

## 2 BACKGROUND TO THE SHRIMP AND GROUND FISH FISHERIES OF THE REGION

The Brazil-Guianas shelf has one of the most important penaeid shrimp fisheries in the world. The fishing grounds stretch between the Amazon and Orinoco rivers. These rivers are not absolute barriers, however and stock biomass moves across them. In Brazil for example, juveniles of brown shrimp appear to migrate from the coast of the State Pará (East of the Amazon) towards fishing grounds situated in front and to the west of the estuary. At the other end of the area, there is no clear-cut discontinuity across the Orinoco River. However, consideration of the regional topography suggests that the shrimp populations in the Gulf of Paria may not mix to a great extent with those located southeast of Trinidad.

### 2.1 Brazil

The shrimp fishery in northern Brazil is one of the most important fisheries in the country. The main fishing area is located between the mouth of the Parnaíba River and the border of French Guiana, along the coast of the States of Maranhão, Pará and Amapá. Fishers use artisanal, small-scale and industrial vessels, outfitted with trawls (puca-de-arrastro or guizo), cast nets (tarrafa) and fixed traps (zangaria). The main species caught are *Penaeus subtilis*, *P. schmitti* and *Xiphopenaeus kroyeri*.

The small-scale fishery is concentrated in the Maranhão area, where small, motorised trawlers (7 to 11 m) are commonly used to catch *X. kroyeri* and *P. schmitti*. The artisanal fishery is conducted in estuaries and shallow waters, using fixed gear or hand-operated trawl nets. The shrimp produced by the small-scale and artisanal fisheries are sold fresh or, sometimes, frozen in domestic freezers. A significant amount is also cooked in saltwater and sun-dried. The products from these fisheries are sold locally or exported to other States in Brazil.

In the past, many foreign trawlers have operated in Brazilian waters under international fishing agreements, but this ended in 1978. Since then, only national vessels or Brazilian flag vessels under leasing agreements have operated in the area. From 1985, the Brazilian government has been doing away with the leasing agreements, which led to some vessels being incorporated into the national fleet. The leasing agreement arrangements ceased before the end of the 1980s.

Most of the industrial vessels operating in the shrimp fisheries in the north coast of Brazil are based in Belem/Macapá (159), in the States of Pará/Amapá. Some vessels are based in Fortaleza and Camocim, in the State of Ceará and others in Parnaíba, State of Piauí. In general, the trawlers are the Tampa/Florida type, made of steel and ranging from 19 to 25 m. They are powered by 235 to 540HP engines and operate double rigged trawls. The vessels are equipped with instruments for satellite navigation, radio communication, echosounding and freezing. Some of the vessels from Piauí are smaller in size and a few of them operate with single trawls. In 1994, using data from the States of Pará and Ceará, an average of six trips per vessel per year was determined, with each trip lasting about 36 days. The crew is generally made up of 5 fishers, but a few larger vessels may have a crew of 6.

The best shrimp yields used to be obtained from February to November, but over the last two years the trawlers have been getting good catches all year round.

The shrimp caught by the industrial fishery are frozen mainly with head-off, with some processed as whole shrimp on-board vessel. Most of the processed shrimp tails are exported to the USA and Japan, with the whole shrimp being exported mainly to Japan.

A study in 1998 (Damasceno, 1988), showed that for the shrimp fishery in northern Brazil the bycatch was about 7.2kg per kg of shrimp, of which 4.4 kg was useful for human consumption. It is believed that the above rates have not changed significantly since then.

Until 1997, the management measures for this fishery used to be:

- Limitation of the number of licensed vessels to 250;
- A closed season from December to January;
- Prohibition of trawling in waters within 10 miles of the coast in Amapá and Pará and up to 3 miles of the coast in Maranhão.

