

A Preliminary Survey of Clupeoid Fishes in Trinidad, West Indies, and Their Use in Live Bait Fishing

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ABSTRACT

Eleven species each of clupeids and engraulids were identified. An extension of range was found for *Anchoviella lepidentostole*. The dominant species were *Opisthonema oglinum*, *Harengula jaguana*, which were more abundant in the wet season (June–December) and *Sardinella aurita*, which showed no seasonality. Each school consisted of one dominant species and smaller quantities of other species. Size at maturity was 12 cm for *Sardinella aurita* and 15 cm for *Opisthonema oglinum*. Both species showed a 1:1 sex ratio and spawned in the wet season. Length frequencies indicated the presence of two year classes for *Sardinella aurita* and *Harengula jaguana* and three for *Opisthonema oglinum*.

A description of the clupeid fishery and live bait fishing is given.

INTRODUCTION

Clupeoid fishes constitute an important potential resource in the Caribbean (e.g., Simpson and Griffiths, 1967; Simpson, 1969; Bullis *et al.*, 1971; Klima, 1977). Estimates of annual potential yields of clupeids in the western central Atlantic have ranged from 1,200,000 metric tonnes (Gulland, 1970) to 4,000,000 metric tonnes (Bullis and Carpenter, 1968). Statistics from the Fisheries Division, showed that an average of about 150 metric tonnes of this group, mainly the Spanish sardine or "D'anchois" (*Sardinella aurita*) and the thread herring (*Opisthonema oglinum*) are landed annually in Trinidad and Tobago. About 95% of this catch is landed on the west coast of the island of Trinidad.

Clupeids are caught incidentally in trawls and in beach and lampara (Italian) seines which are used mainly for catching mackerels. The Spanish sardine is also caught by bait seine and is used as live bait. Other species, mainly the thread herring, are also used as bait but they are not fully utilized for human consumption. However, canned and smoked herrings are widely accepted, and an average of 2000 metric tonnes of these products with a value of almost US \$3 million are imported annually.

Presented here is information on abundance, seasonality, size and reproduction of *O. oglinum*, *S. aurita* and *H. jaguana*. Included is a description of live bait fishing ("a la vive") in which mainly *S. aurita* is used as bait.

METHODS

Samples were obtained from commercial beach seine catches on the east

coast, from trawl catches on the north and west coasts, and from the wholesale fish markets in Port of Spain and San Fernando (Fig. 1). In addition, fishing was carried out in the northwestern waters using a bait and lampara seine. The former was 50 m long and 3 m wide with a mesh size of 6 mm. The Italian seine was 200 m long with mesh sizes of 305 mm in the wings and 25 mm in the bag. Fishing was carried out using a 9.7 m long wooden pirogue.

Relative abundance of each species was described as follows: abundant, when it dominated the catch; common, when it comprised a large part of, but did not dominate the catch; rare, when only few individuals occurred. Each species was identified following Whitehead (1973) and Fischer (1978). Fork length was measured to the nearest 0.5 cm., sex and gonad maturity state (immature, developing, ripe or spent) were determined macroscopically.

RESULTS AND DISCUSSION

Species Occurrence

Eleven species of clupeids and eleven species of engraulids were caught, compared to twelve and sixteen species respectively recorded by Whitehead (1973). One species fitting Whitehead *et al.* (1988) description of *Anchoviella lepidentostole*, which has not been previously recorded in Trinidad, was found. The specimens had 22 anal fin rays and 18–20 lower gill rakers, which are the major distinguishing features. According to Whitehead *et al.* (1988), this species is found from the Orinoco delta south to Brazil. This extension of range is due to the close proximity of the island of Trinidad to the Orinoco delta. A list of species and their occurrence is given in Tables 1 and 2. Each school consisted of several species, although only one was dominant at any particular time. The three most abundant species were *S. aurita*, *O. oglinum* and *H. jaguana* ('hardback').

