Exploitation and Biology of the Mackerel Fishery in Trinidad[1]

MAXWELL G. de L. STURM, MICHELE JULIEN AND PREMILA SALTER
Institute of Marine Affairs
P.O.Box 3160, Carenage
Trinidad and Tobago

In Trinidad, the mackerel (Scombridae) fishery is artisanal in nature and is comprised of two species, Scomberomorus brasiliensis (Collette, Russo and Zavala-Camin), and S. cavalla (Cuvier). The former is known locally as carite while the latter is referred to as kingfish. Considering their commercial importance, literature on these species in Trinidad waters is sparse. Early work by Brown (1942) stated August to be the best month for kingfish, and defined different periods of abundance for carite along the Trinidad coast. Later, Whiteleather and Brown (1945) reported that carite was the most abundant continental pelagic fish in Trinidad, with kingfish approaching it in importance. More recent studies have investigated the biology of carite (Sturm 1974; 1978) and their mortality rates (Julien et al., in press). The status of the mackerel fishery in Trinidad has also been discussed by Sturm and Julien (in press).

This paper is based mainly on data collected by the Fisheries Division, Ministry of Agriculture, Lands and Food Production from 1964 to 1981. It describes the exploitation of the mackerel fishery in Trinidad and provides information on the commercial value of the fishery, fishing methods, catch trends and seasonal abundance. A summary of work done in 1981 and 1982 on the biology of both species is also presented.

DESCRIPTION OF THE FISHERY

Several types of gear are used in the fishery. These are as follows: gill nets or filettes, trolling lines, beach seines, and tuck and Italian seines. Details of the construction and use of these gears are found in Brown (1942), Whiteleather and Brown (1945) and Kenny and Bacon (1981). Although the first two papers were published some years ago, much of the information they provide is applicable today. Further information, especially on beach seines, is supplied by Sturm (1974). These gears are deployed from outboard (and at times inboard) powered open boats or pirogues ranging in length from 7-10 m. A brief description of these gears and methods is as follows:

GILL NETS: The nets are made of multi-filament nylon twine and range in length from 140 to 860 m and are set 5-9 m in depth. The most commonly used mesh size is 113 m (4.1/2 in) stretched mesh. The nets are fished at night and are usually allowed to drift, but are occasionally anchored. The fish are caught by

[1] This paper is based on an in press IMA report as well as recommendations for future studies of the fishery.

being entangled by the gills.

TROLLING OR "TOWING": Pirogues, by the use of outriggers, may tow up to four lines. The leader wire is long, varying in length from 45 to 90 m. A variety of lures may be used, with spoons and cut bait being the most common. A variation of towing is "a-la vive" fishing, in which live bait, almost invariably jashua (Sardinella aurita), is used at the end of a very short (0.3 m) leader wire, and which is practised from an anchored, drifting or slow moving boat.

BEACH SEINES: These are used mainly at Mayaro on the east coast and Icacos on the south coast. They vary from 340 m to 660 m with a mesh size from 13 mm (1/2 in) stretched mesh in the cod end, to 152 mm (6 in) in the wings. The net is operated in the familiar manner, from 10 to 40 fishermen being required to haul the net, depending on its size.

Occasionally, large catches of carite are taken by beach seines. However, few kingfish are caught, due to their loose schooling habits and tendency to live further offshore.

TUCK AND ITALIAN SEINES: These are offshore seines derived from the Mediterranean lampara. These seines do not close at the bottom, i.e., purse, and essentially consist of two wings and a bag or bunt in which the fish are entrapped. The tuck seine is rarely used nowadays, and is largely replaced by the Italian seine, which is a local derivation of the tuck seine. In the Italian seine, the bag may be from 20-40 m in length and the wings are approximately 80 m in length, with a mesh size of 25 mm (1 in) stretched mesh in the bag to 305 mm (12 in) in the wings. Italian (and tuck) seines are used in the day to catch mackerel. As carite school more compactly than kingfish, the former are most readily caught in the seines. The use of these seines is a skilled procedure, and it takes seven men to operate the net.