Based on recent assessments of the stock and after negotiations with the shrimp fishery industry, these measures were modified and the following established:

- Limitation of the number of licensed vessels to 185;
- Close the fishery in the area between latitudes of 00°20' N and 01°10' N and longitudes of 47°00' W and 47°55' W;
- A total annual total allowable catch (TAC) of 4600 t;
- Prohibition of trawl fisheries within 10 miles of the coast in Amapá, Pará and Maranhão.

## 2.2 French Guiana

The entire shelf of French Guiana is exploited for shrimp, using various fishing strategies. The area most exploited is between the 20m and 90m isobaths. A regulation forbids trawling within 30m. Inside 20m the catches are mainly of small individuals, which is in keeping with the migratory behaviour of the juvenile shrimp, from mangroves, marshes and estuaries. Seasonally, the best catches occur from December to May during the wet season.

The main shrimp species exploited on the continental shelf is *P. subtilis*, with its landings representing nearly 95% of the total shrimp landings of the area. The other species landed is *P. brasiliensis*, which is not separated in landings, but its proportion is estimated from market samples.

From 1979 to 1990, the fishery was exploited by French, US and Japanese companies. The landings of the various species of shrimps were exported head-less to USA and Japan. Following the naturalisation of the fishery under the French flag due to the extension of the EEC area, the new market was mainly for small shrimp as well as the larger sizes, but always whole. All the shrimps are processed at sea and packaged frozen.

The market demand has induced a change in the habits of shrimp-trawler operators, who during the second half of the year exploit juveniles in the shallow waters. Due to the recent fluctuations on the international market, a decrease in the demand was observed, resulting in a reduction in effort of the French fleets from 22500 days at sea in 1989 to 15700 in 1994. This was confirmed in 1997 and in 1998.

There is no fishery for *X. kroyeri* although the resource seems to be significant. Some fixed gear operations in the estuaries catch these shrimp and sell the landings on the local market.

The trawl fishery has been controlled by a total allowable catch (TAC) system implemented by the European Union (EU) and since 1992, by a local licence system fixing the maximum number of trawlers allowed to exploit the stock.

## 2.3 Suriname

Shrimp is exploited over the entire EEZ in the depth range from 20 to 90m. There are three main fishing areas, namely, the "Western Grounds" between 40 to 90m in the western part of the EEZ; the "Middle Grounds" between 25 and 40m off the central EEZ; and the "Puw Patch" between 30 and 80m in the eastern part of the EEZ. Depth is very important for the distribution of shrimp and a distinction is usually made between "deep fishing grounds" of more than 50m depth and "shallow fishing grounds" less than 50m depth.

In 1995, the shrimp trawling fleet was owned by 22 fishing companies. The fleet can be divided into a Japanese fleet (2 companies operating under the Japanese flag), Korean fleet (hoisting a variety of flags) and the Surinamese fleet, of which the Sugam Company is the main component. All shrimp trawling companies use the same kind of vessel, the traditional double-rigged “Florida” or “Gulf of Mexico” type trawler.

The strategies of the two main components of the fleet (Japanese and Korean) are fundamentally different. The Japanese companies specialise in the exploitation of the deeper grounds, targeting the species *P. brasiliensis*. Fishing is almost exclusively done at night. The Korean fleet, as well as the trawlers operating under the Suriname flag, tend to exploit the shallower fishing grounds. Trawlers of both fleets carry out long trips of 50 to 100 days. The Japanese vessels make two hauls of 5 ½ hours in a night, while Korean vessels make hauls of 4 hours during the day.

Almost all shrimp landings take place at the two shrimp processing plants SAIL (Suriname American Industries Limited) and SUJAFI (Suriname Japan Fisheries). The bulk of the production is exported to Japan, with limited exports to Europe, USA and the Caribbean.

Besides the shrimp fleet, there is a growing number of trawlers targeting finfish. Except for part of the SUGAM fleet, which delivers at SAIL, most of the finfish trawlers use other landing places. Part of this fleet consists of former shrimp trawlers using a gear adapted to increase the finfish catch. The fleets also include larger vessels, generally with higher engine power. The vessels operated by Guiana Seafoods target *X. kroyeri*.

