Appendix 3 to Annex 10

SCRS/85/7 (Revised)

Report of the Planning Committee for the Yellowfin Year Program

The Planning Committee for the Yellowfin Year Program met on November 2-4, 1985, at the Hotel de Mar Sol, Palma de Mallorca, under the chairmanship of Dr. A. Fonteneau. The participants were Messrs. A. Fonteneau, F. X. Bard, P. Soisson, P. Kleiber, S. Kume, A. González-Garcés, J. Ariz, J. Pereira, P. Cayré, T. Diouf, J. P. Wise, and P. M. Miyake. Dr. P. Kleiber served as rapporteur.

1. Introduction

Assessments of the status of yellowfin stocks in the Atlantic have been regularly reported to ICCAT for many years. These assessments have been primarily based on analyses of catch and effort data. In the east Atlantic during the last decade, effort has increased considerably with little or no increase in catch. Production model analysis shows that effort levels from 1980 to 1983 were at or above the level of maximum sustained yield (Figure 1). On the basis of similar analyses and more detailed analyses of catch at size, ICCAT recommended that a minimum size limit be imposed in order to maintain yield from the fishery which appeared to be close to the maximum sustainable yield level.

Starting in 1983, overall effort in the east Atlantic declined markedly due to the movement of purse seiners (primarily FIS) from the eastern tropical Atlantic to the Indian Ocean (Figure 1). The catch also declined markedly and it appears that the system is in a state of disequilibrium. If effort is maintained at the current level, the system should approach equilibrium again; that is, the abundance should increase and so should the catch. The rate at which equilibrium is approached can help measure some imprecisely known parameters of yellowfin population dynamics.

To take advantage of this unique opportunity, a committee was formed at the 1984 SCRS Meeting to make a proposal for appropriate research activities. This is the report of that committee. The goal of our proposed research is to deepen our understanding of yellowfin population dynamics and thereby improve our ability to make wise recommendations for management of this important resource.

Besides the unique opportunity offered to understand how the stock reacts to the spectacular drop in effort now being observed, the Program would better define the serious problems that are still poorly resolved, such as:

- To determine the real usefullness of having a size-limit regulation for Atlantic yellowfin.
- To determine if there is one or more yellowfin stocks in the Atlantic.
- To better estimate the catch potential in the west Atlantic which is presently unknown.

2. Planned activities

2.1 Catch and effort data

It is important that detailed and reliable data on catch at size and effort continue be collected. These are the only pertinent data that have been collected consistently prior to the decline in effort. They are therefore among the few types of data that will allow direct before-and-after comparisons to be made. Collection of detailed catch and effort data is also important in relation to the proposed tagging activity which will be discussed below. Without such data the full benefit of tagging cannot be realized.

The quality of catch-at-size and effort data for Atlantic yellowfin has been improving steadily for the east Atlantic and is currently very good. The complex job of maintaining these high standards of detail, reliability and timeliness is properly the function of the Sub-Committee on Statistics. However, we wish to emphasize that such high quality should continue. In addition, special attention should be given to the fact that the composition of the overall fleet has changed now that FIS purse seiners are no longer the major component. Therefore, previous sampling priorities may need to be adjusted to emphasize fleets that were previously of less importance. Some attention should also be given to improving the collection of data from the growing fleets in the west Atlantic. Finally, the longline data should not be neglected because the catch of large yellowfin by this fleet could very well rise in response to the decline in surface fishing effort.

2.2 Observers

As mentioned above, the overall fleet has changed dramatically in size and composition. We suspect that the new situation may have engendered a change in predominant target species, size and searching patterns. As a result some aspects of the processing of raw catch and effort data may need to be recalibrated as well as the relationship between CPUE and abundance. We therefore propose that an observer program be conducted.

An observer program would be useful in other ways as well. For the tagging program, it is important to investigate the efficiency of the tag recovery process. To help in this, observers can be used to plant tagged fish (post mortem tagging) in the holds of fishing vessels. School sighting data by observers might be directly related to abundance using

the transect theory which has been used for porpoise surveys. Super-concentrations of yellowfin have been found to occur; and, during certain times of the year, they are fished intensively enough to undergo short-term (2-4 weeks) depletion. Detailed observation of such events could lead to more reliable estimates of the size of these super-concentrations and therefore in combination with survey data to an estimate of abundance. Finally, the observers could help improve port sampling by providing ground truth for size and species composition of fish in holds that will later be sampled in ports.

