

# FISHES OF THE GULF OF MAINE

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During the summer of 1912 the Bureau of Fisheries, with the cooperation of the Museum of Comparative Zoology of Harvard University, commenced an oceanographic and biological survey of the Gulf of Maine, with special reference to its fishes, to its floating plants and animals (plankton), to the physical and chemical state of its waters, and to the circulation of the latter. Cruises were made on the Fisheries schooner *Grampus* during the summers and autumns of 1912, 1913, 1914, 1915 and 1916, and during the winters and springs of 1913 and 1915. The work was interrupted by the war, but was resumed with a cruise of the Fisheries steamer *Albatross* in the late winter and spring of 1920, and was continued by the Fisheries steamer *Halcyon* during the winter and spring of 1920-21, and the summers of 1921 and 1922.

The first part of the general report, dealing with the fishes, was published in 1925, as Bulletin 40 (Pt. 1) of the United States Bureau of Fisheries;<sup>1</sup> subsequent parts describing the plankton of the offshore waters of the Gulf and the physical characteristics of its waters were published in 1926-27, as Part 2.

The preparation of the section on the fishes was assigned originally to W. W. Welsh, who had gathered a large body of original observations on the growth, reproduction, diet, and other phases of the lives of many of the more important species. The report was far advanced when it was interrupted by his untimely death, and H. B. Bigelow undertook to carry it to publication along the lines originally laid down. The new edition, entailing a general revision and the addition of much new material, has been prepared jointly by H. B. Bigelow and by W. C. Schroeder.

<sup>1</sup> The Bureau of Fisheries was transferred on July 1, 1939, from the Department of Commerce to the Department of the Interior, and on July 30, 1940, it was consolidated with the Bureau of Biological Survey to form the Fish and Wildlife Service.

## AREA COVERED

The term "Gulf of Maine" covers the oceanic bight from Nantucket Shoals and Cape Cod on the west, to Cape Sable on the east. Thus it includes the shore lines of northern Massachusetts, New Hampshire, Maine, and parts of New Brunswick and of Nova Scotia. The eastern and western boundaries adopted in this paper are 65° and 70° West longitude, respectively. Southern strays, or northern, which have no real status in the Gulf of Maine except by accident, are mentioned only briefly, or are relegated to footnotes. The Gulf of Maine has a natural seaward rim formed by Nantucket Shoals, by Georges Bank, and by Browns Bank. We have chosen the 150-fathom contour as the arbitrary offshore boundary, because this will include all of the species that are likely to be caught by commercial fishermen but will exclude almost the entire category of the so-called "deep-sea" fishes, which are numerous in the basin of the open Atlantic but are not constituents of the fauna of the Gulf of Maine, properly speaking.

The general oceanography of this area has been the subject of another report, but it may not be amiss to point out that the temperature of the Gulf and its fauna are boreal, and that its southern and western boundaries are the northern limit to common occurrence of many southern species of fishes and of invertebrates.

## SCOPE OF THE WORK

Our aim has been a handbook for the easy identification of the fishes that occur in the Gulf of Maine, with summaries of what is known of the distribution, relative abundance, and more significant facts in the life history of each. The descriptions are as little technical as is compatible with scientific accuracy, and are limited

chiefly to such of the external features of each kind of fish as may serve for identification in the field.

References to more detailed descriptions and synonymies are given to Bigelow and Schroeder (Fishes of the Western North Atlantic, Parts 1 and 2, 1948, 1953) for the cartilaginous fishes; also to Garman's beautiful plates for such of these as he pictured in his classic monograph, published in 1913, in vol. 36, of the *Memoirs of the Museum of Comparative Zoology*. References for the various species of bony fishes are to Jordan and Evermann's *Fishes of North and Middle America* (Bulletin 47, U. S. National Museum, 1896-1900, Parts 1-4), which still remains the only comprehensive work on the bony fishes of North America. Many of the illustrations have been borrowed from earlier publications, but some of them are original.

Keys are provided for all species as a further aid to identification.

In most cases the sizes of larval fish and eggs are given in millimeters (1 inch equals 25.4 mm.); the sizes of the larger fishes are in inches and feet; weights are in pounds.