Beach Landings.--From 1964 to 1981, data were collected from 16 beaches (Tables 1 and 2). During this period a total of 22,214 metric tons (average 1234 metric tons/year) of carite worth some TT $32 million (US $1 = TT $0.42) were landed, and the price rose steadily from approximately $0.37/kg ($0.17lb), to approximately $5.53/kg ($2.51/lb)(Fig. 1). For kingfish, during the same period, a total of 2614 metric tons (average 145 metric tons/year) worth some $7 million was landed. Again, the price showed a steady increase, rising from approximately $0.79/kg ($0.36/lb) in 1964 to approximately $10.71/kg ($4.86/lb) in 1981 (Fig. 1). The 1981 prices for both species compared well with present observed beach prices, demonstrating that the combined beach landing data (Fig. 1) are reasonably accurate. These figures demonstrate the value of the mackerel fishery to artisanal fishermen, and make carite the most important commercial finfish in Trinidad, with kingfish approaching it in importance (Fig. 1).

Table 1 shows that Erin on the south coast and Icacos and Fullerton on the southwest coast are the most important beaches

Table 1. Beaches and ranking by weight of landings of carite for the years 1964 to 1980

Beaches	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
WEST COAST																	
Port of Spain	3	3	3	3	2	3	5	7	8	6	8	7	6	7	7	5	4
Orange Valley	12	12	12	12	12	11	13	10	13	13	11	14	9	10	9	7	13
Carenage	8	8	11	8	8	7	12	12	12	11	13	11	11	12	13	11	11
La Brea	5	5	5	7	7	5	6	5	9	10	14						
San Fernando	4	4	4	4	3	2	4	3	5	5	7	8	8	6	6	6	6
NORTH COAST																	
Toco	11	11	10	10	10	10	10	13	10	12	12	9	10	8	8	8	8
Metelot	10	10	8	9	9	9	14	11	15	14	16	15	15	14	14		12
Las Cuevas	9	9	9	11	11	12	15	15	14	15	15	13	14	13	10	10	7
Maracas	6	6	6	6	6	8	11	14	11	9	9	10	13	11	11	9	10
EAST COAST																	
Mayaro	7	7	7	5	5	6	8	8	4	7	10	12	12	15	12	12	9
SOUTH COAST																	
Cedros	1	1	1	1	1	1	3	2	2	1	2	2	3	4	4	2	2
Icacos	2	2	2	2	4	4	1	9	3	4	5	5	4	9		13	
Erin							2	1	1	2	1	1	1	1	1	1	1
Gran Chemin							9	6	7	3	4	3	2	2	2		
La Lune							7	4	6	8	6	6	7	5	5	4	5
Fullerton											3	4	5	3	3	3	3

Table 2. Beaches and ranking by weight of landings of kingfish for the years 1964 to 1980

Beaches	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
WEST COAST																	
Port of Spain	4	4	5	6	4	3	4	2	5	3	1	1	4	5	4	3	3
Orange Valley	12	12	12	12	11	11	14	14	14	13	14	12	9	14	7	5	13
Carenage	7	5	4	7	5	6	6	3	9	11	10	8	11	10	8	8	7
La Brea	6	6	6	9	9	10	9	13	10	14	16						
San Fernando	10	10	9	5	8	9	12	15	15	12	8	7	8	11	10	9	8
NORTH COAST																	
Toco	5	7	8	3	3	2	1	1	1	5	2	5	3	7	5	4	5
Metelot	8	8	7	4	6	8	7	10	13	15	15	15	14	13	13		11
Las Cuevas	2	2	1	2	2	5	3	7	3	7	5	3	1	1	1	1	1
Maracas	1	1	2	1	1	7	2	4	4	2	4	4	2	2	3	2	4
EAST COAST																	
Mayaro	9	9	11	10	12	12	15	12	12	4	7	9	13	15	11	11	10
SOUTH COAST																	
Cedros	3	3	3	8	7	4	13	11	7	10	12	11	15	9	14	10	9
Icacos	11	11	10	11	10	1	5	8	8	8	13	14	10	8		12	
Erin							11	9	11	9	9	10	6	4	9	7	6
Gran Chemin							10	5	2	1	3	2	5	3	2		
La Lune							8	6	6	6	6	6	7	6	6	6	2
Fullerton											11	13	12	12	12	13	12