The observer program would be aided by the experience of the observer program conducted during the International Skipjack Year Program. The data forms and computer programs should all be used again. Doing so will facilitate comparing observer data before and after the decline in effort.

Observer activities should cover all the important fleets so as to give good geographic coverage and good coverage of the yellowfin size range. All seasons of the year should also be covered, perhaps with emphasis on the first quarter when super-concentrations are more likely to be found.

2.3 Tagging

An increase in yellowfin abundance in the eastern tropical Atlantic could occur in two ways: growth of young fish and immigration from other areas. Tagging can help to investigate both these processes.

Growth has already been investigated from previous tagging of around 10,000 yellowfin. A hypothesis has been put forward that decreased growth for some sizes of yellowfin might occur in the recovered population due to increased competition for food. The new tag recovery results should be compared with the old results to see if such a difference is revealed even though the likelihood of detecting it is small. If no difference is noted, the new data would be an important confirmation of earlier results which showed a peculiar (and controversial to known biology) two-phase growth curve and also showed indications of different growth curves for males and females. Some tagged fish should be injected with tetracycline to aid in the analysis of growth using otoliths and possibly vertebrae as discussed below.

Because the earlier tagging program was not directed towards yellowfin, the distribution of releases was not satisfactory for investigation of yellowfin movement. This new tagging program should concentrate on this aspect. We have identified six areas where yellowfin should be tagged: four in the eastern tropical Atlantic, the Azores and Venezuela. These areas have been selected according to general distribution maps of small yellowfin (Figure 2) and medium yellowfin (Figure 3), as these two categories are the target for tagging. Information on movement will not only help in interpreting local stock recovery in the eastern tropical Atlantic but will also help in resolving the perennial question of one vs. multiple stocks.

An additional benefit of tagging is the possibility of estimating abundance by some variant of the traditional tag-distribution analysis. The tagging of yellowfin during the Skipjack Program was unfortunately not suitable for this purpose. Therefore, we will not have a good point of comparison from the time previous to the decline of effort. However, ef-

fort is likely to build up again, in which case it will be very useful to establish an estimate now during a time of diminished effort.

Much of the necessary material used during the Skipjack Program is still available, including field manuals, recording sheets, posters, tagging needles, computer programs, etc. Many of the fishing industry personnel who were trained to deal with tag recoveries are still in place. ICCAT also has approximately 30,000 tags in stock which coincidentally is a good target number of tags to use. The number of tagged fish would be fewer because a significant number should be double tagged.

We identified four tagging modalities: (1) opportunistic tagging by observers on pole--and-line vessels during normal commercial fishing; (2) chartering a pole-and-line vessel to use exclusively for tagging; (3) use of the research vessel "Nizery", which could be made available by ORSTOM; and (4) tagging by hooks lost on tunas from Cape Verde. All have different advantages, disadvantages, and costs.

Opportunistic tagging would provide extensive coverage of strata where pole-and-line vessels operate and none elsewhere. For most of these vessels, yellowfin are an incidental catch. The greatest part of the cost of this type of operation is payment for fish, which at $3-$4 per fish can add up to a surprisingly large figure (Table 2). The actual price per fish needs to be negotiated. Chartering a pole-and-line vessel allows us to target on yellowfin tuna and on strata of interest to us. Chartering appears to be the only possible alternative in the west Atlantic. Coverage in time must be brief because of the high cost of chartering (about $100,000 per month). Use of the "Nizery" would also allow targeting on yellowfin and on particular strata. Its efficiency at catching fish is less than a commercial pole-and-line vessel but its cost would only be the price of fuel (about $16,000 per month).

We recommend that the first three modalities be used in order to cover all sizes of yellowfin (except the very large) and to cover all the areas recommended above. Details of proposed times, areas, and costs of tagging are given in Tables 1 and 2, and Figure 4.

