

COMMERCIAL PELAGIC FISHING SURVEY AROUND PUERTO RICO 1/

by Donald S. Erdman 2/

- 1/ Authority to undertake this program was granted through the Commercial Fisheries Research and Development Act of 1964, known as PL 88-309, as amended.
- 2/ Assistant Director of the Commercial Fisheries Laboratory and Project Leader.

ABSTRACT

This survey caught 203 pelagic fishes weighing a total of 1,100 pounds. The trolling catch consisted of 19 species, 4 of which were dominant: 66 great barracuda, 36 cero, 35 little tunny and 20 king mackerel.

Barracuda were caught throughout the year. Tunny were caught sporadically, but are known to be more abundant in summer. Cero are caught more often in winter, whereas king mackerel are caught more frequently in summer.

Average catch rates were low at 1.5 fish pounds per boat hour or 0.7 pounds per line hour. Economic feasibility of trolling during this project proved practical only as a subsidiary fishing method while motoring to and from other fishing grounds.

Job No. 2 - Title: "Commercial Pelagic Fishing Survey"

Introduction:

In accord with the Program Narrative and fiscal year work statements with amendments, pelagic fish trolling was conducted by project personnel from the vessels STAHL and GARCIA DIAZ. The latter vessel became inoperable near the end of FY 1976 and was retired from service; and the second captain and 2 crew were dismissed. Because of time limitations with a single vessel, pelagic trolling effort was restricted to conform with the needs of demersal fishing.

The objectives for Job 2 are summarized as follows: a) to determine the species of fishes available to the commercial pelagic fishery, b) to verify fish catch rates from surface trolling, and c) to evaluate commercial feasibility by fishing with a boat in the 35 to 40 foot class.

Methods:

Handlines were used with rubber shock cords trolled from the stern and attached to 14 foot bamboo poles (Bambusa tulda) which were obtained from the Mayaguez Agricultural Experiment Station. Number 05 hooks were used for trolling singly and number 5 for use doubly on a line. Artificial lures such as feathers and spoons were used more often than tied or cut fish baits. Monel wire on a hand line or from a snapper reel was used for subsurface trolling. More often two lines were trolled, one from each side of the stern; and one near the end of each outrigger pole, four lines occasionally.

Records were kept in the ship's log and transferred to a trolling log (as used on board the UNDP/FA) ALCYON; see Marine Fisheries Review 1974, 36, 9, Wagner and Wolf, 35-43). Data were entered in the trolling log table on the

date, fish species, location and station, time, lure type, length-weight, gonad stage, sex and fish line location on the boat. A copy of the "Trolling Log" is included; see figure A.

Total trolling catch and fishing effort:

During FY 1978, the total catch was 75 fishes weighing 201 pounds with an effort of 209 boat hours trolling equal to 494 line hours. The total for the three fiscal year periods was 203 fishes of 19 species weighing a rounded 1,100 pounds; see Table A. Ten fishes were eaten on board and their weights were estimated. The total fishing effort was 712 boat hours equal to 1495 line hours; the average number of fishing lines was 2.1, (including both boats).

The average overall catch rate was 1.5 fish pounds per boat hour. The catch per line hour was 0.7 pounds or 0.28 fish, whereas the Caribbean regional total of the FAO Project (op. cit.) was 2.2 pounds per line hour, but varied from 0.07 pounds to 12.8 pounds per line hour (p. 39, Table 4).

Trolling catch efficiency in respect to fish line position on the boat was recorded for 162 fishes as follows: left outrigger pole (L-2) = 17 fishes; left stern (L-1) = 79; mid-stern or center (C-0) = 7; right stern (R-1) = 53; and right outrigger (R-2) = 13. In agreement with the FAO experience, the left hand side of the boat tended to catch more fish because of the right hand thrust of the propeller which causes more turbulence on the right side.

Fishing success near Mona Island was better on the average than around Puerto Rico. Amounts of fishing effort by coasts are compared with total effort of 3 fishing trips to Mona Island and one trip to Vieques (east coast).

<u>Area</u>	<u>Boat hrs.</u>	<u>Fish No. per boat hour</u>	<u>Fish pounds /boat hour</u>	<u>Fish pounds per line hour</u>
west coast	235	0.26	1.17	0.56
north coast	103.2	0.08	0.67	0.32
south coast	63.6	0.20	0.46	0.22
Mona Island	61.5	0.45	3.65	1.74
Vieques I. (east coast)	4.33	0.70	3.00	1.43

Artificial and natural baits were both used on trolling lines. When both feather and fish bait were used, it was classified as natural fish bait. Most of the barracuda and king mackerel were caught on tied fish bait, whereas most of the cero and tunny were caught on feathers; see Table B.