for landed carite by weight. It can be seen that Maracas and Las Cuevas on the north coast and Toco on the northeast coast are the most important beaches for kingfish (Table 2).

Catch Trends.--The yearly catches of carite and kingfish from 1964 to 1981 (Fig. 1) exhibit the same pattern of fluctuation. Large catches in 1964 declined to minimum catches in 1969 and 1970, and then increased in 1971. After this, there was a decline until 1974, followed by increased catches from 1975 to 1981. Variations in pelagic fish catches are well known and have been documented together with their causes (Nair and Chidambaram, 1951; Uda, 1952; Marr and Bohlke, 1956). A major cause of fluctuations is due to variation in year class size caused by natural oceanographic changes. The fact that cyclic variation is occurring in the mackerel fishery indicates that the stocks are not overfished. This is substantiated by the fact that increased effort (number of boats) does not decrease, but rather increases the catch per unit effort for carite (Fig. 2). Conclusions on catch per unit effort data for carite must be guarded, as the effort data are very sparse.

Seasonality.--Monthly beach landings for carite and kingfish for the years 1968-1970 and 1977-1981 (landings for 1968-1970 are for 4-weekly periods) are shown in Figures 3 and 4. The more abundant occurrence of carite and kingfish at certain times of the year is well known locally. Carite is more abundant from May to August and kingfish from March to August. Data collected by the Division of Fisheries, Ministry of Agriculture, Lands and Food Production, tend to support this observation. However, anomalies such as large reported catches of carite in November and December of 1977 and 1978 and of kingfish in January of 1978 and 1981 do occur, and these data should be treated with a certain amount of caution.

Figure 3 shows that for carite for the years 1968-1970 May to September, at the start of the wet season were the months of maximum abundance. For the years 1977 to 1981, the period of abundance is from May to October. Figures 5a and 5b show the catches per month per coast for carite. The fish appear around May on the west and north coasts and later in the year on the east and south coasts. This movement lends confirmation to the suggestion that carite move towards water of low salinity about August to spawn, and a post spawning feeding migration corresponding with the period of abundance from May to September takes place around the island in a clockwise direction (Sturm, 1974; 1978).

Figure 4 shows that kingfish appear in abundance earlier in the year during the dry season in March and remain until October. Figures 6a and 6b show the catches per month per coast for kingfish. The same trends as for carite can be seen though less convincingly, with kingfish appearing earlier in the year around March on the west and north coasts and later on the east and south coasts. Kingfish spawn around the island throughout the year, peaking from September to March during a period of minimum abundance, and show no evident feeding or local migratory patterns (Sturm and Salter, in prep.). The evidence

indicates that kingfish move southwards during the year towards water of lower salinity to spawn.

RESULTS OF CURRENT BIOLOGICAL RESEARCH ON MACKERELS

Julien et al. (in press) computed instantaneous mortality rates (Z) of 0.83 for 1981 and 0.88 for 1982 for carite. These fish were sampled from the multi-gear fishery at Port of Spain Fish Market. These values agree well with results collected from data from Sturm (1974) and indicate that the stocks are not overexploited. Julien et al. also found that recruitment to the fishery takes place at ages II and/or III for both sexes from September to February.

A total of 151 carite stomachs were examined, of which 123 (82%) had food which consisted of fish remains. Of these only 13 (9%) contained identifiable material which comprised mainly clupeoids.

A study of the biology of kingfish is near completion. The spawning habits of kingfish in Trinidad have been described before in this paper. It is noted that peak spawning from September to March corresponds with that observed for carite (Sturm, 1974; 1978). A report on aspects of the biology of kingfish is in preparation.