Seasonality

O. oglinum and *H. jaguana* were more abundant in the wet season from July to December. Monthly landings (Fisheries Division) indicate a similar trend (Fig. 2). The distribution of clupeids is thought to be controlled by temperature and salinity, through their influence on primary productivity (Reintjes, 1980). The abundance of clupeids in the wet season could be due to an increase in primary productivity in the waters around Trinidad, brought about by increased nutrient input through river run-off (Whiteleather and Brown, 1945). *S. aurita* showed no seasonality, although monthly landings showed this species to be more abundant from December to May (Simpson and Gonzalez, 1967).

Reproduction

Both ripe and spent *O. oglinum* were observed from October to December and *S. aurita* during October and January. During the other months of sampling,

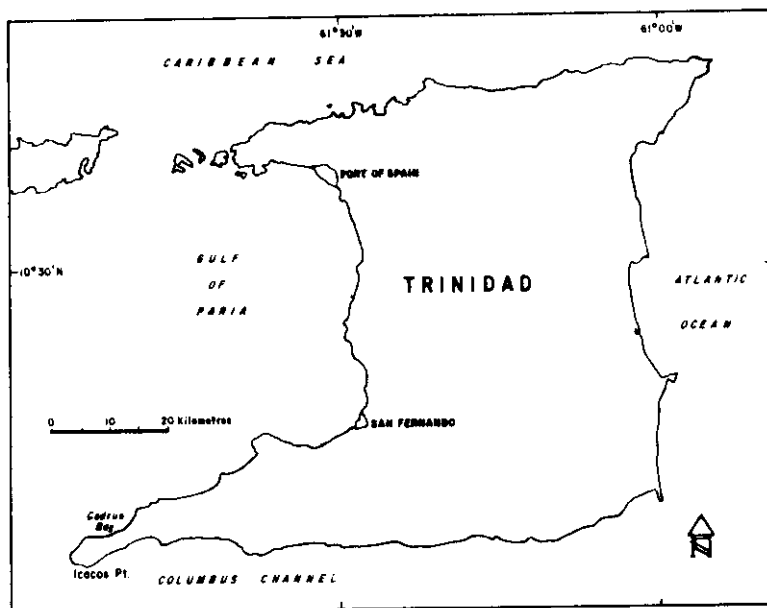


Figure 1. Location of sampling areas.

only immature fish were found. Results are given in Tables 3 and 4. No mature individuals of *H. jaguana* were caught.

Generally, spawning by *S. aurita* and *O. oglinum* occurred in the latter part of the year during the wet season. Similar observations for *S. aurita* were made in the Gulf of Mexico (Finucane *et al.*, 1978; Houde *et al.*, 1979). In Venezuela spawning was observed in February and May (Lopez, 1972). *O. oglinum* was spawning from May to July in the Gulf of Mexico (Fuss *et al.*, 1969) while larvae were more abundant in August and September off Texas (Finucane *et al.*, 1978).

The time of spawning of clupeids is thought to coincide with the production cycle in the sea (Longhurst, 1971). An increase in primary productivity during the wet season in Trinidad may give rise to an intensification of spawning during this time. Simpson and Griffiths (1967) reported intense spawning of *S. aurita* off the northeastern coast of Venezuela during periods of upwelling when primary production increases.

Table 1. Species of clupeids and their occurrence.

SPECIES	OCCURRENCE
<i>Opisthonem oglinum</i>	abundant; Gulf of Paria, north, and east coasts
<i>Sardinella aurita</i>	abundant; Gulf of Paria, north, and east coasts
<i>S. brasiliensis</i>	rare; Gulf of Paria
<i>Harengula jaguana</i>	abundant; Gulf of Paria
<i>H. clupeola</i>	rare; Gulf of Paria
<i>H. humeralis</i>	rare; Gulf of Paria
<i>Odontognathus compressus</i>	abundant; east coast
<i>Chirocentrodon bleekarianus</i>	common; Gulf of Paria
<i>Pellona harroweri</i>	rare; Gulf of Paria
<i>Lile piquitinga</i>	rare; Gulf of Paria
<i>Jenkinsia stolifera</i>	rare; Gulf of Paria

Size at Maturity

Size at maturity of 12 cm for *S. aurita* is similar to that reported by Prosvirov (1967) and Schmidt (1972) in the Gulf of Mexico. Size at maturity for *O. oglinum* was 15 cm and corresponds closely with that reported in the Gulf of Mexico by Reintjes (1980).