Ballyhoo is the best trolling bait, but it is expensive to obtain. Second best is the red goatfish. Bar jack, however, were most readily available to the project.

Time of day appeared to be significant for increased catches of cero (Table C) from 6:00 to 8:29, but less so for other species. Four species were considered dominant in the catch: barracuda, cero, tunny and king mackerel. The other 15 species were caught less frequently.

The earliest fish at 5:30 on June 17, 1976 was a horse-eye jack. The latest fish was a tunny at 17:40 on October 19, 1977. The noticeably larger catch of barracuda than other species agreed with the FAO experience.

Monthly and seasonal change in catches are known to occur among the pelagic fishes, Erdman (1976, 1968, 1962), but were not apparent in the Project catch because of the few numerical data. The four more numerous species, however, showed more gonad ripeness from June through September than other months.

Stomach content examinations were few. A 15.5 pound barracuda had a 2 inch file fish postlarva, Cantherines pullus, perhaps the most common ichthyoplankton forage species in the Antilles, Erdman (1958). A tunny had 2 small flyingfishes of

3 inches, Parexocoetus brachypterus; and a 32 pound dolphin had a 9 inch flyingfish, Cypselurus sp. A yellowfin grouper had a 2 inch cardinal fish, apogonidae.

Gonad development of 4 major pelagic species evinced seasonal patterns in more fishes with near ripe or ripe ovaries or testes (stages 3, 4 or 5) during the spring and summer months. Monthly distribution of near ripe stage 3 and ripe stage 4 gonads (Lerdman, 1968) are listed below for four fish species:

Fishes with ripening gonads (stages 3 & 4) by month, fish species and sex

Fish species	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	
barracuda					3f3 m4	m4		f3		= 6 out of 54
cero		f3	f3	m3	f3	f4 2m3				= 7 out of 21
tunny		m4	f3		3f3 m3, 4	5f3 3m3		f5, 2f4	2m3	= 20 out of 32
kingfish	f3		m3		f3	3m3	2f3 2m3	2f3		= 12 out of 15
	1	2	3	1	11	15	4	6	2	= 45 out of 122

Of particular note is the 11.5 pound king mackerel or kingfish (34" fork length) with stage 3 ovaries with ova (weighing 137.1 g) caught on February 3, 1977 west of buoy 6 southwest of Mayaguez. It was the only female kingfish with developed ova seen by the writer during February over a period of 25 years. During July and August most adult females have ovaries with developed ova.

Minimum fish sizes for four pelagic species may have had significance for the minimum species size of adults during their first spawning, as follows:

Fish sizes in pounds and gonad stages

smallest fish			smallest female			smallest male			postlarvae or
fish species	size	month	f-1-2	f-3-4	month	m-1-2	m-3-4	month	juveniles
barracuda	1.5 lb	June	1.5	7	June	3	7	June	25mm all month Erdman (1976)
cero	.5	Feb.	1.25	2	July	1	2	July	(4)34-35mm, 27 Jul. 78 (50)20-60mm, 6 Aug. 65
tunny	.75	March	.75	1.75	Sept.	1.25	2.5	July	
kingfish	1.5	April	3	3.5	Aug.	6	6	July	

Barracuda: On June 8, 1976, a female of 502 mm and 756 g (1.5 lb) had immature whitish ovaries with slight reddish fat. Perhaps barracuda mature at a smaller size near Puerto Rico than in Florida or the Bahamas. De Sylva (1963, p. 47) said "Some females first mature at three years at a length of about 580 mm".

As early in the season as February 25, 1967, I examined a near-ripe female barracuda with stage-3 ovaries and developed ova off Saba Island, and I have seen ripe and near ripe barracuda males and females as late as September 10. Thus the main spawning season of barracuda is spring and summer with evidence of at least some spawning throughout the year based on the presence of one inch juvenile barracuda throughout the year at La Parguera.

De Sylva (op. cit.) reported ripe females from April 18 to mid-October off Miami, Florida. He stated that spawning ceased when water temperature had dropped from a mean maximum temperature of 83.8° to 77°F. Open sea surface waters seldom reach as low as 77° F. around Puerto Rico.

Cero: Breder and Rosen (1966) said that the cero "has not been studied in detail". This statement is still true today; see also Bohlke and Chaplin (1968). The largest I have seen was a female (stage 3) 11.5 pounds and 30.5" in fork

length speared off La Parguera on July 26, 1962. Sexes have been distinguished in 1.25 pound females and $3/4$ (0.75) pound males. A near ripe female (stage 3) weighed 2 pounds on July 22, 1977 and ripe males 1.25 pounds from La Parguera on December 8, 1957 and 3 pounds on January 4, 1962. It is likely that some spawning occurs throughout the year.