PROPOSED RESEARCH ON THE TRINIDAD MACKEREL FISHERY

Some idea of the state of the mackerel stocks has already been presented in this report. It is clear that future attempts at stock assessment will be greatly facilitated by more accurate data collection methods.

The Institute of Marine Affairs (IMA) will address itself to studies on reproduction, feeding, growth, mortality and recruitment of both Trinidad mackerel species. The work by Sturm (1974; 1978) on carite reported on these aspects, but information on feeding and fecundity was sparse. To fulfill these objectives, the IMA is at present carrying out the following studies: (1) the general biology of kingfish, (2) feeding of carite, (3) fucundity of carite, and (4) monitoring of annual mortality of carite.

Future studies will include more direct approaches such as tagging to investigate migratory movements of both species, larval distribution and abundance of both species, and gill net trials for carite to determine optimum mesh sizes. Improved data collection should enable the use of models to compute maximum sustainable yields (Schaefer, 1954; Beverton and Holt, 1957) for both species to determine exploitation levels. It will be the objective of the IMA to make as thorough a study as possible on the biology of the carite due to its commercial importance.

ACKNOWLEDGMENTS

The authors are grateful to Mr. M. La Croix of the Fisheries Division, Ministry of Agriculture, Lands and Food Production, for making available, beach landing data, without which this report could not be written. Thanks are also due to Dr A.

Siung-Chang for reading the manuscript and to Mr. A. Cummings for help in figure preparation.

LITERATURE CITED

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. U.K. Min. Agric. Fish., Fish Invest. (Ser. 2) 19:533 pp.

Brown, H.H. 1942. The sea fisheries of Trinidad and Tobago. Development and welfare in the British West Indies. Development Welfare Bull. Barbados, BWI 2. 69 pp.

Julien, M., P. Salter and M.G. de L. Sturm. In press. A preliminary report on mortality and recruitment of the carite Scomberomorus brasiliensis (Collegge, Russo and Zavala-Camin) in Trinidad. IMA Report.

Kenny, J.S. and P.R. Bacon. 1981. Aquatic resources. Pages 112-1244 in St. G.C. Cooper and P.R. Bacon, eds. The natural resources of Trinidad and Tobago. Edward Arnold. London.

Marr, J.C. and J.E. Bohlke. 1956. Are the world wide declines in sardine catches related? Proc. Eighth Pacific Sci. Congress Oceanogr. 3:183-186.

Nair, R.V. and K. Chidambaram. 1951. A review of the Indian oil sardine fishery. Proc. Nat. Inst. sci. India. 17(1):71-85.

Schaefer, M. 1954. Some aspects of the dynamics of populations important to the management of the commercial marine fisheries. Bull. 1-ATTC 1(12): 27-k5.

Sturm, M.G. de L. 1974. Aspects of the biologyof the Spanish Mackerel, Scomberomorus maculatus (Mitchill) in Trinidad, West Indies. Ph.D. Thesis, University of the West Indies.

_____ 1978. Aspects of the biology of Scomberomorus maculatus (Mitchill) in Trinidad. J. Fish Biol. 13:155-172.

_____ and M. Julien. In press. The present status of the mackerel fishery in Trinidad. IMA Report.

_____ and P. Salter. In prep. Aspects of the biology of Scomberomorus cavalla (Cuvier) in Trinidad. IMA Report.

Uda, M. 1952. On the relation between the variation of the important fisheries conditions and the oceanographical conditions in the adjacent waters of Japan 1. J. Tokyo Univ. Fish. 38:363-389.

Whiteleather, R.T. and H.H. Brown. 1945. An experimental fishery survey in Trinidad, Tobago and British Guiana. Anglo-Amer. Carib. Comm. Washington, D.C. 130 pp.