Sex Ratio

The sex ratio of *S. aurita* was 58:61, (male: female) and did not differ significantly from 1:1, ($X^2 = 0.08$; $P > 0.05$). This is similar to the sex ratio reported in the Gulf of Mexico (Prosvirov and Varea, 1965) and in Venezuela (Simpson and Griffiths, 1967). The sex ratio of *O. oglinum* was 82:78 (male: female) for October and November combined and showed no significant departure from 1:1 ($X^2 = 0.1$; $P > 0.05$). However, in December the entire catch of *O. oglinum* was composed of females. Cyclic fluctuations in the sex ratio of this species have been reported in the Gulf of Mexico (Prest, 1968), and in

Table 2. Species of Engraulids and their occurrence.

SPECIES	OCCURRENCE
<i>Anchoa hepsetus</i>	rare; Gulf of Paria
<i>A. lamprotaenia</i>	rare; Gulf of Paria
<i>A. lyolepis</i>	rare; Gulf of Paria
<i>A. spinifer</i>	common; Gulf of Paria
<i>A. trinitatis</i>	common; Gulf of Paria
<i>Anchovia clupeoides</i>	common; east coast
<i>Anchoviella lepidentostole</i>	common; east coast, Gulf of Paria
<i>Cetengraulis edentulus</i>	abundant; east coast, Gulf of Paria
<i>Engraulis eurystole</i>	abundant; east coast, Gulf of Paria
<i>Lycengraulis batesii</i>	common; Gulf of Paria
<i>L. grossidens</i>	common; Gulf of Paria

Florida (Fuss, 1968).

Size Composition

Length frequency distribution of individual schools showed that these fishes school according to size. This tendency presented uncertainty in the validity of length frequency distributions for age determination. *S. aurita* showed two modes at 7.0 cm and 11.0 cm (Fig. 3). Houde and Berkeley (1982) reported length at age of about 9.7 cm, 14.0 cm and 16.8 cm for ages 1–3 respectively for this species in the Gulf of Mexico. *O. oglinum* showed three modes at 5.0 cm, 12.0 cm and 18.0 cm, and the possibility of a fourth mode at 25.0 cm (Fig. 4). Houde and Berkeley (1982) reported four age groups for this species in the Gulf of Mexico, with lengths of 10.7 cm, 15.6 cm, 18.5 cm and 20.4 cm. *H. jaguana* showed two modes at 8.0 cm and 13.0 cm (Fig. 5). Although these modes may indicate year classes, further studies on age and growth are necessary before any conclusions can be made.

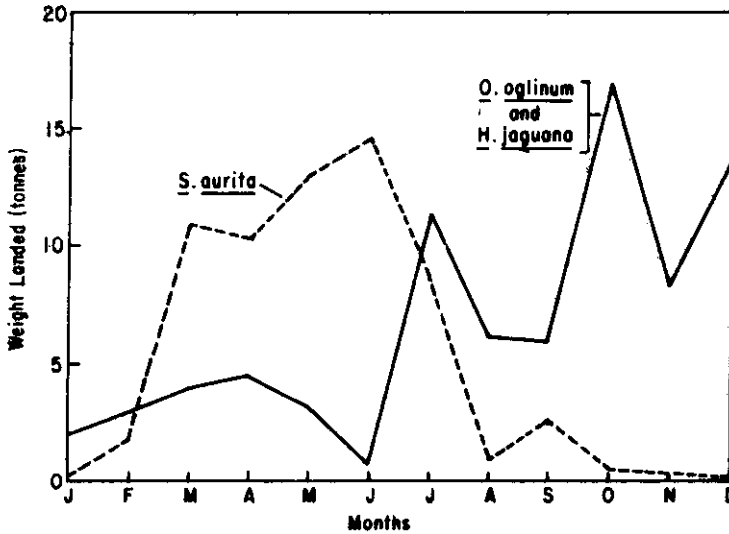


Figure 2. Seasonal variation in weight of clupeids landed in Trinidad.