Small-scale fishers use funnel nets or “fyke nets” in the tidal zones and in estuaries to catch *X. kroyeri* and *Nematopalaemon schmitti*. In certain seasons, their catch includes small amounts of juvenile *P. subtilis*.

Fishing for groundfish is carried out in marine waters, brackish waters, rivers and other inland water bodies by artisanal fishers. The fishing vessels can be classified into snapper boats, decked Guyana boats, open Guyana boats and korjaal (canoes of different types). A number of small fishing devices are operated without a boat. The main fishing gears are vertical hook and lines, drifting gillnets, kieuwnet and spannet (fixed gillnets), njawarie (pin seine), fuiknet (Chinese seine) of different sizes, haritete (river seine) and dragnets.

Fisheries in Suriname are currently regulated by the Decree on Marine Fishery (Decree C-14), operational since 1 January 1981. The legislation is being revised and a new fisheries law is expected to be promulgated soon. For the time being, the shrimp trawl fishery is being regulated by the following:

- **Registration:** Compulsory registration of the boats, which are classified into three categories, according to their nationality.
- **Annual Fees:** Annual licence fees based on nationality of owner or company and whether the operation is established in Suriname or not.
- **Closed Seasons:** Shrimp trawling is forbidden in areas shallower than:
  - 12 fathoms (22m) from January to June;
  - 15 fathoms (27m) from July to December.
- **Destination of catch:** The entire catch has to be landed in Suriname. Transshipment at sea is prohibited.
- **Reporting:** Each vessel has to report its position daily to its base. In addition, a logbook has to be filled out and submitted to the Fisheries Department within three days after completion of each trip and a landing report has to be delivered to the Fisheries Department within three days after delivery of the catch.

In 1989 and 1992, the State Commission for the Fishery recommended that the limit on the number of trawlers should be set at 100.

## 2.4 Guyana

Guyana has a coastline of 432 km and a continental shelf area of 48 665 km<sup>2</sup>. The average width of the continental shelf is 112.6 km, while the area of the EEZ is 138 240 km<sup>2</sup>. The living marine resources being exploited within the EEZ are mainly the demersal resources (shrimp and finfish) and to a limited extent, the pelagic resources over the continental shelf and towards the continental slope.

The offshore industrial shrimp trawl fleet exploits mainly penaeids (*Penaeus subtilis*, *P. brasiliensis*, *P. notialis*, *P. schmitti*) in the case of the penaeid trawl fleet and *Xiphopenaeus kroyeri* in the case of the seabob/finfish trawl fleet. *Nematopalaemon schmitti* is also caught seasonally to a lesser extent as incidental catch in the seabob/finfish fishery.

The Chinese seine vessels of the inshore artisanal fleet exploit both *X. kroyeri* and *N. schmitti*. Some of the larger penaeid shrimp are occasionally caught in the Chinese seine fishery, with various finfish species, including juveniles. DOF estimates put the number of these vessels at 354 for the year 1996.

The Offshore Industrial Fishery consists of 127 trawlers, 5 fish / shrimp processing plants and numerous wharves and dry docking facilities. The trawlers are 48% foreign owned. Foreign trawlers mainly exploit penaeid shrimp (*P. brasiliensis*, *P. notialis*, *P. schmitti* and *P. subtilis*) with finfish and small amounts of squid (*Loligo* spp.) and lobster (*Panulirus* spp.) as bycatch. The locally owned trawlers mainly exploit seabob (*Xiphopenaeus kroyeri*) and various finfish species (*Macrodon ancylodon*, *Micropogonias furnieri*, *Nebris microps*, *Arius* spp., *Cynoscion* spp.), with small quantities of penaeid shrimp as bycatch.

