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Recent Developments in the Brazilian Fisheries

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Abstract

This paper gives a concise summary of the present position of the fisheries in Brazil. The latest development is the formation, at the national level, of a Fisheries Development Council for the purpose of placing fisheries management on a sound basis throughout the United States of Brazil.

Because the coastline of Brazil extends some 4,600 miles from tropical to sub-arctic waters the various major fisheries of Brazil are discussed on a regional basis.

In the north and northeastern States bordering the Amazon River freshwater fish and shrimp dominate the catch. As there is little mechanized shrimping in this region there appears to be excellent possibilities for the development of this resource. Spiny lobster fishing and tuna long-line fishing are also important industries of this area.

In the eastern zone sardine landings are most important. Southward from Rio de Janeiro considerable sardines are still landed, but mechanized trawling for species of croaker, seatrout and cod dominate the landings.

Location

THE UNITED STATES OF BRAZIL (Figure 1) occupy one half of the South American continent, with an area comparable to that of the United States of America. There are 24 individual States and Territories, three of which are each about the size of Alaska. The population was officially estimated at 66,000,000 in 1960, with 11,000,000 concentrated in the highly industrial State of São Paulo in the South, and 3,200,000 in the ex-capital city of Rio de Janeiro.

This vast country, the interior of which is still an Indian frontier, stretches from 5° north of the equator well into the southern temperate zone, with a corresponding climatic spectrum. Temperatures are generally more moderate along the inhabited coastal belt than might be expected from the geography, but humidity is high in most parts of the country.

Oceanographic Conditions

There are 4,600 sea miles of coastline bordering the Atlantic Ocean and the "bulge" of Brazil cuts the warm, nutrient-poor South Equatorial Current

FIGURE 1. Map of Brazil, showing States.

in two (with some enrichment at the divergence), one fraction being forced past the Amazon estuary into the northern hemisphere, while the residue flows southward as the warm, saline Brazil Stream.

The northern current is enriched by the massive run-off from the Amazon valley, the effect of which can be seen 200 miles out to sea, but the richest fisheries of northern Brazil are in the State of Maranhão, which lies considerably to the east. It is possible that there may be comparable unexploited resources further west and north.

Regarding the southern branch, although the oceanographic picture is not yet clear, the scattered observations carried out by the Brazilian Navy and the São Paulo Oceanographic Institute seem to indicate that when this configuration turns against the coast, the combination of forces (moving mass of deep waters, southwest winds and coriolis factor) is such as to bring the cold, nutrient-rich water towards the surface in a cool stream parallel, and inshore to the Brazil Current. A rather clear idea of these conditions along the coast of eastern Brazil may be obtained from Figure 2 This situation persists from the southern part of Bahia at least as far as Santos, and is strongest off Cabo Frio ("the Cold Cape"), near Rio de Janeiro, where the cold water may sporadically reach the surface in a green upwelling known locally as "agua