Table 3. Percentage gonads in each stage for *O. oglinum*

Month	Immature	Developing	Ripe	Spent	Number Examined
Oct.	9.9	13.5	11.7	64.9	111
Nov.	46.9	4.1	0.0	49.0	49
Dec.	78.6	0.0	0.0	21.4	14

LIVE BAIT FISHING

The clupeoid fishes, mainly *S. aurita* are important as bait in the live bait fishery. Live bait fishing is carried out both commercially and recreationally on the north and west coasts of Trinidad from May to September. Of the total fish landed, 1.5% is caught by this method. The main species caught are the Spanish mackerel *Scomberomorus brasiliensis* and king mackerel *Scomberomorus*

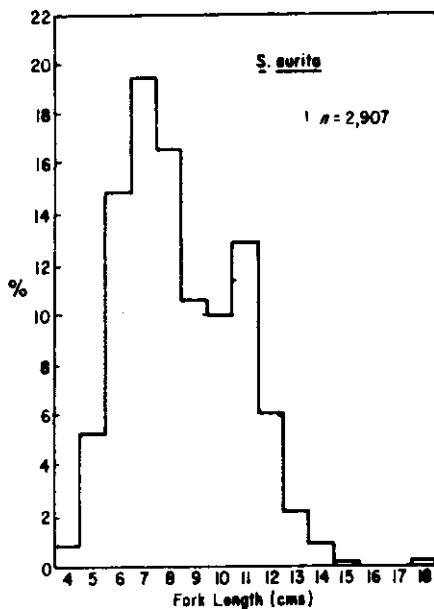


Figure 3. Length frequency distribution of *S. aurita*.

Table 4. Percentage gonads in each stage for *S. aurita*

Month	Immature	Developing	Ripe	Spent	Number Examined
Oct.	0.0	0.0	14.3	85.7	7
Jan.	40.1	46.5	11.8	1.6	187

cavalla. Other fish caught include cavali (horse-eye jack), pompano, bechine (southern sennet), bonito, sailfish, garfish and tarpon. The bait is usually caught at night when they are attracted to lights on the shoreline. A small bait seine, previously described, is used to surround the fish, which are transferred with dip nets directly to the boat or penned within the net or transferred to floating cages.

The boats used are the traditional pirogue (Fig. 6) of wood or glass reinforced plastic construction and range from 6 m to 9 m in length. These boats fish for one day only. In recent times larger boats of about 12 m are being used and they stay up to five days on the fishing grounds, doing handlining and live

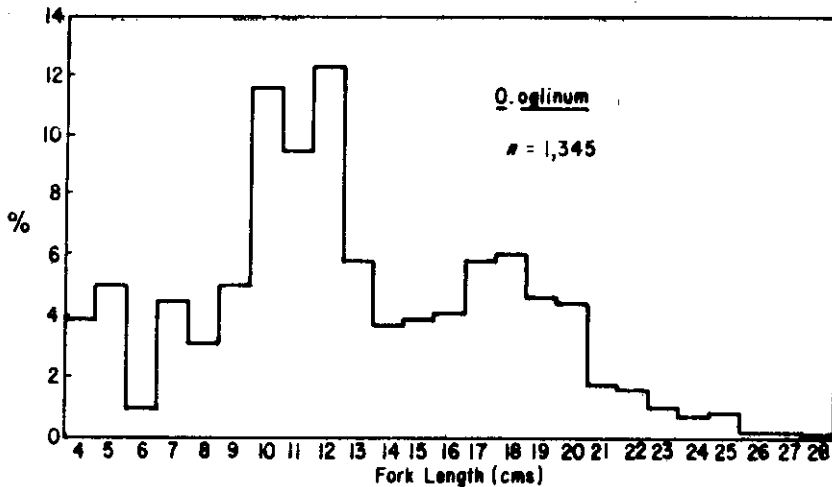


Figure 4. Length frequency distribution of *O. oglinum*.

bait fishing. Outboard motors ranging in size from 30 to 235 h.p. have become very popular since the time spent travelling to and from the fishing ground is reduced. However, the cost of operating outboard motors has risen dramatically in recent years due to increased fuel cost and currency devaluation.