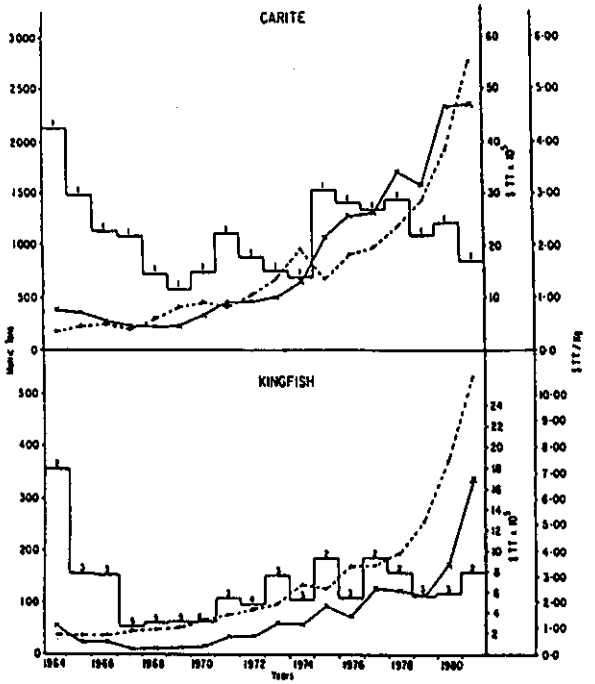

Figure 1. Yearly catches, $TT values ($TT 1 = $US 0.42) and prices per kg of carite and kingfish. Numbers above each bar indicate ranking by $TT value compared to other fish species (x---x = value in $TT; 0---0 = price/kg in $TT).

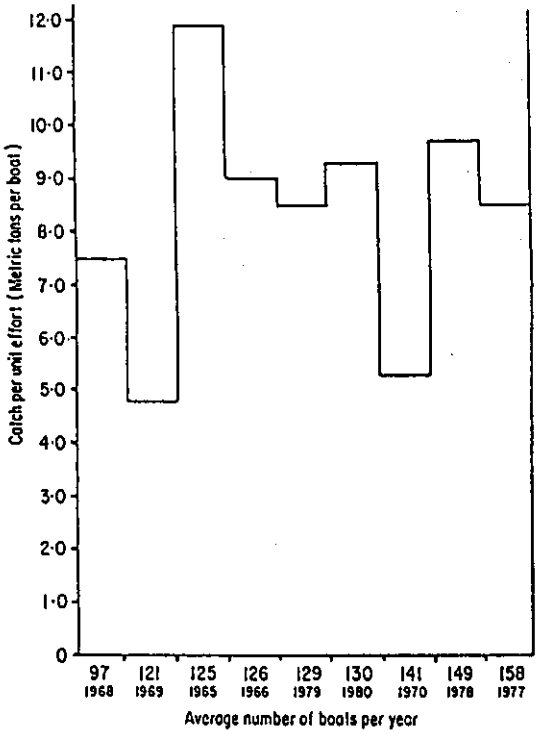

Figure 2. Catch per unit effort of carite arranged in ascending order of effort.

