

**Artisanal Fisheries of Eastern Venezuela:
Evaluation of Potential Fishing Effort
(1981-1983)**

L.M. IRIARTE², P. FREON³, A. RODRIGUEZ²,
A. GONZALEZ², F. GERLOTTO³ and J. MENDOZA²

Since 1981 Fundacion La Salle de Ciencias Naturales (FLASA), in cooperation with Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM), has been developing a fisheries biology program, aimed at evaluating the fishery resources of Venezuela. Two kinds of investigations were utilized: (1) a global fish biomass estimation by hydroacoustic surveys (echo-integration) and (2) surveys of the artisanal fishery in eastern Venezuela. We present preliminary results from three surveys of the artisanal fishery made in 1981, 1982 and 1983, in the Venezuela states of Nueva Esparta (Margarita and Coche islands) and Sucre (Fig. 1).

Geographical Limits of the Study.--The states of Nueva Esparta and Sucre represent the most important part of the artisanal fishery in eastern Venezuela; comparatively, the contributions from the states of Anzoategui (to the west) and Monagas (to the east) are only marginal. We have been unable to cover entirely the small-scale fishery of eastern Venezuela. In particular, in Sucre we are lacking data concerning the Gulf of Paria fishery and the Gulf of Cariaco sardine fishery.

In 1981 a preliminary survey was done. In 1982 we covered the entire 54-village artisanal fishery of Margarita and Coche islands. In 1983 we began our survey of Sucre but we did not study Coche, and only 39 villages in Margarita were sampled.

Description of the Artisanal Fishery.--Considering the variety of gears, boats and fishing methods, the eastern Venezuela small-scale fishery has been divided in several categories. The coastal fishery is comprised of fishermen who do not leave port for more than a day, remaining close to the coastline. In certain cases they may leave port for prolonged periods (up to 6 months). Then they fish from temporary camps along the coastline. This fishery uses two types of boats, peneros and lanchas. Peneros are the most popular type of boat in the artisanal fishery. They are found in all ports of the region. Generally, they leave at night for 12 h; fishing for approximately 8 h. These outboard powered boats carry a crew of two to five fishermen. Fishing gear is extremely varied but mainly nets and handlines. Lanchas are decked, lack cabins; are generally powered by inboard diesel engines and are crewed by three to six men. Fishing occurs during the day, mainly using different types of seines.

¹ Contribution number 109 EDIMAR FLASA OEA.

² FLASA, Apto 144, Porlamar 6301, Nva Esparta, Venezuela.

³ ORSTOM, 24 rue Bayard, 75008 Paris, France.

The boats in the high seas fishery are almost exclusively located on Margarita island. Two categories are distinguished. Tres punos are (15m), decked, with or without a cabin; powered by inboard diesel engines. Fishing is done by longlines, with crews averaging four or five fishermen and trips rarely exceed 5 days. The areas fished are the national waters and neighboring countries such as Trinidad and Grenada. The second category, pargueros, are the largest boats (up to 25m); they are always equipped with a large cabin. The crew is approximately 12 fishermen; at sea for periods of at least 15 days and up to several months. Fishing occurs mainly in waters of foreign countries (Guyana, Surinam, French Guiana, Brazil), using handlines.

METHODOLOGY

Since it is impossible to obtain a complete view of the artisanal fishery (there are more than 100 landing places in the region), we have proceeded in the following manner to obtain the necessary data for studying population dynamics:

Catch per Unit of Effort (CPUE).--These data are obtained in selected villages considered representative of a certain area and type of fishery, and in the principal landing points and markets, where fishermen of many villages disembark fish. We have established a data collection network (temporarily only on Margarita island), where the most important villages are visited once or twice a week (generally, up to 10 samples take place weekly in Margarita). From these visits the most important parameters obtained are: CPUE, gear, boat, fishermen, species and the boat utilization rate (number of days at sea/boat/month).