The bait well is positioned between the stern and second seat in wooden pirogues (Fig. 7). Ingress of water is either through several 10 cm P.V.C. pipes fitted with a perforated baffle or through numerous small holes in the planking. Flow of water into and out of the well is facilitated by placing temporary funnels of plastic (cut and shaped from plastic bottles) through selected holes.

The smaller boats are operated by two people while the larger boats (9 m) may have up to four people on board. Hand reels are the standard form of fishing and sizes of hooks, breaking strain and colour of lines used vary greatly from one period of time to another and depend on personal preferences. Fish may be baited to the hook through the snout, behind the dorsal fin, or through the caudal peduncle. Fishing is practiced from an anchored, drifting or slow moving boat. The catch is stored in a cool place in the boat but in recent times many fishermen have begun to use ice.

The structure of the bait well is still developing and the performance of a newly installed bait well is unpredictable. Bait fish are also not available all year. Research on improving the structure and performance of the boat and bait well and providing a regular supply of bait is now needed.

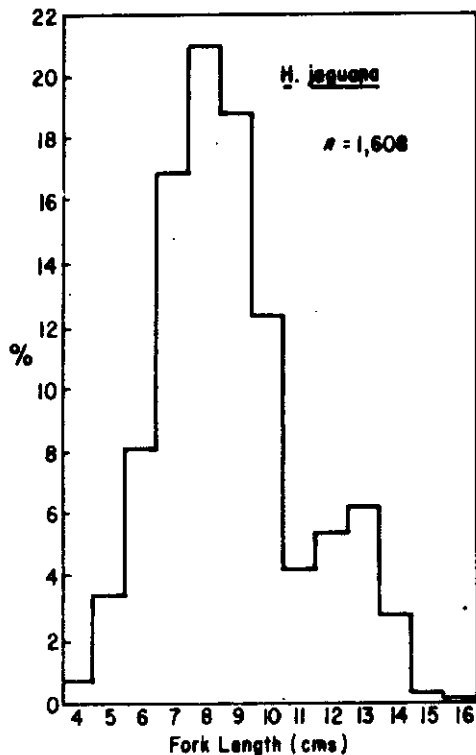


Figure 5. Length frequency distribution of *H. jaguana*.

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LITERATURE CITED

Bullis, H.R. Jr. and J.S. Carpenter, 1968. Latent Fishery Resources of the Central Western Atlantic Region. Univ. Of Wash. Publ. Fish. 4: 61-64.

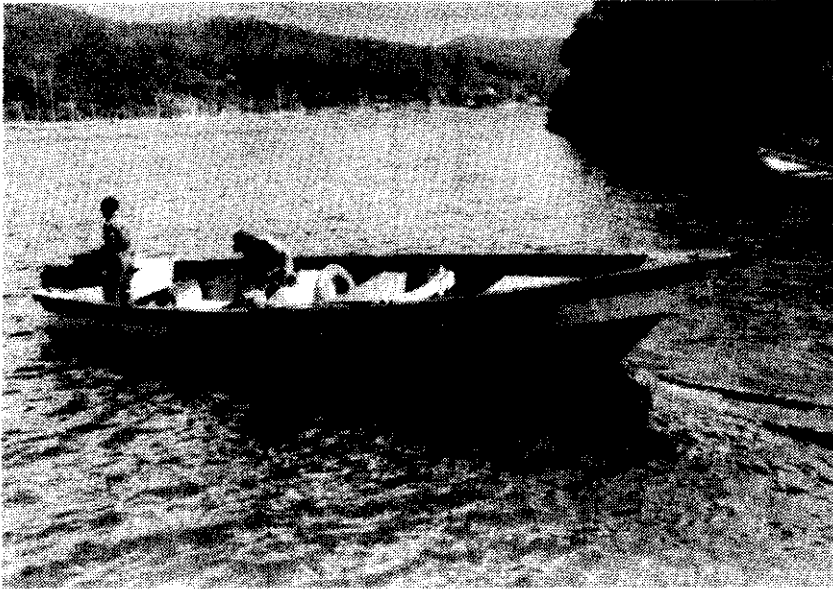


Figure 6. Pirogue -- boat used in live bait fishing.