Knowledge on the migrations of large yellowfin is of great importance to the Atlantic fisheries. The usual and most direct method to acquire this knowledge, which is tagging with dart tags, cannot be performed on such big fish which are difficult to catch and to handle for traditional tagging purposes. Therefore, a fourth type of tag with an original design should be tried on an experimental basis during the Program, although the expected results are only hypothetical.

This tagging is based on observations of catches made in the Azores of large yellowfin which have grown during a seemingly long period with a hook in their mouth. The current project is to manufacture hooks with "ICCAT" and an identification number written on them. These hooks could be distributed, at no cost, to the artisanal fishermen catching large yellowfin with hooks.

The tagging would then be based on the fact that a certain number of lines break during fishing operations (especially hand lines); the large yellowfin thus freed involuntarily at a certain geographic point with an ICCAT hook in their mouths could then be recaptured and identified, which would provide information on their migration.

The artisanal fishery of the Cape Verde Islands would be an ideal site to start this project. Other fisheries, such as the fisheries of the Canary Islands, Madeira and Azores,

could also serve as a base for this project in second place. The ICCAT hooks will have to be identical to those of the fishery which will use them.

The operation could be carried out at a low cost (approximately $10,000) and could provide very interesting information on the migrations of large yellowfin.

2.4 Hard part analysis

A technique for micro-chemical analysis of tuna vertebrae has recently been developed (SCRS/85/36). It has been shown to be useful for bluefin for studying the exchange of fish between geographic areas and for studying the history of the growth for individuals. This information would be useful for yellowfin studies for the same reasons outlined above for tagging. However, the technique has never been tried for yellowfin or any other tropical species. The use of this technique would therefore be speculative, particularly the history of growth aspect. Nonetheless, we recommend that samples be taken for three reasons: (1) The cost of sampling is negligible. (Funds for the high cost of analysis would have to be sought from a university that is interested in carrying out the research); (2) The likelihood of success with exchange rates is considered favorable; and (3) The benefit is very high if the history of growth aspect is successful (or perhaps some other historical trace, such as episodes of spawning). Some of the yellowfin at large now are carrying in their hard parts a chemical record of the time previous to the decline in effort.

2.5 Identification of spawning areas

Previous efforts to identify spawning grounds were very limited in area and missed some of the zones presently exploited which are theorized to be aggregations for the purpose of spawning. To check on this and perhaps to identify other spawning areas, we recommend that samples be taken for measurements of gonad index both in strata with super-concentrations and in other strata. Gonad samples should also be examined for fecundity to compare with a previous fecundity investigation in the inner part of the Gulf of Guinea done during 1985.

3. Possible alternatives to the present project

If ICCAT is not in a position to finance the present project, especially at the most interesting level of tagging, the Program would lose most of its importance, since the small isolated laboratories working in the study area have, in general, only modest funds and could not meet the high costs of tagging. Also, these research centers are, in general, under strict administrative regulations which often prohibit this type of project (for example, paying the fishermen for the fish they return to sea).

Under the hypothesis that only a part of the funds foreseen in the actual budget could be available, it would still be possible to reduce the tagging objectives, considering the allowed budget, and still maintain the importance of the Program. These adjustments in the

Program could be decided, if the case arises, by the scientists responsible for the Program (a meeting is planned for early 1986).

Under the unfavorable hypothesis in which no financing would be granted by ICCAT, only the improvement in statistics and a reduced observer program could be put into operation, measuring the changes in catch-per-unit-of-effort by size of fish for various fleets and areas. It would still be difficult to understand how the stock is reacting, and the international scientific community would only receive marginal benefit from the unique circumstances which are offered in the Atlantic.

4. Logistics

We recommend that this Yellowfin Year Program commence as soon as possible during the first quarter of 1986. The tagging and observers activities should continue through the first quarter of 1987. Collection of tag returns, analysis of data and presentation of results would extend for some time after that (see Section 6, "Calendar of events"). The two important activities that we have indicated, observers and tagging, should be conducted by two activity teams composed of scientists based in the appropriate areas. The activity team for observers would also deal with hard part and gonad sampling. A third activity team should conduct the data processing and analysis. The SCRS should appoint team members and team leaders. Procedures for supplying tagging materials and handling tag recoveries should be the same as for the International Skipjack Year Program. The Secretariat would administer ICCAT funds used in the Yellowfin Year Program and in consultation with the tagging team would conduct negotiations for vessel charter. In liaison with the data analysis team, the Secretariat would also serve as a data clearing house and assist where needed in data processing.