Fishing Effort.--The following relation is used to obtain nominal fishing effort (EN):

$$EN = EP * UT$$

where EP is the potential fishing effort, which is defined by the sum of boats in working condition, and UT is the utilization rate (in %) of boats. To obtain potential effort we conducted the following operations: (1) once every 3 years a complete census of the number of fishermen, number of boats and number of gears is conducted in all the villages of the region and (2) each year a complete census is made of the number and types of boats in all the villages. This parameter has been retained because it is the easiest parameter to estimate as well as being the most representative of the artisanal fishing effort. The number of boats in working condition, the proportions of gear types per boat category and the number of fishermen per boat allow us to estimate potential effort.

This work was started in 1981. During that year the first overall census of the fishery in Margarita island was completed. In 1982 and 1983 boat counts were made in Margarita, and in 1983 the first boat census was completed in the state of Sucre. We

shall briefly present the main results obtained during these last 3 years.

Sampling Methods.--Every year we take advantage of Easter holidays to conduct the census. Easter is the traditional period when all the fishermen return to their respective villages interrupting their fishing activities. It is then possible to obtain a complete view of the fishery in each village. The census is done with the help of students from the nautical high school of FLASA at Margarita island. Teams of three or four students visit all villages and perform the most complete possible survey of their area with the aid of questionnaires. As far as possible, they interview all boat owners to determine fishing gear, number of fishermen per boat and the general fishing characteristics of the village.

At the same time of the year, the staff of the Fisheries Department of FLASA made boat counts by category, and interviewed some of the fishermen present. In 1981, in Margarita and Coche only, a photographic aerial count was made to include distant fishing camps. The data obtained was subsequently analyzed by means of a Hewlett-Packard 9845 desktop computer.

RESULTS

Overall Census in Margarita Island (1981).--Margarita and Coche islands have been divided into five zones from which 11 villages have been selected (Fig. 2). For each of these representative villages, Table 1 gives the average value per boat category for these parameters: length of the boat, number of fishermen and number of kinds of gear designated as handline (C), gill-net (T), longline (P), seine (M), trap (N).

Table 1 shows that the villages appear to be very specialized by boat categories and fishing gear. For example, fish traps are substantially used in only four villages of 11 and are almost non-existent elsewhere. We also observed that pargueros were used predominantly in Boca de Rio. It also appears that this specialization is more related to individual villages than to geographical zones (or it may be that the different zones have not been defined). Except for Coche island, it seems that all defined zones are extremely heterogeneous. The penero is the type of boat that has the greatest versatility for gear use (Table 1). It principally uses traps, gill-nets and handlines. The three types of gear are not used simultaneously and boats are generally specialized for one fishing mode. For example, in Juan Griego and Coche island, fishermen use only gill-nets. However, trap fishermen may use handlines (El Tirano, Los Cocos), for the two gears are compatible; traps are visited once or twice a week and the remaining time is used for handlining. Other boat types are much more homogeneous. Except in a few cases, pargueros and tres punos do not use gill nets and lanchas do not use handlines.

Annual Census, Margarita and Coche.--Detailed results for the censuses for 1981 to 1983 are available from the authors. We have already mentioned that these two islands were exhaustively

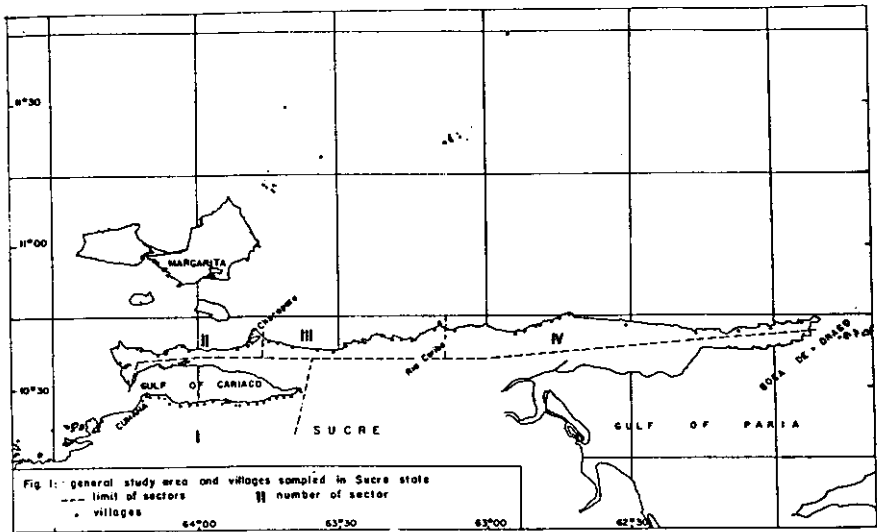


Figure 1. General study area and villages sampled in Sucre state
 --- limit of sectors number of sector villages.