The scientific nomenclature of the cyclostomes, of the elasmobranchs, and of the chimaeroids, follows Bigelow and Schroeder (Fishes of the Western North Atlantic, No. 1, Parts 1 and 2, 1948; 1953) that of the bony fishes follows Jordan, Evermann, and Clark's Check List of the Fishes and Fishlike Vertebrates of North and Middle America (Report, U. S. Commissioner of Fisheries for 1928 (1930), Part 2), unless otherwise noted. The families of bony fishes are arranged for the most part in the sequence employed by Jordan, Evermann, and Clark, except that the several families of luminescent fishes are grouped together, in the hope of making it easier for the nontechnical observer to identify such of them as may come to hand.

## SOURCES OF INFORMATION

The literature dealing with the fishes of the Gulf of Maine begins with the earliest descriptions of New England. Captain John Smith, for instance, commented on the abundance of sturgeon, cod, hake, haddock, cole (the American pollock), cusk, sharks, mackerel, herring, cunners, eels, salmon, and striped bass, in his *Generall Historie of Virginia, New England and the Summer Isles*,

published in 1616, while Wood in his *New England's Prospect*, 1634, gave much interesting information, some of which we quote hereafter.

The sea fishes of northern New England and of the Maritime Provinces had begun to attract scientific attention by the early part of the nineteenth century, and many local faunal lists have been published since then. The following are the most important of these, in chronological arrangement:

1850. Report on the sea and river fisheries of New Brunswick, within the Gulf of St. Lawrence and Bay of Chaleur, M. H. Perley, 137 pp., 1850. Fredericton, New Brunswick.

1853-1867. A history of the fishes of Massachusetts, David Humphreys Storer. *Memoirs, American Academy of Arts and Sciences*, New Series, vol. 5, pp. 49-92, 122-168, and 257-296; vol. 6, pp. 309-372; vol. 8, pp. 389-439; vol. 9, pp. 217-256, 39 pls. (Also in book form with supplement, 1867), Cambridge and Boston.

1879. A list of the fishes of Essex County, including those of Massachusetts Bay, George Brown Goode, and Tarleton H. Bean. *Bulletin, Essex Institute*, vol. 11, No. 1, pp. 1-38. Salem.

1884. Natural history of useful aquatic animals, George Brown Goode and associates, Section I, The Fisheries and Fishery Industries of the United States. Published jointly by the U. S. Fish Commission and the U. S. Bureau of the Census, 895 pp. Washington.

1908. Fauna of New England. 8. List of the Pisces, William C. Kendall. *Occasional Papers, Boston Society of Natural History*, vol. 7, No. 8, April 1908, pp. 1-52. Boston.

1914. An annotated catalogue of the fishes of Maine, William C. Kendall. *Proceedings, Portland Society of Natural History*, vol. 3, 1914, Part 1, pp. 1-198. Portland.

1922. The fishes of the Bay of Fundy, A. G. Huntsman. *Contributions to Canadian Biology* (1921), 1922, No. 3, pp. 1-24 (51-72). Ottawa.

These lists contain all the early published locality records of the rarer species, either first hand, or by reference to original sources, while the last two, with a paper by Gill,<sup>2</sup> and the first edition of the present book give complete bibliographies for the Canadian coasts of the Gulf and for the coasts of Maine and of Massachusetts. A similar list of the captures of deep water fishes along the outer part of the continental shelf is to be found in Goode and Bean's "Oceanic Ichthyology."<sup>3</sup>

The most pertinent extralimital lists are Smith's<sup>4</sup> and Sumner, Osburn and Cole's<sup>5</sup> lists of Woods

<sup>2</sup> Rept. U. S. Comm. Fish., (1904) 1905, pp. 163-188.

<sup>3</sup> Smithsonian Contribution to Knowledge, vol. 30, 1895.

<sup>4</sup> Bull. U. S. Fish Comm., Vol. 17, 1898, pp. 85-111.

<sup>5</sup> Bull. U. S. Bur. Fish., vol. 31, Pt. 2, 1913, pp. 549-794.

Hole fishes; Halket's <sup>6</sup> Checklist of the fishes of Canada and of Newfoundland, and Vladykov and McKenzie's *The Marine Fishes of Nova Scotia*.<sup>7</sup>

The literature dealing with the habits of the fishes of the Gulf of Maine is very extensive, for most of the important commercial species, and many of the others also, are common to both sides of the North Atlantic. Among general European manuals, Day's *Fishes of Great Britain and Ireland*,<sup>8</sup> Smitt's "Scandinavian Fishes,"<sup>9</sup> and Ehrenbaum's summary of the many scattered accounts of the eggs and larvae of northern fishes<sup>10</sup> have been especially helpful.

