

# ANNOTATED BIBLIOGRAPHY ON BIOLOGY OF MENHADENS AND MENHADENLIKE FISHES OF THE WORLD

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## ABSTRACT

The bibliography has 238 references on the classification, distribution, abundance, ecology, and life history of menhadens and similar clupeid fishes of the genera *Brevoortia*, *Ethmalosa*, and *Ethmidium*. Included are major references to the North American menhaden

articles published through 1957 and all references 1958-62. All available references to the South American menhadens and the West African shad are included. Brief annotations and a subject index also are provided.

This bibliography is an expansion and a continuation of that compiled by Reintjes, Christmas, and Collins (1960) on the biology of the American menhadens. Of the literature listed in that publication pertaining to the North American menhadens, only the major references published before 1958 are included in this work; the minor references, checklists, and incidental reports are not. Any references published prior to 1958 that were omitted from the preceding bibliography are included.

The bibliography concerns the menhadens, genus *Brevoortia*, and similar clupeid or menhadenlike fishes of the genera *Ethmalosa* and *Ethmidium*. At present, *Brevoortia*, on the Atlantic Coast of the United States including the Gulf of Mexico, and *Ethmalosa*, on the Atlantic Coast of West Africa, compose the largest fishery in each area. Furthermore, *Brevoortia* and *Ethmidium* offer resource potentials for the Atlantic and Pacific Coasts of South America.

Knowledge of the scientific and technical information on the identity, distribution, and biology of these fishes is essential for determining the

extent of their resources and their potential. The principal purpose of this bibliography is to encourage inquiry, research, and exploration, by furnishing references to the published accounts on menhaden and menhadenlike fishes.

In general, the geographical distribution of the species of menhadens and menhadenlike fishes of the world<sup>1</sup> may be summarized as shown in table 1.

In reviewing the literature, certain criteria were used to decide which references should be included. Included, in general, were references to taxonomy, distribution, occurrence, abundance, life history, morphology, ecology, and behavior. Excluded generally were references on the technological aspects of the fishery and the processing industry; daily, monthly, and annual landing reports and statistics; popular accounts in trade journals, newspapers, and magazines; and administrative and project reports. Mimeographed or similarly processed reports of an established series, or when principally concerned with these fishes, have been included.

The arrangement of the references is alphabetically by author's surname. With multiple authors the entry is made only under the senior author's name. Each author's works are listed chrono-

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<sup>1</sup> The genera *Macrura*, *Gudusia*, and *Hilsa* (in part) from the Indian Ocean, although similar, are not included in this bibliography.

TABLE 1.—*Menhaden and menhadenlike fishes by geographical areas*

Scientific name	Common name	Area
<i>Brevoortia tyrannus</i> ....	Atlantic menhaden.....	Atlantic Coast of North America from Nova Scotia to Florida.
<i>Brevoortia smithi</i> .....	Yellowfin menhaden.....	Atlantic Coast of the United States and Gulf of Mexico from North Carolina to Louisiana.
<i>Brevoortia patronus</i> ....	Gulf menhaden.....	Gulf of Mexico from Florida to Mexico.
<i>Brevoortia gunteri</i> .....	Finescale menhaden.....	Gulf of Mexico from Alabama to Mexico.
<i>Brevoortia pectinata</i> ....	Lacha or savelha.....	Atlantic Coast of South America from Brazil to Argentina.
<i>Brevoortia aurea</i> .....	Lacha or savelha.....	Atlantic Coast of South America from Brazil to Argentina.
<i>Ethmidium chilcae</i> .....	Machete, machuela, or trite.	Pacific Coast of South America from Peru and Chile.
<i>Ethmidium maculatum</i>	Machete, machuela, or trite.	Pacific Coast of Central and South America from Mexico to Peru.
<i>Ethmalosa fimbriata</i> ...	West African shad or bonga.	Atlantic Coast of West Africa from Senegal to Angola.

logically by year of publication, and those published in the same year are given alphabetical sequence by title. Pagination is given for the complete paper, not solely for the pages referring directly to the subject species. Such a restricted pagination was used by Reintjes, Christmas, and Collins (1960) to circumscribe limited references to menhaden occurring incidentally in larger works.