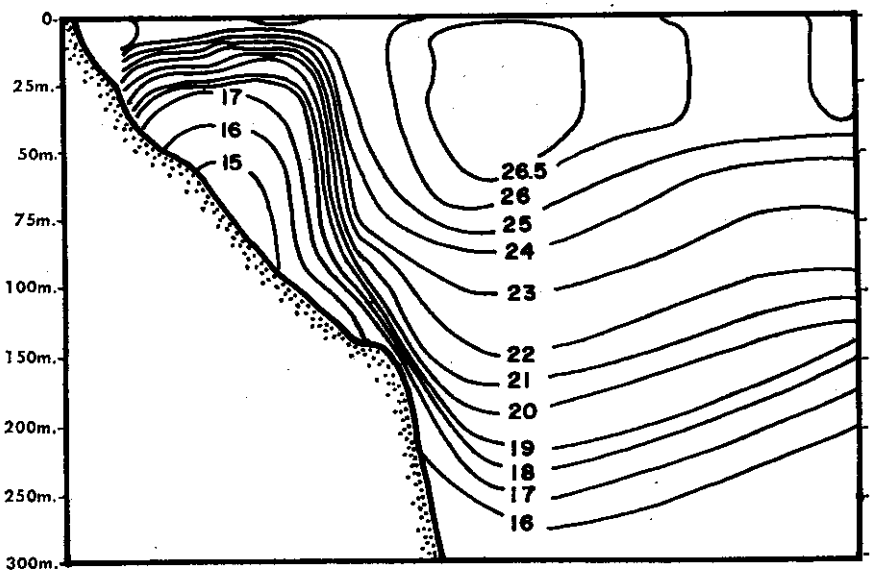

FIGURE 2. Isothermic cross-section of the Brazil Stream and accompanying upwelling water, for a distance of 300 miles S.E. of Santos. Observations by Dr. Emilsson of the Oceanographic Institute of São Paulo, aboard the Brazil Navy corvette "Solimões," March, 1956. Further east, the cold water sporadically bursts through to the surface.

fina", which supports a population of sardines *(Sardinella aurita* or *S. allecia),* the most abundant single species of fish in Brazilian waters.

In the extreme south, off the States of Santa Catarina and Rio Grande do Sul, a tongue of colder water, representing the death of the Falklands Current, intrudes between the coast and the Brazil Stream, carrying northwards the run-off of the River Plate, and giving rise to a long line of convergence of Atlantic and Pacific waters. There is a predominance of ground fish in this area, which increases in abundance as one progresses south.

The Fisheries

Fishery statistics are not organized by the Fisheries Department, but by the Service of Production Statistics. Until quite recently their collection was not subject to any technical planning nor, as far as is known, were they put to any use. The figures have been tabulated in usable form for the first time in 1959, for which credit is due to Dr. J. M. Rangel, the present Director of the Statistical Service. They must, however, still be considered as estimates, with varying degrees of precision. In particular, they do not include a substantial amount of subsistence fishing.

In Table 1, the estimated total landings of the more important fishing States in 1958/59 is compared with the earlier figures for 1950/51. The approximate breakdown by major groups, given in Table 2, is possible for the first time in 1959. It must be appreciated that these landing figures reflect to some extent

TABLE 1

BRAZIL - TOTAL LANDINGS OF ALL AQUATIC ANIMALS BY STATES, 1950 - 1959

State	1950	1951	1958	1959
	000s of metric tons			
Pará	9.0	7.9	11.2	13.3
Maranhão	34.3	30.1	31.6	31.1
Ceará	3.5	4.5	7.9	9.8
Paraíba	0.6	1.0	4.7	12.0
Rio de Janeiro & Guanabara	38.0	43.8	39.3	45.9
São Paulo	12.6	14.1	36.0	37.5
Santa Catarina	10.1	11.0	11.6	13.1
Rio Grande do Sul	21.8	22.0	29.0	45.8
15 Other States	24.0	23.9	43.7	44.6
Total Brazil	153.9	158.3	215.0	253.1

areas of demand rather than of abundance (except for sardine), since the trawlers sailing out of the eastern ports make extended trips to the rich bottom grounds off Southern Brazil, Uruguay and Argentina.

North and Northeast

The unexplored tropical rain forests of the Amazon Valley in Northern Brazil are sparsely populated, with only three towns of any size, Belém, Manaus and Santarém. The fisheries are correspondingly small (23,000 tons for the whole area in 1959). The officially reported catch of freshwater fishes (Characids, cichlids, catfishes and Arapaima) from this enormous river basin is surprisingly small, and it is suspected that much of the catch does not get into the statistics.

As one proceeds eastwards, there is an abrupt change of climate from the extremely damp conditions prevailing in the Amazon to the notoriously dry zone of the bulge, which, although more densely populated, has become the most under-privileged area of Brazil.