Fishermen report catching more cero in gill nets during the cooler weather in winter near the reefs off La Parguera. Of 38 cero trolled on this project, 8 were caught in December and 8 in February or a total of 24 for the months of December through March. Nearly $2/3$ of the cero were caught during $1/3$ of the months.

Cero are important in the fisheries of Puerto Rico, but they are included with the catch of kingfish, 125,000 pounds in 1975, Suárez-Caabro and Abreu (1976). Kingfish on the other hand are caught more frequently in summer than winter.

Kingfish are more important than cero because they average more in weight. Kingfish average around 10 pounds whereas cero average around 2 pounds; see Table A. Of 20 kingfish caught by the project, 8 were caught in July and August. In the 1950's and 1960's, the larger catches of the commercial fishery for kingfish off La Parguera occurred in July and August. Beaumariage(1973) discusses protected spawning for kingfish in Florida but indicated greater spawning activity in summer which is also true around Puerto Rico, Erdman (1976).

A. B. Cochran and Hipolito Fantauzzi reported pelagic fish landings for 1955-56 for Playhuela, Aguadilla; also see Erdman 1963, p. 29. Their unpublished records for kingfish and cero were as follows:

Kingfish and cero reported by numbers from Aguadilla in 1955-56

<u>Species</u>	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
Kingfish		26	10	27	76	236	137	33	61	4	1	2
cero	—	—	—	2	72	177	15	162	1	few	—	1
		26	10	29	148	413	152	195	62	4	1	3

The identifications of the two species are uncertain. It is likely that most of the fish were kingfish including some of the fish listed as cero. The large catches from May through September are characteristics of kingfish, not cero.

Tunny: Tunny usually occur in schools around Puerto Rico and the Virgin Islands. Locally they are called "vaca"; and they are sometimes caught by beach seines in large numbers along the west coast at Aguadilla and Aguada during the summer. They are caught rather sporadically by trolling.

Two small stage-2 females of 0.75 pounds each were dissected on 5 December 1977. Apparently this species attains sexual maturity at a relatively small size. The largest caught by this project weighed 4.75 pounds. The largest I have seen in this region of Puerto Rico and the Virgin Islands was a 6-pound near ripe male from Henley Cay, St. John on May 20, 1959. Generally tunny from this Caribbean area are small, usually less than 5 pounds.

Commercial feasibility of catching pelagic fishes was evaluated by records of fishing success and expenses attributable to trolling. The trolling effort by fiscal years was 102 boat hours in 1976; 401 hours, in 1977; and 209 hours, in 1978 equal to a total of 712 boat hours or 1495 line hours.

The average price of diesel fuel in FY 1976 was just under 50¢ per gallon, and had risen to 55.7¢ per gallon on October 3, 1978. Fuel consumption at trolling speed was estimated at 2.5 gallons per hour. Total cost of fuel was 53¢ per gallon average times 2.5 gal./hr. times 712 hours equals \$946.96. The average

prices for fish to the fishermen were 61¢ per lb in FY 1976, 66¢ in FY 1977 and 71¢ in FY 1978. The approximate market value of the total catch of 1100 pounds was \$726.00 at an average price of 66¢ per pound.

There is no evidence from this investigation that pelagic fish trolling, independent from combination with other fishing methods, would be commercially feasible or profitable. On the other hand trolling 2 lines to and from trips to regular fishing grounds for fish pots, lines or other gear is worthwhile since it adds only slightly to trip costs for baits and trolling gear, and is occasionally productive.

The only port in Puerto Rico with a sizeable pelagic fishery is Aguadilla Playhuela where some 100,000 pounds per year of tuna, mackerels, dolphin, barracuda and occasional billfish are landed by the commercial fishery. Blackfin tuna are the most commonly caught species. This port has a small pelagic fishery because of particular local ecological oceanic conditions. Some 30 fishermen operate from this port.

Summary

Of 203 fishes weighing 1,100 pounds caught trolling by the Project, there were 19 species. Four species dominated the catch: 66 great barracuda, 36 cero, 35 little tunny and 20 king mackerel, which totalled 157 fishes weighing 785 pounds.

The total catch of pelagic fishes caught trolling comprised the following amount in pounds and numbers of fish by fiscal year:

FY 1976	442 lbs.	53 fish
FY 1977	457	75
FY 1978	<u>201</u>	<u>75</u>
	1100	203

Average catch rates were low. The overall average catch rate was 1.5 fish pounds per boat hour, and 0.7 pounds per line hour.

Economic feasibility of trolling during this project proved practical only as a subsidiary fishing method to other types of fishing gears. Since fishing craft travel from port to fishing grounds, an extra line or two off the stern adds little to the cost of operation and yet can catch larger fishes on the average than any other method commonly used in our area.

Tied fish baits caught most of the barracuda and king mackerel, whereas artificial lures such as feathers caught most of the cero and tunny.