The penaeid and seabob/finfish trawlers are the standard Gulf of Mexico type trawlers. Chinese seine vessels are small flat-bottomed dory type vessels 6.4 to 12.2m (21 - 40ft.) in length and are powered by sails or outboard engines (frame survey, 1994). Penaeid shrimp trawl vessels normally have a crew of 5, while seabob vessels and finfish vessels carry 5 - 6 and 4 - 5 crewmembers respectively. Chinese seine vessels carry 2 - 4 crew.

Upwards of 95% of the penaeid shrimp are exported, primarily to the U.S.A. and smaller amounts to Japan, Canada and CARICOM countries. Approximately 90% of the seabob is exported, primarily to the U.S.A. and smaller amounts to CARICOM countries. The whitebelly shrimp is landed whole. It is then dried and the shell is removed. The shell or shrimp meal is used as livestock feed. The dried shrimp is sold either locally or exported. Finfish is landed whole and sold fresh.

The overall goal for the management and development of the Fisheries Sub-Sector is to achieve sustainable levels of production, productivity and real incomes of fishery producers and other groups involved in the delivery of products to domestic and export markets, thereby contributing to national production, income and welfare. The current limit on the penaeid shrimp trawl fleet is 100 vessels and the limit on the seabob fleet is 30 vessels.

Artisanal fishers operate on the continental shelf at distances up to 56 km (30 miles) from the shore, all along the coast. The most productive period generally runs from March to October, which is the period when the common species (*X. kroyeri*, *N. schmitti*, *Macrodon ancylodon*, *Cynoscion virescens*, *Micropogonias* spp., etc.) are caught. Most scombrid species (*Scomberomorus brasiliensis*, *S. cavalla*, etc) are abundant from May to September. During the months of November to February, most finfish species are relatively scarce and the fishing effort is increased to obtain a reasonable catch. This coincides with the period when the winds are high and the sea rough.

The Inshore Artisanal Fishery is made up of an estimated 1331 boats ranging in size from 6-18 m and powered by sails, outboard, or inboard engines. All the boats are made from wood and are manufactured locally. The fishing gear in use includes pin seines, Chinese seines/fyke nets, cadell lines/"demersal longlines", drift nets/gillnets, circle seine and hand-lines/snapper lines.

A flat-bottom dory powered by sail, paddle, or small outboard engine is used for Chinese seine, cadell lines and a few pin seines to give more manoeuvrability over shallow, muddy and sandy bottom areas. The boats that operate close to shore are not equipped with iceboxes. A V-bottom boat, 7.6-9.2m (25–30ft) with an ice-box, an outboard engine, but no cabin, is used by smaller gillnet fishermen. A larger V-bottom vessel, 12.2 - 15.3m (40 - 50ft) with an inboard engine and cabin, is used for larger gillnet and handline operations.

There are about 4 500 artisanal fishermen and of these about 1 000 are boat owners. Sixty to seventy percent of the boat owners are members of Fishermen's Cooperatives, which acquire and sell fishing requisites to their members (unpublished Fisheries Background Report, 1994).

The management objective for the Inshore Artisanal Fishery is to increase the landings to a sustainable level which would enable the Fishery to contribute to improved nutrition for the population, export earnings, increase employment and aggregate output thereby stimulating growth of the national economy (Shepherd *et al.*, 1997).

## 2.5 Venezuela

The area where the shrimp fleet operates is located in the Atlantic zone of Venezuela, between Bocas del Dragón in the Northern Gulf of Paria, to the Boca Grande, Southern Orinoco River Delta, covering an area of 71 000 km<sup>2</sup>. Although, there has been a reduction in effort over the last ten years, its distribution in the zone has shifted towards the south of the Orinoco river delta, where 33% of the total effort made in the zone is being applied. The industrial fleet operates in the area throughout the year.