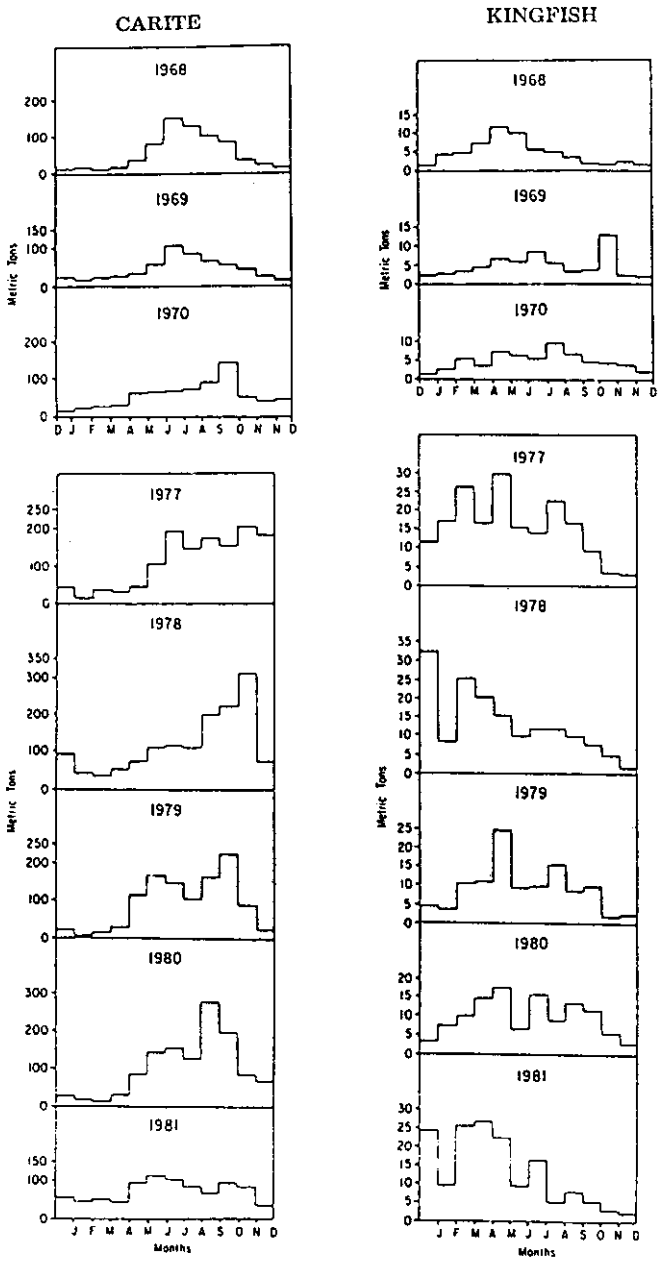

Figure 3. Catches of carite (1968-=1970 data collected over 4-week intervals; 1977-1981 data collected monthly).

Figure 4. Catches of kingfish (1968-1970 data collected over 4-week intervals; 1977-1981 data collected monthly).

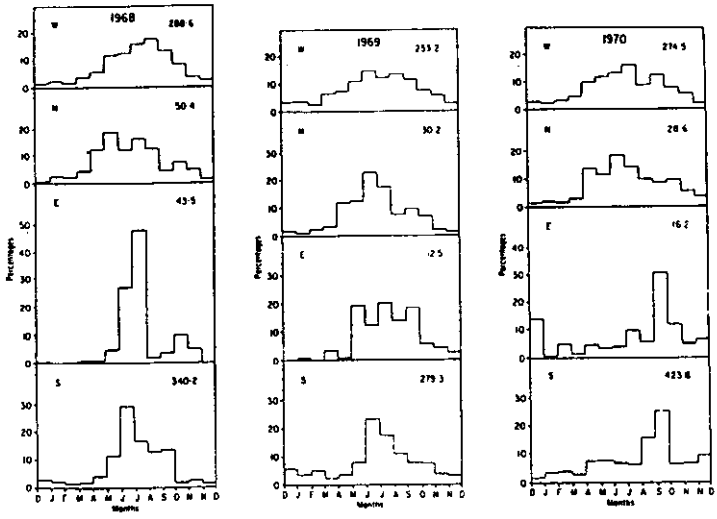

Figure 5a. Monthly catches per coast of carite (data collected over 4-week intervals; figures on top righthand corner of histograms indicate total catches in metric tons).