A large amount of information as to local distribution and abundance of various fishes has been gleaned from unpublished material in the files of the U. S. Fish and Wildlife Service, as well as from the fishery statistics published by the Fisheries Branch, U. S. Fish and Wildlife Service (formerly the U. S. Bureau of Fisheries), by the Dominion of Canada, and by the Commonwealth of Massachusetts. The superintendents of the Woods Hole, Gloucester, and Boothbay hatcheries have supplied much valuable information, as have other members of the U. S. Fish and Wildlife Service. Among these, Leslie Scattergood has given many interesting pieces of information for Maine waters, while Howard Schuck has contributed authenticity to the account of the haddock. Dr. A. G. Huntsman has contributed his unpublished notes on the fishes of the Bay of Fundy and Gulf of St. Lawrence. Dr. A. H. Leim, Mr. R. A. McKenzie, and Dr. Vadim D. Vladykov have supplied us with pertinent information on certain species from the Nova Scotian-St. Lawrence River regions. The late Prof. J. P. McMurrich permitted the use of his unpublished plankton records, and a number of Newfoundland records were furnished by Drs. George W. Jeffers and E. Templeman.

The late W. F. Clapp has contributed many interesting notes gleaned during his experience as a fisherman before entering the scientific field. Harry Piers of the Provincial Museum of Halifax,

has supplied interesting information on the occurrence of the blue shark. John Worthington has furnished us with pound-records for the Truro-Provincetown region covering a recent span of about fifteen years and has given us specimens of three species heretofore unreported in the Gulf of Maine. Benjamin H. Morrow has supplied interesting data from the vicinity of Sandwich, Mass. We have received much information about the striped bass in Nova Scotia from Major Howard Scott, through the kind offices of Henry Lyman. And we owe it to consultation with Dr. Å. Vedel Tåning of the Marine Biological Laboratory, Charlottenlund, Denmark, and the specimens contributed by Dr. C. E. Lucas of the Scottish Fisheries Laboratory, Aberdeen, that we have dared to reach a conclusion as to the relationship between the rosefish of our gulf and of north European waters. Francis Sargent, also of the Division of Marine Fisheries of Massachusetts, and Henry Lyman, editor of the *Salt Water Sportsman*, have been unfailing in their response to our many inquiries. Myvanwy Dick of the Harvard Museum of Comparative Zoology has been of assistance in the handling of certain of our study material and in the preparation of a number of illustrations. The illustrations of the hagfish and lamprey and most of those of the sharks, skates, rays, and chimaera are reprinted here through the courtesy of the Sears Foundation for Marine Research, publisher of the *Fishes of the Western Atlantic, Memoir 1, Parts 1 and 2*, in which the illustrations originally appeared. Claude Ronne of the Woods Hole Oceanographic Institution prepared many photographs from both original and published drawings, which were used to illustrate this book.

We owe a debt of gratitude, also, to the late Dr. Samuel Garman, who was ever ready with assistance until the time of his death, and to W. C. Adams, former director of the division of fisheries and game of the State of Massachusetts. We wish to express our hearty thanks to the many commercial fishermen and to the many salt water anglers of our acquaintance who have met our inquiries in the most cordial way and who have supplied us with a vast amount of first-hand information on the habits, distribution, and abundance of the commercial and game fishes, which could be had from no other source. The

<sup>6</sup> Checklist of the Fishes of the Dominion of Canada and Newfoundland 1913, 138 pp.

<sup>7</sup> Proc. Nova Scotia Inst. of Science, vol. 19, Pt. 1, 1935, pp. 17-113.

<sup>8</sup> The fishes of Great Britain and Ireland, by F. Day, Text vol. 1, CXII+336 pp., vol. 2, 388 pp., and atlas, 179 plates, 1880-1884. London and Edinburgh.

<sup>9</sup> A history of Scandinavian fishes. Second edition, vol. 1, 1892; vol. 2, 1895; 1,240 pp., 53 pls. Stockholm.

<sup>10</sup> Eier und Larven von Fischen. Nordisches Plankton, vol. I, 413 pp., 148 figs.; appeared in two parts as Lief. 4, 1905, and Lief. 10, 1910.

preparation of this book would have been out of the question without their help.

Finally, we have ourselves gathered a large body of data as to distribution, habits, spawning seasons, and like matters, through many years, at many localities, both inshore and on the offshore banks.

## USE OF THE KEYS

The various fins and other structures mentioned in the keys are named in the accompanying outlines of a haddock and of a typical shark (fig. 1). A simple way to explain the use of the keys is to use the haddock as an example, running it down with the illustration at hand for reference.