The transition occurs in the State of Maranhão, which, for at least ten years, has reported an inexplicably large fishery in excess of 30,000 tons, of which 6,000 tons is shrimp and at least 8,000 tons freshwater fishes. According to the information available, about half of the fin-fish and almost all the shrimp are dried and, presumably, a large part is transported outside the State.

According to Lindner (1957), about 60 per cent of the shrimp consists of the small sea bob *(Xiphopeneus kroyeri)*, while the rest is about equally divided between the young of the so-called "white shrimps"—*Penaeus schmitti* and *P. aztecus*—which are caught throughout the year along the beaches and in the estuaries with traps, castnets, and seines. There is no large, mechanized fishery and since the "white shrimps" are at present exploited in the juvenile stage, government investigations may well point the way to a more economic use of the resource, which accounts for about half of the shrimp caught in Brazil.

Spiny Lobster (Palinurus) is fished with pots ("covos") along the coasts of Ceará, Paraíba and Pernambuco. Some 1,000 tons are reported each year,

TABLE 2

BRAZIL - SIGNIFICANT LANDINGS OF IMPORTANT GROUPS OF FIN-FISHES BY STATES - 1959

State N. to S.	Croakers	Sardines	Marine Catfish	Mullets	Tuna-like fishes	Anchovy	Spiny rayed fishes	Fresh water fishes
	000s of metric tons							
Pará	—	—	1.25	1.45	—	—	+	3.91
Maranhão	1.15	—	3.78	2.57	—	—	+	7.56
Ceará	—	—	—	—	1.01	—	+	1.47
Pernambuco	—	—	—	—	2.47	—	+	—
Bahía	—	—	—	—	0.66	—	+	0.80
Rio de Janeiro & Guanabara	7.45	22.04	0.75	0.63	—	—	+	—
São Paulo	9.06	9.45	—	0.52	1.64	4.01	+	—
Sta. Catarina	1.04	1.64	1.86	0.88	—	—	+	—
Rio Grande do Sul	28.80	—	10.04	1.12	—	—	+	—
15 Other States and unallocated	3.47	0.71	1.83	1.96	1.79	0.36	+	29.88
	50.97	33.84	19.51	9.13	7.57	4.37	18.78	43.62

+A large number of perch-like species are caught uniformly along the coast.

mostly for export to Rio de Janeiro, São Paulo and the U.S.A. Since there is a good deal of uncontrolled fishing, it would appear that this fishery, on a semi-sedentary stock, may be vulnerable in the future unless government measures for its appraisal are instituted.

An FAO expert, Mr. E. K. D. Lee, commenced experimental fishing for *tuna-like fishes* off Recife in 1955. Following this, several long-liners, including the Toko-Maru of the Japanese Fisheries Agency, began in 1956 to explore the possibility of establishing a tuna fishery in the tropical Atlantic Ocean based on Brazilian ports. The first reconnaisance cruises of the Kaiko Maru No. 13 obtained high average catches of 7.7 and 10.5 fish per hundred hooks, with spectacular maxima on several days well in excess of 20 fish per 100 hooks, the composition of the catch being predominantly yellowfin to the north of the equator, with a somewhat higher percentage of albacore in the Brazil Current to the south. There are small, incidental catches of big-eye, the marlins, sailfish and swordfish.

Although the 12 vessels based on Brazilian ports (of tonnages between 55 and 817 gross tons) form only a small part of the fleets fishing the tropical South Atlantic between the West Indies and the African coast, the agreement with the Japanese boats has resulted in significant quantities of tuna fish coming on to the Brazilian internal market as food, at very reasonable prices. The Atlantic tuna fleets still fish with long line, but have recently asked for permission to change over to 450-ton purse-seiners. According to Paiva (in press) there is not, as yet, any significant reduction in abundance of the major species (yellow-fin and albacore), as reflected by catch per 100 hooks, at least as far as the Brazil-based vessels are concerned. Fishing pressure would presumably become more intense with the new method.