Brief annotations of the contents of the publications and the scientific names of the species concerned are given. This annotation is done not to make value judgments of the papers but to give clearer descriptions of the contents than can be obtained from their titles.

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Postel, 1959.  
Price, 1961.  
Reintjes, 1961.  
Richards, 1959, 1963a, 1963b, 1963c.  
Roithmayr, 1962.  
Schwartz, 1961.  
Springer, 1960.  
Springer and Woodburn, 1960.  
Sproston, 1946.  
Sutherland, 1958, 1963.  
Svetovidov, 1952, 1953, 1961, 1963.  
Tagatz and Dudley, 1961.

Classification:

Berg, 1940, 1947.  
Cuvier and Valenciennes, 1847.  
De Buen, 1958.  
Fowler, 1942, 1948.  
Hildebrand, 1948.  
Monod, 1961.  
Regan, 1917.  
Svetovidov, 1952, 1963.

*Clupanodon aureus*: See *Brevoortia aurea*.

*Clupea advena*: See *Ethmidium*.

*Clupea aurea*: See *Brevoortia aurea*.

*Clupea caerulea*: See *Ethmidium*.

*Clupea dorsalis*: See *Ethmalosa fimbriata*.

*Clupea fimbriata*: See *Ethmalosa fimbriata*.

*Clupea laccia vel 20-radiata*: See *Brevoortia pectinata*.

*Clupea pectinata*: See *Brevoortia pectinata*.

*Clupea maculata*: See *Ethmidium maculatum*.

*Clupea menhaden*: See *Brevoortia tyrannus*.

*Clupea notocanthus*: See *Ethmidium chilcae*.

*Clupea notocanthoides*: See *Ethmidium chilcae*.

*Clupea 20-radiata*: See *Brevoortia pectinata*.

*Clupea senegalensis*: See *Ethmalosa fimbriata*.

*Clupea setosa*: See *Ethmalosa fimbriata*.

Common names:

Anonymous, 1948.  
Bailey, et al., 1960.  
Cadenat, 1947.  
De Carvalho, 1957.  
Delfin, 1902.  
Hildebrand, 1948.  
Silva, 1944.  
Watts, 1963.

Distribution:

Briggs, 1958.  
Christmas and Gunter, 1960.  
Hildebrand, 1948.  
Reintjes, 1960.  
Reintjes and June, 1961.  
Roithmayr, 1962.  
Svetovidov, 1952.

Eggs:

Bainbridge, 1961.  
Herman, 1963.  
Kuntz and Radcliffe, 1917.  
Marak and Colton, 1961.  
Marak, Colton, and Foster, 1962.  
Merriman and Sclar, 1952.  
Reintjes, 1961, 1962.  
Richards, 1959.

*Ethmalosa dorsalis*: See *Ethmalosa fimbriata*.

*Ethmalosa fimbriata*:

Anonymous, 1948.  
Bainbridge, 1957, 1960, 1961, 1962.  
Blanc, 1948.  
Boulenger, 1905.  
Bowdich, 1825, 1826.  
Cadenat, 1947, 1950, 1960.  
Chabanaud and Monod, 1926.  
Cuvier and Valenciennes, 1847.  
Dumeril, 1861.  
Fowler, 1911, 1936.  
Gras, 1961.  
Günther, 1868.  
Hornell, 1928.  
Irvine, 1947.  
Longhurst, 1957, 1960a, 1960b, 1961.  
Lozano Rey, 1950.  
Mainguy and Doutre, 1958.  
Monod, 1927, 1949, 1961.  
Osorio, 1905.  
Otorubio, 1959.  
Postel, 1950, 1959.  
Regan, 1915, 1917.  
Steindachner, 1882, 1895.  
Steven, 1947.  
Svetovidov, 1952.  
Watts, 1963.