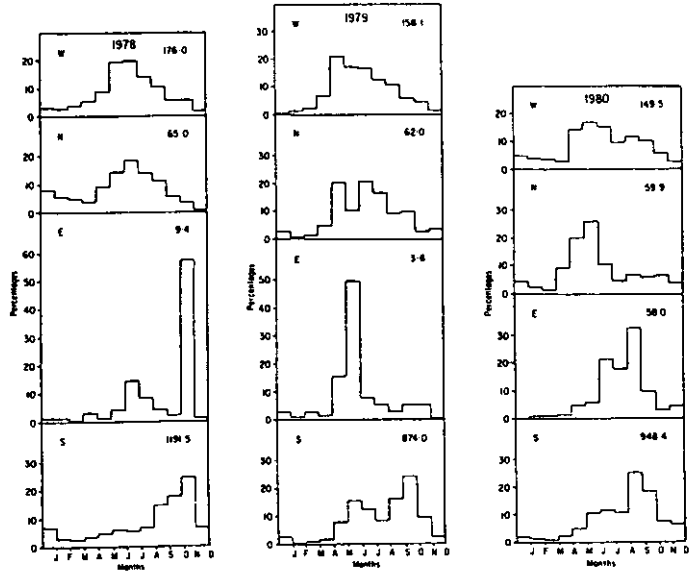

Figure 5b. Monthly catches per coast of carite (figures in top righthand corner of histograms indicate total catches in metric tons).

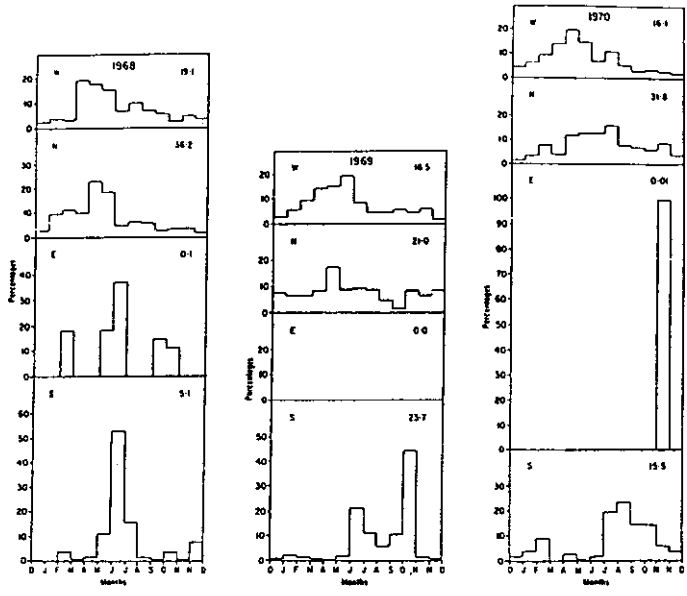

Figure 6a. Monthly catches per coast of kingfish (data collected over 4-week intervals; figures in top righthand corner of histograms indicate total catches in metric tons).

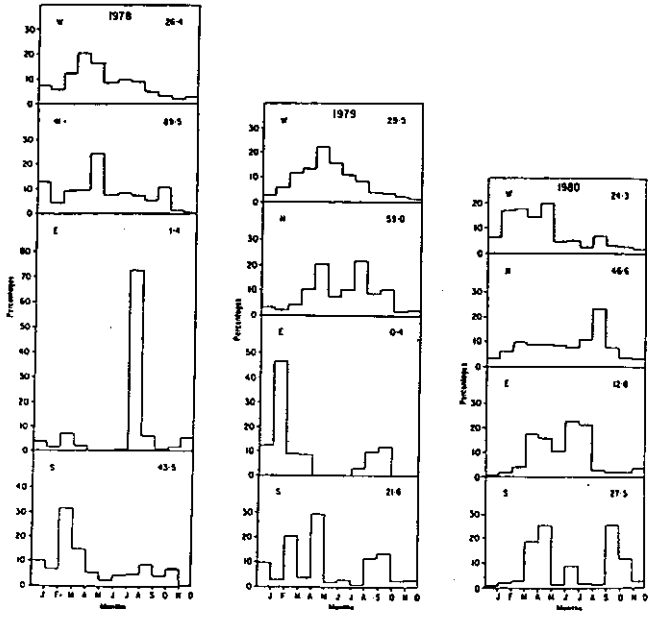

Figure 6b. Monthly catches per coast of kingfish (figures in top righthand corner of histograms indicate total catches in metric tons).