The man-hours and materials presently foreseen on the national level of the ICCAT member countries to carry out the Program are important and are given for information only (Table 3). These means are not counted in the Program budget because they are not charged to the Program. The procedure would be the same as was used with the International Skipjack Year Program for which national investments were not counted in the ICCAT budget, although they were very important.

5. Budget

	Normal ICCAT budget
Tags & tagging materials	$ 5,000
Payment of observers	48,500
Payment for tagged fish	48,000
Fuel for "Nizery"	80,000
Charter of Venezuelan BB	100,000
Charter of Ghanaian BB	10,000
Publication	10,000
Travel	5,000
Meetings	

Workshops	7,000
Training of technician	5,000
Reward costs	24,000
ICCAT hooks	10,000
Contingency	10,000
TOTAL	$ 362,500

6. Calendar of events

November, 1985	SCRS appoints activity teams
January, 1986	Start of Program
Jan. or Feb., 1986	Meeting of team leaders
March, 1987	End of observing and tagging
March, 1988	Bulk of tag returns received
July, 1988	Workshop
November, 1989	Special SCRS session

Table 1. Time-area strata where best probabilities of fishing medium or small yellowfin exist

Quarter	*Cap Lopez*	*Ghana Ivory Coast*	*Liberia*	*Senegal*	*Azores*	*Venezuela*
1	S	S				
2	S, M	S		M		
3	S, M	S, M		M	M	M
4		S, M	S, M			
Tagging Project	NZ OGBB ECBB	NZ OGBB ECBB	NZ ECBB	OSBB	AZBB	WCBB

S = Small yellowfin.
M = Medium yellowfin.
NZ = "Nizery".
OGBB = Opportunistic Ghanaian BB.
ECBB = Eastern chartered BB.
OSBB = Opportunistic Senegalese BB.
AZBB = Azorian BB.
WCBB = Western chartered BB.

Table 2. Estimation of expected taggings and related costs (US$)

Tagging Project	*Size of YFT targeted*	*Number expected*	*Duration*	*Time*	*Cost of operation*

WCBB	M	*Venezuela*	yellowfin

Table 2. Estimation of expected taggings and related costs (US$)

Tagging Project	*Size of YFT targeted*	*Number expected*	*Duration*	*Time*	*Cost of operation*
Nizery	Medium	6,000 (TTC)	3 months 6 trips	February, 1986 February, 1987	48,000
Opportunistic Ghanaian BB	Small Some medium	12,000 (TTC?)	9 months 6 trips	April, 1986 March, 1987	36,000*
Western chartered BB	Medium	5,000 (TTC)	1 month 1 trip	mid-1986	> 80,000**
Eastern chartered BB	Medium and small	15,000 (TTC)	1 month 1 trip	Second half 1986	≥ 100,000**
Opportunistic Senegalese BB	Medium	2,000	2 months 5 trips	mid-1986	10,000*
Azores BB	Medium	500	2 months	mid-1986	2,500
Cape Verde	Large	1,000	12 months	1985-1986	10,000

Small = 1.5-4 kg.
Medium = 4-15 kg.
Large = over 20 kg.
TTC = Tetracyclene use. In such cases, 20 percent of tagged fish to be injected.
*Costs proportional to number of fish tagged.
**Costs still uncertain. To be discussed.