- Bullis, H.R. Jr., J.S. Carpenter and C.M. Roithmayr, 1971. Untapped West Central Atlantic Fisheries, 374–391. In: S. Shapiro (ed): *Our Changing Fisheries*. Gov't Print. Off. Wash. D.C.
- Finucane, J.H., L.A. Collins, and L.E. Barger, 1978. Determining the Effects of Discharges on Seasonal Abundance, Distribution and Composition of Ichthyoplankton in the Oil Field, 157 pp. In: W.B. Jackson (ed.), *Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico, 1977–1978*. NOAA Rept. to EPA IAG–DS–E696–EO, NMFS Southeast Fisheries Center, Galveston.
- Fischer, W. (ed.), 1978. FAO Species Identification Sheets for Fisheries Purposes, Western Central Atlantic (Fishing Area 31). Vol. II.
- Fuss, C.M. Jr. 1968. The New Thread Herring Fishery in Eastern Gulf of Mexico. *Comm. Fish. Rev.* 30(6):36–41.
- Fuss, C.M. Jr., J.A. Kelly, Jr. and K.W. Prest, Jr. 1969. Gulf Thread Herring: Aspects of the Developing Fishery and Biological Research, *Proc. Gulf Carib. Fish Inst.* 21:111–125.
- Gulland, J.A. 1970. *The Fish Resources of the Ocean*. FAO Fish. Tech. Pap. 97, 425 pp.

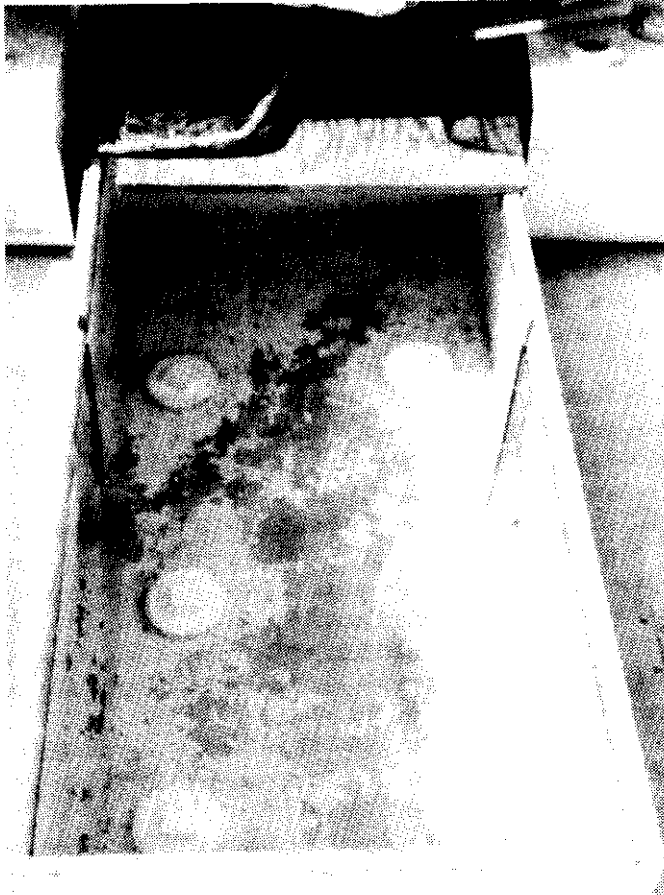


Figure 7. Structure of bait well.