The only other fisheries of even modest size in northeastern Brazil, apart

from mixed catches of assorted finfish, are a very small but interesting flying-fish fishery, and some 9,000 tons (1959) of whales, caught from the small station at João Pessoa (Paraiba).

The fishing craft most often encountered in northeastern Brazil is the "jangada"—a primitive sailing raft made up of six light wood logs pegged together and fitted with a typical, turkey-wing lateen sail, a seat, a rudder, and a centerboard. They are found sailing or floating in a seemingly half-submerged condition, up to twenty miles out to sea, to the surprise and entertainment of liner passengers rounding the bulge. Being light, they are able to move with the slightest breeze, and from the point of view of maneuverability, cheapness and beaching on rough shores, they may be said to be efficient, but they may not in the end survive mechanization if this results in quicker trips to, and more time on, the fishing grounds, plus an amelioration of an extremely hard way of life.

The study of the origin of the "jangada" is a fascinating one, for which this is not the place. Suffice it to say that almost identical light-wood rafts are worked off three short, widely dispersed coasts—the "jangada" of Brazil, the "balsa" of Ecuador, and the "catamaran" of South India (the "teppan" of Ceylon). One theory is that the Portuguese brought the idea from the East, but it is perhaps more likely that some Portuguese colonial officer noticed the similarity and used the name "sangádam," which is a different primitive craft in use elsewhere in India.

We shall not here go into the knotty conundrum as to whether fisheries development planning should help the subsistence fisherman to perpetuate his insecurity through small, palliative improvements, or should on the other hand accept that, like most other things, fish can eventually only be economically mass-produced by large mechanized vessels. This is perhaps a philosophical and sociological question rather than a technical one, and will no doubt, given the necessary time, solve itself without causing displacements of unemployed and unemployables.

In the meanwhile, wherever there are long coastal stretches with no refuge, such raft types will continue to hold their own for some time to come, especially where, as in Brazil, there is profitable fishing for lobsters, an artisanal operation which can well be done from such small, inexpensive craft. It has been repeated in many technical reports, that the "jangada" type of craft was the one hopeless case, as far as possible mechanization was concerned. It was, therefore, surprising to find that, in parts of India and Ceylon, a small outboard motor plus some improvements in the local fishing methods, resulted in a sevenfold increase in the catch. This can, of course, only be done where the seas and surf are moderate. An improvement of this order in Brazil might well mean tolerable living conditions for thousands of underprivileged fishermen, without discouraging investment or outpricing the product.

Eastern Zone

Although some 8,000 tons of fish are reported each year from Bahía (including a small amount of tuna and shrimp), the important landings are at the city of Rio de Janeiro in the old Federal District (now the State of Guanabara) and Niteroi, the capital of the State of Rio de Janeiro. Because of their geographic proximity and their joint dependence on the sardine fishery, they have been combined for the purposes of this report.

As will be seen from Table 3, landings of sardine (*Sardinella aurita*, the

"sardinha verdadeira") have averaged 20,000 tons over the last five years, or about 50 per cent of the total landings at these two ports. In recent months (1961), the Rio fishermen complain of smaller catches, while they may have increased further south. As to whether changes are occurring in the fishery, only research can tell. Landing statistics are being collected, and sufficient data should soon be available to make a first appraisal with technical assistance from FAO.

A preliminary report (Richardson et al., 1959), indicates that actual catches are in excess of the figures recorded by the official statistics, and that the catch per hour's fishing is highest in the first six months of the year.

