in oblique hauls with open nets.

[32] Kuntz and Radcliffe (Bull. U.S. Bur. Fish., vol. 35, 1918, p. 109) describe the spawning and early development.

[33] Goode, Fish. and Fish. Ind. U.S., Sect. 1, 1884, p. 242.

[34] Fry taken in February of different years by Albatross II have ranged from 1¼ inches (31 mm.) long to 4¾ inches (120 mm.).

[35] In April 1930 Albatross II trawled young fry ranging in length from 2 inches (54 mm.) to 63/8 inches (163 mm.) long at a number of stations from the offing of Rhode Island to the offing of Chesapeake Bay, at 14 to 85 fathoms.

[36] For further details, see Bigelow and Schroeder (Biol. Bull., vol. 76, 1939, pp. 319-320, fig. 8).

[37] Information supplied by Wm. A. Ellison, Jr.

[38] Belloc, Notes et Memoires No. 21, Office Scientifique et Technique des Pêches Maritimes, France, 1923.

[39] the silver hake has been said, repeatedly, to range southward to the Bahamas, in deep water, following Jordan and Evermann (Bull. 47, U.S. Nat. Mus., Pt. 3, 1898, p. 2530). But the most southerly positive record we have found for it is off Charleston, S. C. (Blake Sta. 313, lat. 32° 32' N., long. 78° 45' W.; Goode and Bean, Smithsonian Contrib. Knowl., vol. 30, 1895, p. 387).

[40] Notes et Mem., 2, Off. Sci. Tech. Pêches Maritimes, France, 1920.

[41] "Round" and dressed fish combined.

[42] For further details, see Bigelow and Schroeder (Biol. Bull., vol. 76, 1939, p. 308, table 1; p. 314, table 5.)

[43] Reported landings, 1945-1947, ranged between 3,000 and about 33,000 pounds for Georges Bank, between 0 and 6,000 pounds for Browns.

[44] the average catch per haul was 262 fish from shoaler than 30 fathoms and 151 fish from deeper than 60 fathoms on the northern part of the bank; 90 fish per haul from shoaler than 30 fathoms and 285 fish per haul from deeper than 60 fathoms on the southern part.

[45] Twenty-one trawl hauls at 60 fathoms and shoaler yielded none at all in March; but no hauls were made in that month deeper than 60 fathoms, where the silver hake doubtless were.

[46] Dannevig, Canadian Fish. Exped., (1914-15) 1919, p. 28.

[47] Goode, Fish, Ind. U.S., Sect. 1, 1884, p. 242.

[48] Canad. Fish. Exped. (1914-1915) 1919, p. 28.

[49] For further details, see Bigelow and Schroeder, Biol. Bull. vol. 76, 1939, pp. 308, 319-320, fig. 8.

[50] Information supplied by William A. Ellison, Jr.

[51] Information supplied by the Pond Village Cold Storage Co., North Truro, Mass.

[52] Pounds of round fish and dressed fish combined.

[53] Practically no trawling is done in winter in the deepest parts of the Gulf.

[54] Albatross II trawled 8 fish, 7 to 9 inches long, off New York, February 28, 1929, at 28 fathoms; and the dragger Eugene H., Capt. Henry Klimm, picked up 115 of market size in a week's trip, about 80 miles off Martha's Vineyard, at 47 to 67 fathoms, January-February 1950.

[55] 1942, 5,343,300 pounds; 1945, 5,842,900 pounds; 1947, 1,784,500 pounds.

[56] Otter trawl landings of "whiting," for New York and New Jersey combined, were 3,468,200 pounds in 1942; 5,243,700 pounds in 1945; and 7,498,600 pounds in 1947. Delaware trawlers reported 203,500 pounds for 1947.

[57] Vladykov and McKenzie, Proc. Nova Scotia Inst. Sci., vol. 19, 1935, p. 72.

[58] According to Dr. Huntsman all ostensible reports of their presence in the Gulf of St. Lawrence have been based in reality on the other hakes of the genus Urophycis (p. 221). And it is these that are meant when "hake" are mentioned in the early publications of the U. S. Fish Commission, such as Baird's (Rept. U.S. Comm. Fish. (1886) 1889, app. A.) report on the fisheries of eastern North America.

[59] Landings for Maine and Massachusetts combined.

[60] Maine and Massachusetts combined.

Fishes of the Gulf of Maine by Bigelow & Schroeder is the seminal work on North Atlantic fishes. It was originally published in 1925 with William Welsh, a Bureau of Fisheries scientist who often accompanied Henry Bigelow on his research cruises. In the late 1920's, Bigelow began a long association with William C. Schroeder, publishing a number of papers and reports on fishes of the North Atlantic, including the first revision of Fishes of the Gulf of Maine. This excerpt is from that 1953 edition.