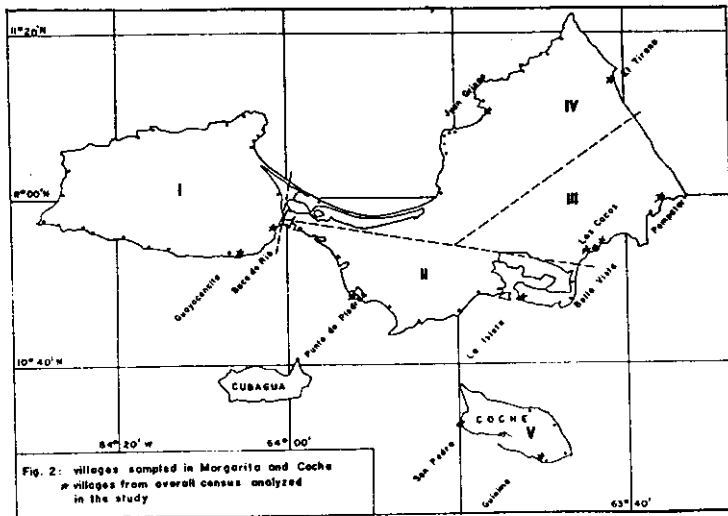


Figure 2. Villages sampled in Margarita and Coche * villages from overall census analyzed in the study.

Table 1. Types, number and average length of boats; average number of fishermen per boat and quantities of gear in villages of Margarita and Coche islands for census year 1981 (PEN, Penero; LAN, Lancha; PARG, parguero; TPU, Tres Punos; C, handline; T, gill-net; P, longline; M, seine; N, trap; L, average length; No, Sample size)

Village	Zone	Boat	No	L	N. Fisherm	C	T	P	M	N
Boca de Río	1	PEN	10	5.7	2.7	0	0.9	0	0.1	2
		PAR	17	18.5	9.8	9.1	0.7	0.6	0	0.6
Guayacancito	1	PEN	2	8.0	3.0	0	1.0	0	0	30
		LAN	4	10.5	3.0	1.0	5.0	0	3.0	2.5
Pta Piedras	2	PEN	21	6.7	2.9	0	1.1	0	0.1	2.0
		LAN	21	9.4	4.0	0.3	0.9	0.3	0.3	5.2
La Isleta	2	PEN	26	5.8	2.3	0	0.4	1.5	0	27.3
		LAN	10	10.2	5.0	0	0.3	0.7	0.7	20.0
Pampatar	3	PEN	22	6.9	3.3	2.7	0.3	0.1	0.9	0
Los Cocos	3	PEN	7	7.6	3.0	2.3	0.6	0.9	0	55
Bella Vista	3	PEN	13	7.0	2.7	0.2	0.8	0.2	0.7	0
		LAN	6	11.7	4.8	0	0.9	0.3	0	0
Juan Griego	4	PEN	7	9.7	3.1	0	1.8	0	0	0
		TPU	23	9.7	4.5	2.4	0	2.3	0	0
El Tirano	4	PEN	10	7.2	2.8	3.2	0	0	0	60.5
		TPU	3	10.3	4.4	6.0	3.0	0	0	11.0
Guinima	5	PEN	5	6.1	2.4	0	0.6	0	0	0
		LAN	13	9.7	3.5	0	1.6	0	0	0
San Pedro	5	PEN	15	7.2	5.9	0	0.9	0	0.2	0
		LAN	5	9.1	4.8	0	0.8	0	0	0

surveyed in 1982, but that only 39 villages out of 54 were covered in 1983. Results for 1983 indicate great stability in boat numbers in comparison to the previous years (Table 2). The variations observed may be attributed to the absence of 15 villages; inter-village migrations are not excluded and would explain the 1% to 13% variation.