TABLE 3

BRAZIL — LANDINGS OF SARDINE *(Sardinella aurita)* 1955 - 1959

State	1955	1956	1957	1958	1959
	000s of metric tons				
Rio de Janeiro & Guanabara	20.7	20.7	17.1	17.9	22.1
São Paulo	2.9	3.0	2.4	2.8	9.4
Santa Catarina	0.8	0.9	1.3	1.6	1.6
Other States	0.9	0.9	0.6	1.1	0.7
Total Brazil	25.3	25.5	21.4	23.4	33.8

Utilization of the sardine was as follows (1959 figures): canned 15.5 thousand tons; dried-salted 5.9 thousand tons; the remainder was consumed fresh or turned into meal. This represents a pronounced tendency towards canning (less than 10.0 thousand tons in 1956) and away from drying (more than 10.0 thousand tons in 1956), while smoking (1.6 thousand tons in 1956) has been almost abandoned.

Reports on the degree of productivity of the Cabo Frio up-welling are still contradictory. It is, however, believed that the potential of the sardine fishery based on this rather small and erratic phenomenon may be less than the first optimistic estimates of some workers led us to believe. It seems clear, however, that once an idea of the size and distribution of the stock can be gained, the sardine landings could be increased, by equipping boats with fish finders and by exploring the off-shore waters (Richardson, in press).

Southern Zone

Southwards from Rio de Janeiro, there is an abrupt change in the fishery as we enter the temperate zone. Considerable quantities of sardine are still landed at Santos and this species is found as far south as Santa Catarina, but in ever diminishing quantities. Anchovy ("manjuba") are landed almost exclusively by beach seines in southern São Paulo when they migrate up river, and are mostly salted. The trawl fishery, for several species of Sciaenids, becomes increasingly important in the ports of Santos and Rio Grande, the latter having become the most thriving fishing port in Brazil, and plans are afoot for rapidly increasing the trawler fleet still further. Landings of tuna species again become important, but catch per 100 hooks is considerably reduced in the south. There is some seasonal mullet, especially at the mouth of the vast brackish Lagoa dos Patos; shark (cação), caught sporadically all

along the Brazilian coast, becomes an important item in the south; and considerable quantities of shrimp are landed, especially in the State of Santa Catarina.

Statistical analysis of landings, with a view to identifying variations in the yield per unit of effort, has been undertaken for the first time in Brazil (and, as far as is known, in Latin America) first in Rio Grande under the joint auspices of the State Fisheries Department and the University and, somewhat later, a similar operation was started in Santos by the Fisheries Department of the State of São Paulo and the Oceanographic Institute of the State University, both with technical assistance from a series of FAO biologists. It has been found that, since the compilation of statistics was started in 1955, there has been a significant change in the character of these southern fisheries. With the move towards larger boats, there are now only four principal species landed —"corvina" *(Micropygon furnieri)*, "pescada foguete" *(Macrodon ancylodon)*, "goete" *(Cynoscion petranus)*, and "pescada olhuda" *(Cynoscion striatus)*. A species of *Gadus* is now entering the catch with a high yield per unit of fishing time and, it is believed, will become important in the future.

A first interpretation of the Santos landing data has been published by Richardson and Moraes (1960), while a similar analysis is in manuscript for Rio Grande (Barcellos and Richardson, in press). Although the period covered is still insufficient, there are indications of a decline in the catch per hour of three of the available species (as forecast by Devold, 1958), which should be followed closely in the near future in order that the money and effort put into these investigations may pay off in terms of proper management procedures.

Most of the shrimp landed in Brazil outside the northern State of Maranhão are caught in lakes near Florianopolis in Santa Catarina. These are mostly *Xiphopeneus kroyeri* and juveniles of *Penaeus aztecus* and *P. schmitti*. The adults of these species are, however, increasingly caught by the trawlers operating out of Santos and Rio Grande, and also those entering Rio de Janeiro, and no doubt trawling will in time replace manual on-shore fishing for shrimp. Total landings of shrimp in Brazil by States between 1955-1959 are given in Table 4.

Fishery Administration

Responsibility for framing the country's fisheries policies, at the federal level, was, until recently, delegated by the Ministry of Agriculture, through its Department of Animal Production, to the Division of Hunting and Fishing

TABLE 4

BRAZIL — LANDINGS OF SHRIMP *(Penaeus, Xiphopeneus* spp.) 1955 - 1959.