Most of the vessels use the Florida type trawls, however the fishing gear has been changed in ten vessels (7% of the fleet) to fish trawl nets. Four of these vessels use a single net from the stern, while the other six use two nets from the sides of the boat.

Over the last eight years, although still high, the number of fishing enterprises decreased by 39, from 97 in 1991 to 58 in 1998. Likewise, the number of industrial trawlers decreased by 37%, from 140 in 1990 to 88 in 1998. All vessels are based in the ports of Güiria, Cumaná and Punta Meta.

Seabob, *X. kroyeri*, which used to be discarded before 1991, is now landed. It is peeled in factories located in Güiria and sold in national markets.

During 1998, the bycatch accounted for 93% of the total catch in the nets. Of this, 33% was sold in the local market and the other 60% was returned, mostly dead, to the sea. The main fish species are: croaker (*Micropogonias furnieri*), curbina (*Cynoscion* spp.), dog trout (*Macrodon ancylodon*), lane snapper (*Lutjanus synagris*), catfishes (*Bagre bagre*; *Arius* spp.; *Cathorops* sp.), Atlantic moonfish (*Vomer setapinis*), Atlantic cutlassfish (*Trichiurus lepturus*), sharks (*Rizhoprionodon* sp.; *Mustelus* sp.). These species represent 80% of the total bycatch landings.

Approximately, 40% of the shrimp are exported. Headless shrimp are exported to the North-American market, while whole shrimp are exported to Europe. The small shrimp (penaeid and seabob) are peeled and sold in national markets. There are 10 processing plants for shrimp and fish in the Atlantic zone of Venezuela.

The artisanal shrimp fishery takes place in the northern Gulf of Pari, by fishermen with beach seines, without boats and in front of Pedernales, in the Northern Orinoco river delta near Pedernales, where the fishermen use small trawl nets, similar to the ones used by the fishermen from Trinidad and Tobago. The latter fishery originated in 1992 and operates during the entire year. There are around 28 wooden vessels operating in the area, with outboard engines, with a length of 7 to 9 m. The catch is sold to processing plants located in Güiria and Soro.

The construction of new conventional trawling units has been forbidden since 1989, in order to stabilise the size of the fleet. Until 1993, the Government had promoted the move of

industrial units to Guiria, in order to increase the fishing effort in the Atlantic zone and decrease it in other more traditional fishing areas. Since then, the situation has been reversed and the number of trawl units in the Atlantic zone has progressively decreased.

## 2.6 Trinidad and Tobago

The areas fished are the North Coast, Gulf of Paria, Columbus Channel and Orinoco Delta. Overall, the total areas fished within each coast are: the North Coast - 234.98 km<sup>2</sup>, the Gulf of Paria - 1 957.32 km<sup>2</sup>, the Columbus Channel - 826.23 km<sup>2</sup> and the Orinoco Delta - 393.7 km<sup>2</sup>. The total area fished is 3 412.23 km<sup>2</sup>. The principal exploited species are the penaeids: *Penaeus brasiliensis* (hoppers), *P. notialis* (pink shrimp), *P. schmitti* (white/cork shrimp), *P. subtilis* (brown shrimp) and *Xiphopenaeus kroyeri* (honey/jinga shrimp). The latter species is also targeted by bait trawlers. A significant quantity of finfish, crabs and squid are landed as bycatch. Several species of groundfish exploited incidentally in the demersal trawl fishery are also targeted by an inshore gillnet fishery. The most commercially important and abundant groundfish species are *Micropogonias furnieri* and *Cynoscion jamaicensis*.

There are four trawler fleets: two inshore, artisanal fleets, an offshore, semi-industrial fleet and an offshore industrial fleet. Major trawling activities are centred on the Gulf of Paria in the west, the Columbus Channel in the south and seasonally in areas off the north coast.