Turning to Key A (p. 5), we find that our fish fits the second alternative under section 1, since it has bony jaws and pectoral fins, and is not shaped like an eel. This refers us to section 3.

There being only one gill opening on each side, we go from section 3 to section 5. As our fish does not have a tubular snout section 5 refers us to section 6, and this in turn to section 7, since neither the upper jaw nor the lower is greatly

prolonged. Since the body is not square-cut close behind the dorsal and anal fins, but has a definite tail part, we proceed from section 7 to section 8, and from section 8 to section 11, for our fish has no sucking plate or disc, either on top of the head, or on the chest. Section 11 refers us in turn to section 12 because the tail fin is nearly symmetrical in outline. The anal fin being clearly and definitely separated from the caudal fin, we go from section 12 to section 13; and from section 13 to section 14, for our fish does not have any evident light-producing ("luminescent") spots either on its sides or on its head. Our fish does not have a fleshy fin or flap either in front of the ordinary dorsal fins or behind them, but all of its dorsal fins are supported by rays that are visible if held against the light. Consequently, we proceed from section 14 to section 18, and this refers us to section 22, there being no flaps or tags of skin on the sides of the head.<sup>11</sup> Our fish obviously does not lie flat on one side, i. e., it is not one of the flat fishes, which brings us to section 23, and

<sup>11</sup> There is a barbel on its chin, but this is very different in appearance from the skin flaps around the jaws that are characteristic of the few species that fall under the first alternative of section 18.

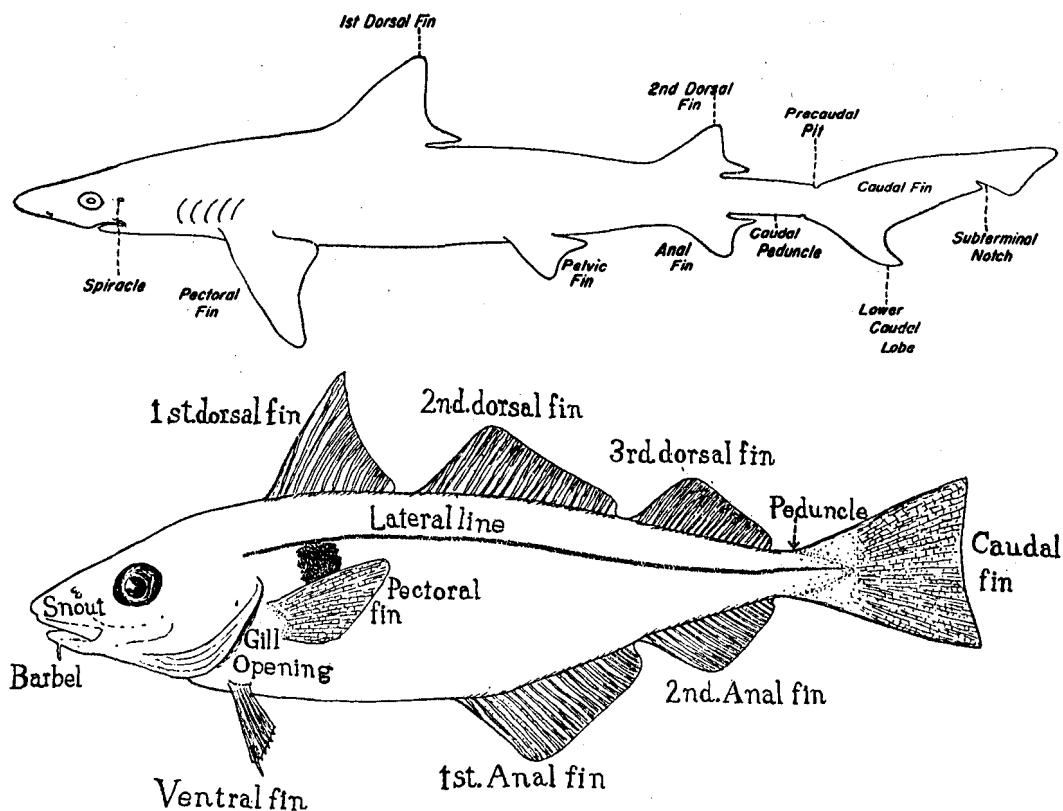


FIGURE 1.—Diagrams of a haddock (below) and of a typical shark (above) with terms used in the keys and descriptions.