Table 3. National means currently foreseen to put the Yellowfin Year Program into operation in 1986-87 (in months). (Estimates given for information only)

Country	*No. of Months Researchers*	*No. of Months Technicians*	*Observers*	*Facilities*
Cape Verde	6	12	---	---
Ivory Coast	18	24	6	---
Spain	18	12	6	Data processing.
France	12	---	3	Three months research vessel (without fuel).
Ghana	6	12	3	---
Senegal	24	24	3	Gathering and processing of data.
U.S.A.	6	---	---	Data processing.
Venezuela	24	12	3	---
Portugal	6	6	2	---
Total	150	102	24	
Estimated cost	$300,000	$50,000	$200,000	

TOTAL COST = $550,000

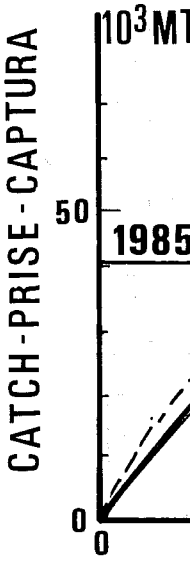


Fig. 1 Production
ed equal to

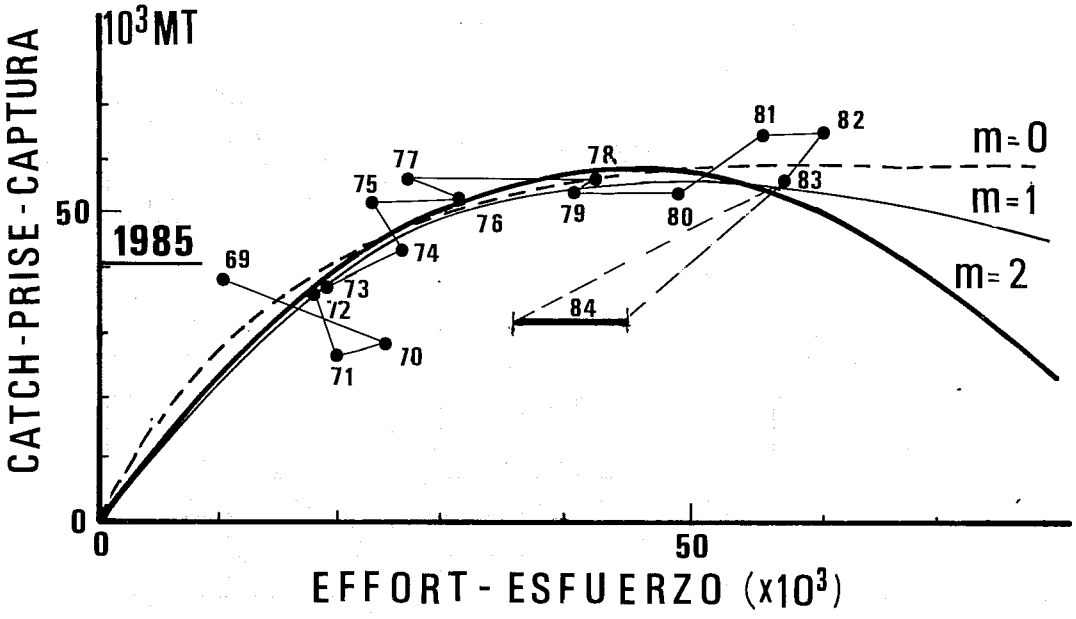


Fig. 1 Production model for east Atlantic yellowfin. (84) SCRS provisional estimates, 1984 CPUE being estimated equal to 1983 CPUE.