There is one exception to the general stability observed, and it concerns the large pargueros which decreased by 22 units, or 59%. These boats are found exclusively at Boca de Rio, which has been surveyed during the 2 years. Because Boca de Rio was sampled in 1983 after Easter, it is possible that the missing boats may have left prior to sampling.

Annual Census, Sucre.--Our data are for 1983. Sixty four fishing sites were surveyed from Cumana to Boca de Drago, except for the northern coast of the Gulf of Cariaco, where the fishing effort is almost exclusively for sardines. Outside the latter region, it appears that almost all the artisanal fishery is composed of peneros; 1.6 times more numerous than in Margarita island. We also note the near absence of large pargueros, the state's fishery being mainly restricted to the coastal area (Table 2).

According to the region along the coastline there are great differences in the proportion of gear types used by the peneros. As in Margarita there exists in Sucre a specialization in gear by village. Nevertheless, it appears that to the west of Chacopata, nets are predominant and that they disappear almost entirely to the east of Rio Caribe where handlines are more important. The fishermen to the east of this village remain closer to shore when compared with their western colleagues who fish in the same regions as the fishermen from Margarita island.

We assumed that the numbers of fishermen per boat in eastern Venezuela were equivalent to the numbers from the Margarita census: peneros, 3; tres punos, 4.5; small pargueros, 4.5; large pargueros, 10 and lanchas, 4.5. From these numbers of fishermen, we estimated the total number which is almost identical in the two states: 7800 fishermen in Nueva Esparta, 7300 in Sucre, excluding in the latter the sardine fishermen in the Gulf of Cariaco and those in the Gulf of Paria.

DISCUSSION

The different aspects that we have treated in this paper are not complete enough to draw conclusions on the artisanal fishery in eastern Venezuela. Nevertheless, we can advance certain working hypotheses which will permit better planning of future work.

Evolution of Data.--Generally, it appears that fishing effort has remained relatively unchanged in Margarita island from 1982 to 1983. Between 1982 and 1983, variations appear in the data, but they are most likely attributed to sampling variance. Finally, the fact that results are comparable from one year to the other could indicate that the method chosen is well adapted.

We have previously noted the important decrease in the number of large pargueros, which could be due to the fact that they

Table 2. Boat censuses in the States of Nueva Esparta and Sucre, 1982-1983 (Summarized data by zones)(SPe, number of small peneros (- 6 m); LPe, number of large peneros (+ 6 m); L, number of lanchas; TP, number of tres punos; SPa, number of small pargueros (- 15 m); LPa, number of large pargueros (+ 15 m); (r), number of boats under repair)

Nueva Esparta State									
Zone (nb vill.)	Year	SPe (r)	LPe (r)	L (r)	TP (r)	SPa (r)	LPa (r)		
Macanao (19)	1982	101 (3)	123 (11)	19 (6)	64 (33)	9 (11)	31 (2)		
	1983	132 (1)	93 (6)	11 (8)	58 (31)	33 (15)	6 (0)		
South (12)	1982	119 (4)	138 (11)	48 (22)	71 (31)	13 (12)	2 (2)		
Margarita	1983a	91 (2)	173 (3)	50 (12)	71 (30)	6 (3)	4 (5)		
South East (4)	1982	214 (4)	194 (12)	50 (6)	55 (8)	2 (0)	0 (0)		
Margarita	1983a	118 (0)	24 (3)	26 (1)	13 (2)	1 (0)	0 (0)		
North (12)	1982	86 (11)	174 (6)	36 (12)	62 (20)	1 (0)	0 (0)		
Margarita	1983	75 (4)	207 (3)	25 (3)	66 (4)	1 (0)	0 (0)		
Coche (7)	1982	104 (12)	110 (20)	43 (17)	13 (3)	0 (1)	0 (0)		
Island	1983	---	---	---	---	---	---		
Total (54)	1982	624 (34)	739 (60)	196 (63)	265 (95)	25 (24)	33 (4)		
Nueva Esparta	1982*	361 (16)	519 (30)	117 (41)	204 (85)	24 (23)	33 (4)		
	1983	216 (7)	497 (16)	112 (24)	208 (67)	41 (18)	10 (5)		
Sucre State									
Curuna (23)	1983	234 (0)	211 (0)	3 (0)	7 (0)	1 (0)	0 (0)		
Araya (17)	1983	120 (6)	566 (31)	27 (10)	15 (2)	1 (0)	0 (0)		
Carupano (15)	1983	205 (7)	606 (49)	4 (1)	39 (8)	1 (0)	0 (0)		
Paria (9)	1983	113 (4)	93 (10)	0 (0)	0 (0)	0 (0)	0 (0)		
Total Sucre (64)	1983	672 (17)	1476 (90)	34 (11)	61 (10)	3 (0)	0 (0)		