*Ethmalosa* fishery:

Bainbridge, 1960.  
Brown, 1948.  
Cadenat, 1948.  
Hornell, 1928.  
Irvine, 1947.  
Longhurst, 1960a, 1961.  
Postel, 1950.  
Steven, 1947.  
Watts, 1963.

*Ethmidium*:

Berg, 1940, 1947.  
De Buen, 1958, 1959.  
Delfin, 1900, 1902.  
Cuvier and Valenciennes, 1847.  
Gay, 1848.  
Quijada B., 1913.  
Reed, 1897, 1901.  
Svetovidov, 1952.  
Thompson, 1916.

*Ethmidium chilcae*:

Abbott, 1899.  
De Buen, 1958, 1959.  
Delfin, 1900, 1902.  
Dollo, 1904.  
Cuvier and Valenciennes, 1847.  
Gay, 1848.  
Hildebrand, 1946.  
Mann F., 1950, 1954.  
Perez Canto, 1912.  
Porter, 1909a, 1909b.  
Quijada B., 1913.  
Reed, 1897.  
Steindachner, 1869.  
Svetovidov, 1952.  
Thompson, 1916.  
Tortonese, 1942, 1951.

*Ethmidium maculatum*:

Abbott, 1899.  
Castillo and Vergara, 1907.  
De Buen, 1958, 1959.  
Delfin, 1900, 1902.  
Fowler, 1940, 1944, 1945, 1951a.  
Cuvier and Valenciennes, 1847.  
Gay, 1848.  
Mann F., 1950, 1954.  
Oliver Schneider, 1943.  
Perez Canto, 1912.  
Quijada B., 1913.  
Reed, 1897.  
Regan, 1917.  
Svetovidov, 1952.  
Thompson, 1916.  
Tortonese, 1942, 1951.  
Yanez Andrade, 1955.

Finescale menhaden: See *Brevoortia gunteri*.

Food and feeding:

Anderson, Jonas, and Odum, 1958.  
Bainbridge, 1957, 1960.  
Chipman, 1959, 1960.

Darnell, 1958, 1961.  
Deevey, 1956.  
Harder, 1958, 1960.  
Lagler, Bardach, and Miller, 1962.  
Peck, 1894.  
Richards, 1963b, 1963c.

Gulf menhaden: See *Brevoortia patronus*.

Lacha: See *Brevoortia pectinata* and *B. aurea*.

Larvae and juveniles:

Arnold, Wheeler, and Baxter, 1960.  
Bainbridge, 1961, 1962.  
Breder, 1960, 1962.  
Breuer, 1962.  
Butler, 1959, 1960.  
Chipman, 1959, 1960.  
De Sylva, Kalber and Shuster, 1962.  
Deubler, 1958.  
Herman, 1963.  
June, 1958.  
June and Chamberlin, 1959.  
Kuntz and Radcliffe, 1917.  
Leim and Day, 1959.  
Marak, Colton, Foster, and Miller, 1962.  
Massmann, Norcross, and Joseph, 1961, 1962.  
Merriman and Sclar, 1952.  
Pearcy and Richards, 1962.  
Reintjes, 1961, 1962.  
Renfro, 1960.  
Richards, 1959, 1963a, 1963b, 1963c.  
Schwartz, 1961.  
Simmons, 1957.  
Springer and Woodburn, 1960.  
Tabb and Manning, 1961, 1962.

Machete: See *Ethmidium maculatum* or *E. chilcae*.

Machueta: See *Ethmidium maculatum* or *E. chilcae*.