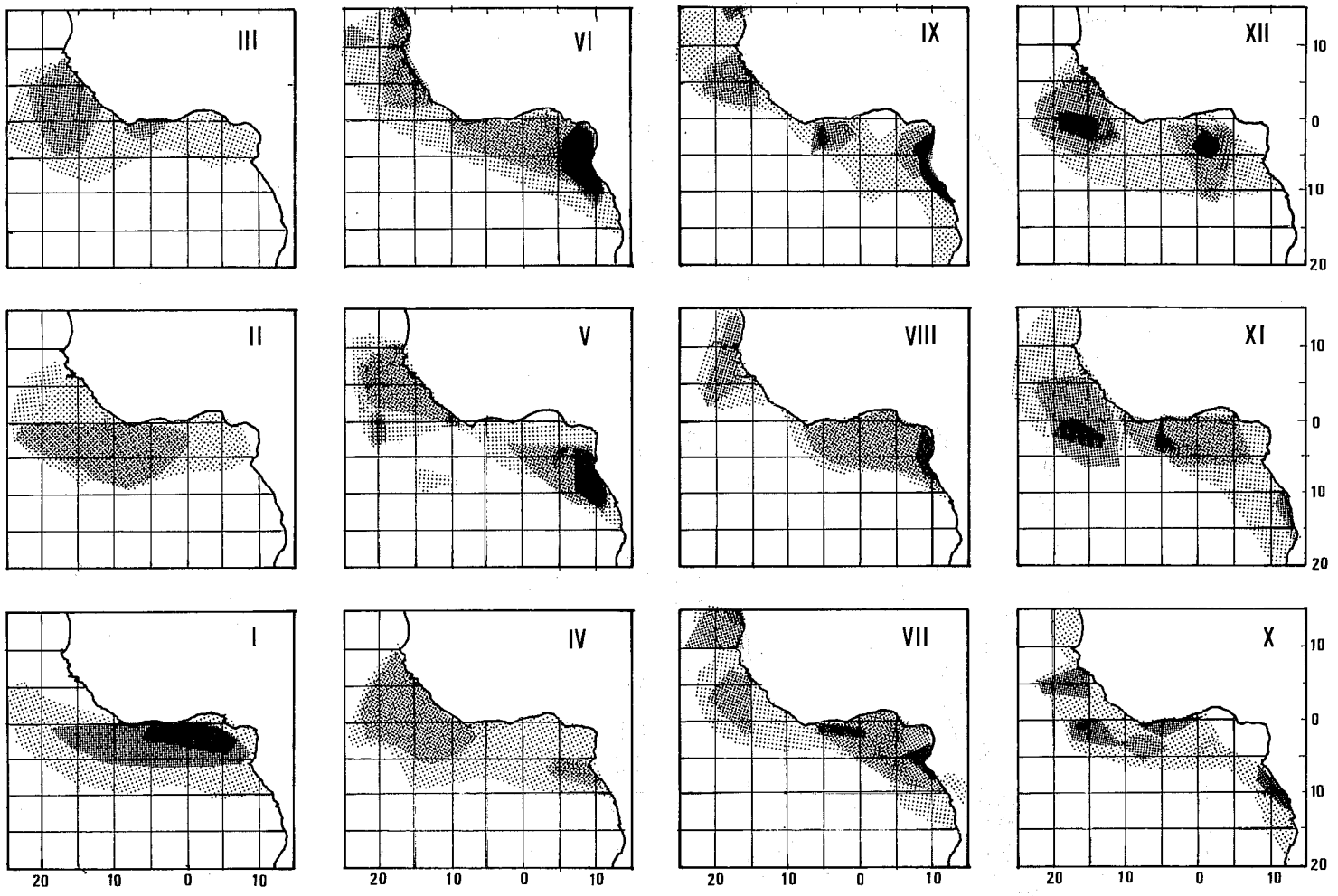
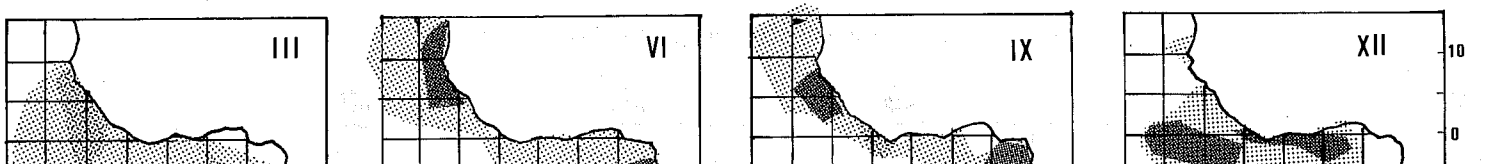
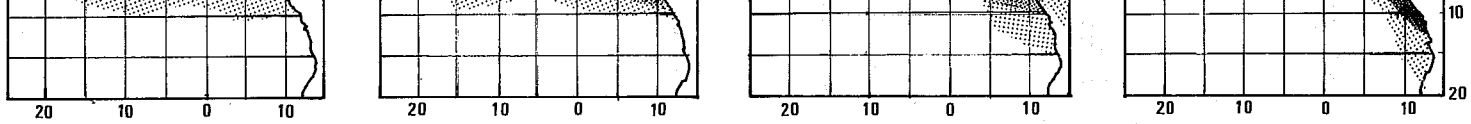


Fig. 2 Distribution of monthly catches of juvenile yellowfin, from tagging conducted from 1979 to 1983 by FISM and Spanish purse seiners. Roman numerals in the figure represent the months of the year.