Barracuda were caught throughout the year. Tunny were caught sporadically, but are known to be more abundant in summer. Cero are caught more often in winter, whereas king mackerel are caught in greater quantities in summer.

More of the fishes were in or near spawning condition during the spring and summer months, mainly from March through September.

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<u>English name</u>	<u>Puerto Rican name</u>	<u>Scientific name</u>	<u>No. fishes</u>	<u>Total lb.</u>	<u>Max. lb.</u>	<u>Min. lb.</u>
1. great barracuda	picua	Sphyaena barracuda	66	427.25	19	.75
2. cero	alasangana	Scomberomorus regalis	36	75.75	6	.50
3. little tunny	vaca	Euthynnus alletteranus	35	87.50	4.75	.75
4. king mackerel	carite	Scomberomorus cavalla	20	194.50	36	1.50
5. skipjack tuna	vacora, bonito	Euthynnus pelamis	7	64.50	16	5.25
6. blackfin tuna	albacora, "bonito"	Thunnus atlanticus	5	40.50	17	5
7. wahoo	pero	Acanthocybium solanderi	1	22.00	22	22
8. dolphin	dorado	Coryphaena hippurus	2	50.50	32	18.50
9. greater amberjack	medregal	Seriola dumerili	2	34.00	26	8
0. yellow jack	guaymen	Caranx bartholomaei	2	5.00	3	2
1. horse-eye jack	jurel ojon	C. latus	2	17.50	10	7.50
2. black jack	jurel negron	C. lugubris	1	4.00	4	4
3. bar jack	cojinua	C. ruber	1	1.25	1.25	1.25
4. crevalle jack	jurel	C. hippos	1	2.00	2	2
5. yellowfin grouper	guajil	Mycteroperca venenosa	2	9.00	6.50	2.50
6. mutton snapper	sama	Lutjanus aralis	1	13.50	13.50	13.50
7. inshore lizardfish	doncella	Synodus foereus	1	0.75	.75	.75
8. sand diver	doncella	S. intermedius	7	2.50	1	.25
9. silky shark	laburón	Carcharhinus falciiformis	2	32.25	21	11.25
			<u>194</u>	<u>1,084.25</u> (average wgt.) =		<u>5.0</u>

TABLE 9. FISHING RECORDS OF BAITS BY MAJOR FISH SPECIES

<u>Artificial baits</u>	<u>barracuda</u>	<u>cero</u>	<u>little tunny</u>	<u>king mackerel</u>	<u>other species</u>	<u>totals</u>
white feathers	3	15	10	6	10	44
red & white feathers	1	14	11	4	4	34
yellow & white	2	3				5
blue & white				1	2	3
other feathers	2	3	4		4	13
metal spoon	$\frac{2}{10}$	$\frac{2}{37}$	$\frac{2}{25}$	$\frac{1}{11}$	$\frac{1}{21}$	$\frac{5}{104}$
<u>Natural bait</u>						
fish as bait:						
a) ballyhoo	9				3	12
b) bar jack	11			2		13
c) goatfish	6			1	1	8
d) sand tilefish	4					4
e) grunts	3				1	4
f) leatherjacket	1					1
g) cutlassfish	1					1
h) jack	1		1		1	3
i) bumper	1		1	3		5
j) cero				1		1
k) mojarra					1	1
l) silk snapper	1					1
m) vermilion snapper	1				2	3
n) fish bait unspecified	$\frac{14}{53}$	$\frac{1}{38}$	$\frac{1}{28}$	$\frac{4}{22}$	$\frac{5}{35}$	$\frac{25}{104}$
Total natural bait	53	1	3	11	14	82
bait totals (artificial & natural)	63	38	28	22	35	186

TABLE - C

Times of day in which fishes were caught in half-hour intervals during FY 1976¹, 77 and 78

<u>hour</u>	<u>barracuda</u>	<u>cero</u>	<u>tunny</u>	<u>kingfish</u>	<u>other species</u>	<u>totals</u>
5:30-5:59					1	1
6:00	1	2		2	1	6
6:30	3	3	1	3	1	11
7:00	6	3	2	2	3	16
7:30	4	11	5	1	3	24
8:00	9	8	1	3	2	25
8:30	1		6	1	3	11
9:00	1	2	1		1	5
9:30	4	2			3	9
10:00	5		2	1	2	10
10:30	2	1		1	1	5
11:00	5	1	1	1		8
11:30	5	1	4	1		11
12:00	2		2		1	5
12:30	2	1	2		1	6
13:00	2		1	1	1	5
13:30	5	1	2			8
14:00	1				3	4
14:30		1		1		2
15:00				1		1
15:30	2				1	3
16:00				1	2	3
16:30	1		1		1	3
17:00						
17:30	—	—	1	—	—	1
	61	37	34	20	31	183