Menhaden fishery:

Borgstrom, 1961.  
Christmas, Gunter, and Whatley, 1960.  
Cushing, et al., 1952.  
Ellison, 1951.  
Goode, 1879.  
June, 1961a, 1961b.  
June and Nicholson, 1963.  
June and Reintjes, 1959, 1960.  
McHugh, 1960.  
Reintjes, 1960.  
Reintjes and June, 1961.  
Robas, 1959.  
Roithmayr, 1963.  
Rosen, 1959, 1960.  
Rosen and Robinson, 1961, 1962a, 1962b.  
Shuster, 1959.  
Smith, 1961.

Methods of capture:

See *Ethmalosa* fishery.  
See Menhaden fishery.  
Angelescu and Boschi, 1959.  
Arve, 1960.

Methods of capture—Continued

Beatty, 1959, 1961.  
Breder, 1960, 1962.  
Bullis, 1961.  
Haskell, 1961.  
Hildebrand, 1958.  
McHugh, 1960.  
Reintjes, 1960.  
Reintjes and June, 1961.  
Richards, 1963a.  
Simmons and Hoese, 1959.  
Smith, 1961.  
Tagatz and Dudley, 1961.  
Walford, 1958.

Morphology:

Doutre, 1959.  
Gunter and Demoran, 1961.  
Harder, 1958, 1960.  
Hyrtl, 1855.  
June, 1958.  
June and Roithmayr, 1960.  
Lagler, Bardach, and Miller, 1962.  
Mainguy and Doutre, 1958.  
Mairs and Sindermann, 1962.  
Monod, 1927, 1949, 1961.  
Nicol, 1960.  
Peck, 1894.  
Sindermann, 1961.  
Sutherland, 1958, 1963.  
Suttkus, 1958.  
Suttkus and Sundararaj, 1961.

Occurrence in fresh water:

Behnke and Wetzel, 1960.  
Butler, 1959, 1960.  
Gunter, 1957, 1961.  
Gunter and Shell, 1958.  
Hedgpeth, 1957.  
Hubbs, 1958.  
Johnson, 1954.  
June and Chamberlin, 1959.  
Massmann, 1954.  
Renfro, 1960.

Parasites:

Anonymous, 1959.  
Bychowsky, 1957, 1961.  
Hargis, 1959, 1961.  
Leach, 1818.  
Mansueti, 1962.  
Milne-Edwards, 1840.  
Price, 1961.

Sparks, 1958.  
Sproston, 1946.  
Walford, 1958.

Physiology:

Burroughs, Chipman, and Rice, 1957.  
Chipman, 1959, 1960.  
Doutre, 1959.  
Hall and McCutcheon, 1938.  
Lagler, Bardach, and Miller, 1962.  
Mainguy and Doutre, 1958.  
Mairs and Sindermann, 1962.  
Marvin and Lansford, 1962.  
Sindermann, 1961.

*Potamalosa maculata*: See *Ethmidium maculatum*.

*Potamalosa notocanthoides*: See *Ethmidium chilcae*.

*Potamalosa notocanthus*: See *Ethmidium chilcae*.

Predators:

Darnell, 1961.  
Grant, 1962.  
Longhurst, 1957.  
Migdalski, 1958.  
Monod, 1927.  
Simmons and Breuer, 1962.

Savelha: See *Brevoortia aurea* or *B. pectinata*.

Serology:

Mairs and Sindermann, 1962.  
Sindermann, 1961.

Sexual maturity:

See Eggs.  
June, 1961a.  
June and Nicholson, 1963.  
June and Reintjes, 1969, 1960.  
Reintjes, 1962.  
Salzen, 1958.  
Simmons, 1957.  
Suttkus and Sundararaj, 1961.

Taxonomy:

Berg, 1940, 1947.  
Gill, 1861.  
Goode, 1878.  
Günther, 1868.  
Hildebrand, 1948.  
Monod, 1961.  
Regan, 1917.  
Svetovidov, 1952, 1963.  
Thompson, 1916.

Trite: See *Ethmidium maculatum* or *E. chilcae*.

West African shad: See *Ethmalosa fimbriata*.

Yellowfin menhaden: See *Brevoortia smithi*.