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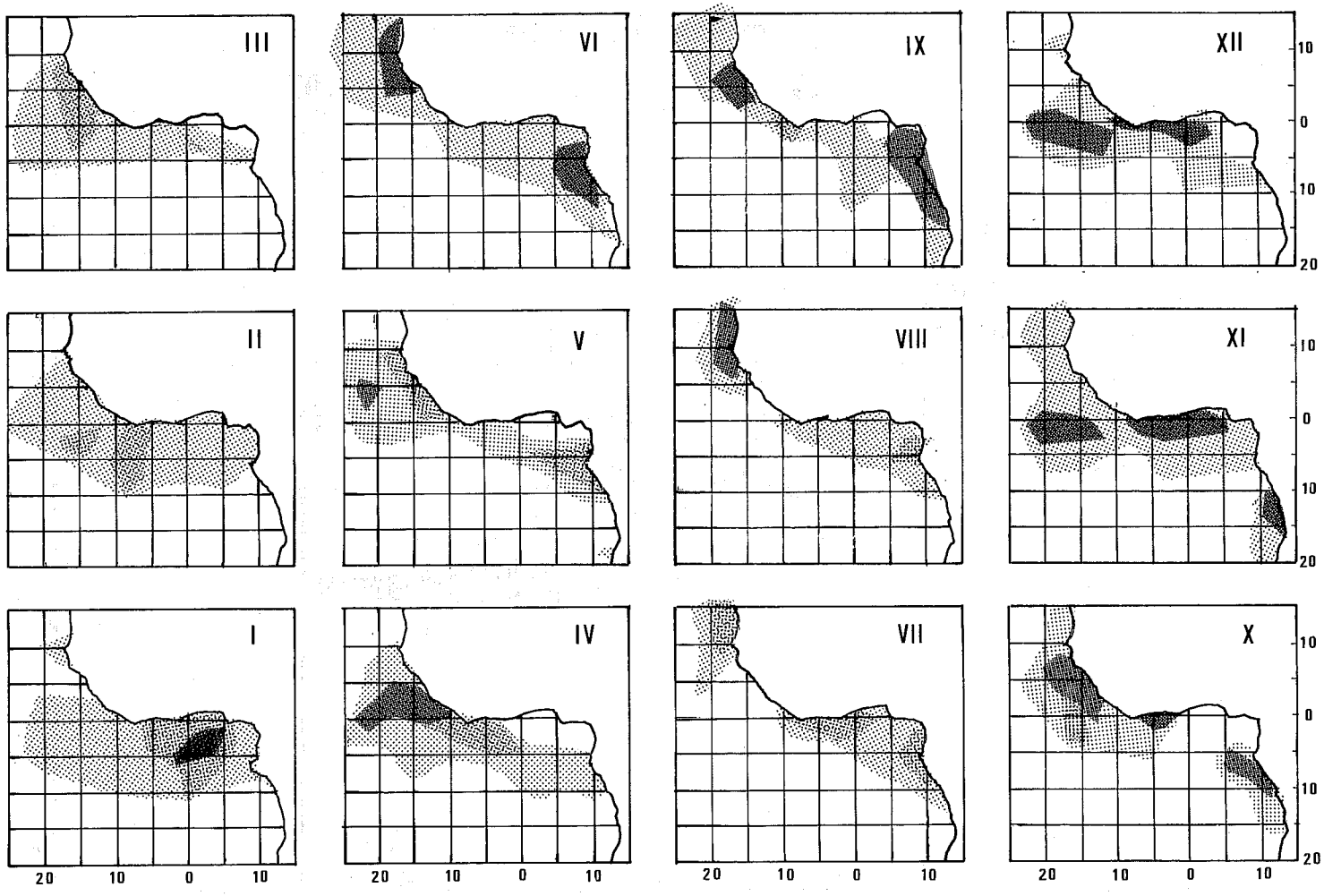

Fig. 3 Distribution of monthly catches of adult yellowfin, from tagging conducted from 1979 to 1983 by FISM and Spanish purse seiners. Roman numerals in the figure represent the months of the year.