a Uncomplete census in the zone during this year.

* Sub-total of the 39 villages sampled us in 1983.

were sampled after Easter. A second artifact which may have influenced boat counts is the estimation of boat length by different people. We have already presented the decrease in large pargueros between 1982 and 1983; at the same time small pargueros increased by 6 units (from 47 to 53).

The 1984 census will confirm whether the decreased number of pargueros was real. Without drawing any conclusion, let us remember that the closure of fishing zones along the Guianas in June 1981 gravely affected the Venezuelan high-sea fishery. However, recent partial observations seem to indicate a recovery in the number of large pargueros, which may be related to the reopening of the Guianas fishing area and the high price of foreign currency in Venezuela.

Definition of Boats "Under Repair".--Considering the similarity of results in all ports from one year to the other, we have studied the correlations between the number of boats in use and those under repair. We obtained the following results:

		Margarita	1982	Sucre	1983
		r	N	r	N
Penero	6m	0.192	49	0.134	53
Penero	6m	0.127	48	0.683	47
Lancha		0.841	29	0.558	14
Tres Punos		0.803	30	-	0
Pargueros	15m	0.610	12	-	0
Pargueros	15m	0.519	6	-	0

where r is the correlation coefficient and N the number of villages which possess the type of boat. As far as the correlation coefficients are concerned, peneros seem to present a particular group, with "under repair" rates varying considerably among villages compared with the other types of boats. Various explanations can be presented: repairs made at precise seasonal village-specific periods, use of peneros for activities other than fishing in certain villages (tourism, transport) which may induce different repair rates. This peculiarity of peneros will oblige us in the future censuses to better define what an "under repair" boat is, and evaluate the proportions of peneros that cannot be included in the potential fishing effort.

Definition of Fishing Zones.--The partial results presented seem to indicate that the fishing mode is not homogeneous in Margarita and that this parameter is village specific in this State. Other results not published indicate that this is not the case in Sucre. In this State the coastal zone consists of different biotypes from one end to the other.

This aspect of the fishery, particularly in Margarita island, must be studied in greater depth to evaluate correctly the degree of extrapolation allowed from our weekly samples. Nevertheless, the present system includes nearly 50% of the potential effort in the island, and it is probable that only

minor adjustments would be necessary to our weekly sampling program, to obtain an overall view of fishing effort and CPUE per gear type.

CONCLUSION

With nearly 5,000 boats and more than 15,000 fishermen, the eastern Venezuelan artisanal fishery lands between 30 and 60% of the total Venezuelan production. It is a major economic activity in the region and probably highly profitable for the fishermen. The study of its mechanisms and the exploited stocks is absolutely necessary, particularly nowadays when numerous factors (industrial fishing, stock overfishing, land management schemes, pollutions, etc.) are working against it.

At the present time detailed knowledge of the fishery is lacking to formulate protective measures which are necessary. The potential fishing effort and the sampling schemes presented here are first steps in the evaluation of the economic importance of this activity and of the resources on which it depends.