State	1955	1956	1957	1958	1959
	000s of metric tons				
Maranhão	3.9	4.9	5.8	6.1	5.7
Rio de Janeiro & Guanabara	2.4	2.3	2.1	2.1	2.7
São Paulo	0.4	0.8	0.8	0.5	1.9
Santa Catarina	9.0	6.7	5.6	5.0	6.0
Rio Grande do Sul	2.5	1.2	4.6	2.7	0.6
Other States	1.3	1.4	1.8	2.2	2.7
Total Brazil	19.5	17.3	20.7	18.6	19.6

(Divisão de Caça e Pesca) with a small staff of veterinarians and a larger supporting staff. In practice, few of the officers had had the opportunity of acquiring specialized training in fishery subjects, or had any access to the literature, the problems being dealt with on an administrative basis as they arose. The newly appointed and energetic Director of Fisheries, Dr. Emilio Varoli (who previously held the corresponding post in the State of São Paulo) has been taking all possible steps to ameliorate this situation.

Most of the States maintain some kind of fisheries department which, while administratively independent, may enter into agreements with the federal agency. In practice, there had been little or no useful interchange. The state fishery departments vary in size from an organization comparable to the federal body in the State of São Paulo, to one man or less in others.

At the university level, the well known Oceanographic Institute of São Paulo has a small and efficient staff which, under the Director, Dr. Ingvar Emilsson, has done considerable work in oceanography, marine biology, and fish technology. There is a joint research in Santos with the State Fisheries Department, with FAO technical assistance.

The Universities of Ceará, Recife, and Rio Grande have departments dealing with one or more aspects of the marine sciences. The Oceanographic Investigations Center of Rio Grande do Sul also co-operates with the State Fish and Game Department in an FAO-sponsored statistical analysis program. But, as a rule, the same lack was observed as in many other countries, of effective liaison between federal, state, and university groups on the one hand, and on the other of the necessary distinction between the mere compilation of data and their application to management.

The Government of Brazil, being aware of these obstacles to rational exploitation, and with a view to placing fisheries management on a sound basis, on June 28, 1961, enacted Decree No. 50872, creating the Fisheries Development Council *(Conselho de Desenvolvimento da Pesca* — abbreviated to *CODEPE),* directly responsible to the President of the Republic for proposing national fisheries policies and projects; training and appointing competent fisheries personnel; promoting technical and economic investigations; coordinating the activities of federal, state and other bodies; organizing finance and loans; improvement of marketing conditions and of fish consumption; and all other activities relating to fisheries which are the responsibility of the federal government. Other federal institutions, such as the Division of Hunting and Fishing of the Ministry of Agriculture, will become executive agencies.

The Council is to consist of (a) a rather large Advisory Board, on which are represented all the federal bodies interested in fisheries; (b) a Board of Directors, consisting of five members nominated by the President of the Republic who are at present the Director of Hunting and Fishing (Dr. Emilio Varoli), the Chairman of the National Committee for Nutrition, a commissioned officer of the Brazilian Navy (Commander Paulo Moreira da Silva), the Superintendent of the Fisheries Credit Fund (later to become the Fisheries Credit Bank); and a Managing Director, who is the legal representative of the Council (Dr. Celio Lyra).

The Secretariat will have a number of sections, responsible to a Technical Adviser and a Legal Adviser, who will in turn be directly responsible to the Managing Director. Since the technical personnel has not yet been appointed and will, in fact, have to be formed through post-graduate training, it is too early to make an appraisal of this new institution, but there is no doubt that

the legal framework now exists, as it never did before in Brazil, to enable the government to put into action a rational and technically sound program of fishery development.

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Shellfish Mariculture[1]

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Abstract

The increasing need for food, the development of techniques for rearing of several of the commercial mollusks including oysters and the quahaug clam,

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