- Houde, E.D., and S.A. Berkeley, 1982. Gulf of Mexico "Coastal Herrings." Southeast Fisheries Center, Stock Assessment Workshop, Miami, Florida, 17 pp.
- Houde, E.D., J.C. Leak, C.E. Dowd, S.A. Berkeley, and W.J. Richards, 1979. *Ichthyoplankton Abundance and Diversity in the Eastern Gulf of Mexico*. Univ. Fla. Rep. BLM Cont., AA 550-CT7-28, 546 pp.
- Klima, E.F. 1977. An Overview of the Fishery Resources of the Western Central Atlantic Region, 231-252. In: H.B. Stewart (ed.): *Symposium on*

- Progress in Marine Research in the Caribbean and Adjacent Regions.*
FAO Fish Rept. No. 200.
- Longhurst, A.R. 1971. The Clupeoid Resources of Tropical Seas. *Ocean and Mar. Biol.: An Annual Review*, 349–385.
- Lopez, R.H. 1972. *Distribucion y Abundancia Estimada de Huevos de la Sardina (Sardinella anchovia) en la Region Oriental de Venezuela 1968–1969.* Min. Agric. Cria Venezuela, Proy, Inv. Desarr. Pesq. MAC-PNUD-FAO Inform. Technico 46, 12 pp.
- Prest, K.W. Jr. 1968. Reproduction of Atlantic Thread Herring, *Opisthonema oglinum*, in the Northern Gulf of Mexico. Manuscript, Beaufort Lab., NMFS, Beaufort, NC.
- Prosvirov, E.S. 1967. Distribution of *Sardinella anchovia* Cuvier and Valenciennes in the Gulf of Mexico and Some Aspects of its Biology. 185–196 (in Russian). In A.S. Bogdanov (ed), *Sovetsko-Kubinskie rybokhozyaistevnenne issledovaniya*, UNRIO-CIP, Vypusk II. Izdatel'stvo "Pischevaya Promyskelnost," Moskva.
- Prosvirov, E.S. and A. Varea, 1965. *Sardinella aurita* Valenciennes of the Gulf of Mexico, 274–281. In A.S. Bogdanov (ed). *Sovetsko-Kubinskie rybokhozyaistevnenne issledovaniya*, UNRIO-CIP, Vypusk I. Izdatel'stvo "Pischevaya Promyskelnost," Moskva.
- Reintjes, J. 1980. Marine Herring and Sardine Resources of the Northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Center, Beaufort Lab. NC. Contrib. No. 80–62B.
- Schmidt, W. 1972. Results of the UNDP(SF)/FAO Regional Fisheries Survey, West Africa. Rept. No. 1. Deepscattering *Sardinella aurita* off Maruitania *Mar. Biol. (Berl)* 16: 91–101.
- Simpson, J.C. 1969. The Present Status of the Investigation and Exploitation of the Clupeoid Resources of Venezuela. *Symp. Inv. Res. Caribb. Sea.* FAO Fish. Rept. 71, Vol. 2, Pt. 2: 263–278.
- Simpson, J.C. and G.G. Gonzalez, 1967. Some Aspects of the Early Life History and Environment of the Sardine *Sardinella anchovia* in eastern Venezuela. *Min. Agric. Cria. Invest. Pesq. Serv. Rec. Expl. Pesq.* 1 (2): 38–93.
- Simpson, J.C. and R.C. Griffiths, 1967. The Fishery Resources of Venezuela and their Exploitation. *Min. Agric. Cria. Invest. Pesq. Serv. Rec. Expl. Pesq.* 1(5): 175–204.
- Whitehead, P.J.P., 1973. The Clupeoid Fishes of the Guianas. *Bulletin of the British Museum (Nat. Hist.) Zoology. Suppl.* 5: 1–227.
- Whitehead, P.J.P., G.J. Nelson and T. Wongratana. 1988. *FAO Species Catalogue. Clupeoid Fishes of the World (suborder clupeioidi). An Annotated and Illustrated Catalogue of the Herrings, Sardines, Pilchards, Sprats, Anchovies and Wolf-herrings. Part 2. Engraulidae.*

FAO Fish. Synop., 124, Vol. 7, Pt. 2: 305–579.

Whiteleather, R. and H. Brown, 1945. An Experimental Fishery Survey in Trinidad and Tobago, and British Guiana. Anglo-American Caribbean Commission, Wash. D.C. 1945. 130 pp.