A census of fishing vessels conducted in November 1991 identified some 209 active, locally registered trawlers. These vessels are categorised into four types (Types I - IV) according to their lengths, engine horsepower and degree of mechanisation (Maharaj *et al.*, 1993). Nine trawlers currently comprise the semi-industrial fleet (Type III) and 21 the industrial (Type IV) fleet. The exact numbers of artisanal vessels (Type I and II) currently operating have been estimated as 113 and 66 respectively.

There are around 570 fishermen actively involved in the local trawl fishery, of which 231 are fishing full-time and 339 part-time (Fisheries Division Vessel Census, 1991).

Shrimp processing in Trinidad and Tobago is handled by a variety of privately owned companies, which have replaced the National Fisheries Company (NFC) monopoly. This activity cannot be clearly differentiated into industrial shrimp processing and artisanal shrimp processing, since catches from all classes of trawlers are used at the processing plants. Only about 16 processors/exporters operate full-time. The traditional export markets for shrimp are the U.S.A., U.K. and Canada.

The sites of major groundfish fishing activity are the west (Gulf of Paria) and south (Columbus Channel) coasts of Trinidad, with minor activity occurring on the east and north coasts. While trawling accounts for major landings of groundfish, the main fishing gear used to target groundfish is the monofilament demersal set gillnet, known locally as; "transpearing", "monoflemming", or "white net". Other gears, which also capture groundfish, include demersal longlines or "palangue", banking, beach seine, fishpots and multifilament gillnets or "fillet", which though set on the surface may also catch groundfish due to deployment in shallow waters. This is an inshore fishery and most fishing is done in depths between 9-14m. The vessels targeting groundfish are pirogues between 6-10m long. They are constructed of wood, fibreglass or fibreglass coated wood. These vessels may use one or two outboard engines with average horsepower of 45-75 HP.

The effort limit for the vessels in the industrial shrimp fleet was set at the fleet level existing in 1988 (Fisheries Division, T and T, 1997).

## 2.7 Jamaica

Most shrimp fishing occurs along the south coast of Jamaica. This may be attributed to the fluvial discharge along the south coast, which provides a favourable mud bottom substrate. The major fishing areas in which shrimp fishing occurs are Kingston Harbour (St. Catherine) and Savanna-la-mar (Westmoreland). To a lesser extent, shrimp is caught in areas such as

Alligator Pond (Manchester) and Farquhars Beach (Clarendon), mainly as incidental catch. In areas such as Leith Hall, Bowden Bay and Port Morant, the shrimp is targeted primarily as bait.

The Jamaican shrimp fishery is primarily artisanal in nature. The fishery supports approximately 2 000 persons, including vendors and fishers. The species being caught are *P. schmitti*, *P. notialis* and *P. brasiliensis*.

The fishery uses mainly non-motorised wooden dugout canoes approximately 5m in length (oar propelled) and 8.5m fibreglass canoes powered by 40HP outboard engines. The wooden vessels use monofilament gillnets to catch shrimp and the fibreglass vessels use trawls. Some fishers also use shove nets to catch shrimp.

For the trawl nets, shrimping is done primarily at night and lasts 10 to 12 hours. Each haul lasts for about 45 minutes, with the net being towed behind the boat in a circular manner. About 6 hauls are made per night. Monofilament gillnets are thrown overboard and allowed to settle for five to ten minutes. The vessel is then rowed in a circular motion, after which, the net is pulled in and the shrimp picked off the net. This is repeated several times. The length of time spent catching shrimp is about four to five hours.

In addition to the above, shove nets are used by fishers who catch shrimp for bait. Fishing may last from half an hour to four hours. This is done in shallow mangrove areas and sea grass beds.

Shrimp are processed on shore and sold whole. The product is stored on ice and sold locally to hotels, restaurants and households.

The fishery is an open access one. The regulations for the fishing industry fall under the Fisheries Act (1975) and the regulations of 1976. All fishers are given concessions on the importation of fishing gear and equipment and also the purchase of fuel. By law, all fishers should be registered and licensed. The licences are renewable annually.