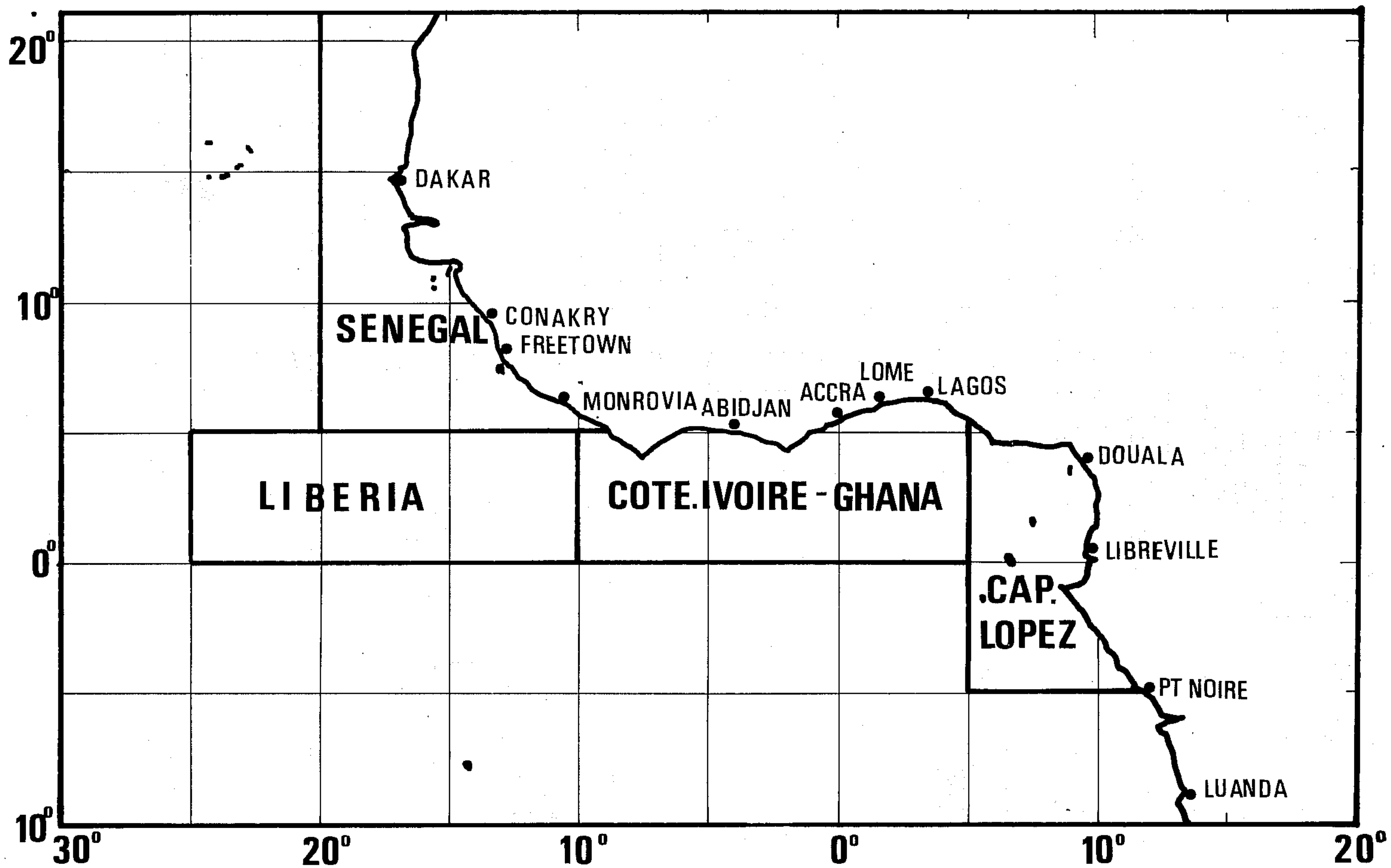

Fig. 4 General areas identified for tagging small and medium yellowfin.