FAO Fisheries Report No.670 SLAC/R670

WESTERN CENTRAL ATLANTIC FISHERY COMMISSION

Report of the

SECOND MEETING OF THE WECAFC AD HOC FLYINGFISH WORKING GROUP OF THE EASTERN CARIBBEAN

Bridgetown, Barbados, 8–12 January 2001

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2002

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

M-00
ISBN 9251047863

PREPARATION OF THIS DOCUMENT

This document was prepared by the Food and Agriculture Organization of the United Nations (FAO), which organized the second Meeting of the WECAFC Ad Hoc Flyingfish Working Group of the Eastern Caribbean. It includes information on the results of the intersessional activities of the group and provides an account of the preliminary analyses of the available country–data–sets. It also includes an account of the group's deliberations on the issue of formulation of a draft Strategy for the Management of the Eastern Caribbean Flyingfish Stock.

The work was accomplished under the guidance and supervision of FAO/WECAFC/FIRM.

Distribution:

FAO Fisheries Department
FAO Regional Fisheries Officers
Workshop Participants
WECAFC Distribution List

FAO/Western Central Atlantic Fishery Commission.
Report of the Second Meeting of the WECAFC Ad Hoc Flyingfish Working Group of the Eastern Caribbean. Bridgetown, Barbados, 8–12 January 2001.
FAO Fisheries Report. No. 670. Rome, FAO. 2002. 156 p.

ABSTRACT

Part one of this report provides a summary of the proceedings of the second Meeting of the WECAFC Ad Hoc Flyingfish Working Group (FFWG) of the Eastern Caribbean. It contains the reports of the participant's evaluation of their national Flyingfish data sets, for catch–rate standardization and for developing and interpreting standardized catch–rate time series for their country's flyingfish fishery.

The other major topics on the group's agenda included: the Social and Economic Status of the Eastern Caribbean Flyingfish Fishery, the Future Options for Management of the Eastern Caribbean Flyingfish Resources and a Proposal to Establish a Working Group on Moored Fish Aggregating Devices (FADs).

The results of meeting revealed that there were residual deficiencies in the national data collection systems that will require further corrective action before standardization at the subregional level can be achieved. The group considered this requirement vital to the development of a workable management regime. The summary of the subregional status of the Sociology and Economics of the Eastern Caribbean Flyingfish Fishery highlighted many similarities and differences; it also highlighted areas where the data gathering methodologies required refinement. The group was cautious in formulating firm recommendations to establish regional cooperation in research and management. It therefore recommended that in light of the need for further adjustments in the existing data and or collection systems a 'generic draft' outline of a Subregional Flyingfish Management Plan (SFFMP) should be mooted for comments from the WECAFC Scientific Advisory Group.

The second part of the report assembles the full Managers' Reports on their Preliminary Analyses and Attempts at Standardization of their Flyingfish data sets. Six National Reports on the Social and Economic Status of Commercial Flyingfish Fishery are also included in this section.

CONTENTS

PART 1: MEETING REPORT

BACKGROUND AND OBJECTIVES

1. The Second Meeting of the WECAFC Ad Hoc Flyingfish Working Group was the result of one of the decisions of the First Working Group Meeting of 22–24 September 1999. That specific decision mandated the group to execute two specific intersessional activities, 1) the making of improvements to national catch and effort data sets and 2) the execution of National Social and Economic surveys. Following the completion of those activities the recommendation was that the group should meet again, to further the subregional responsibility of moving towards the shared management of the flyingfish stock – under the FAO Code of Conduct for Responsible Fisheries. The decision also took note of the relevant articles of the UN Laws of the Sea.

2. Other results of the first meeting of the group included *inter alia*, the agreement that the Eastern Caribbean flyingfish resource should be treated as a single stock, that this should be seen as an opportunity to establish regional cooperation in research and management and the 'precautionary approach' should be followed in further expansion of fishing effort, given the observed interannual variability in the available data.

3. This was the first meeting of the Ad Hoc Flyingfish Working Group since the IX Meeting of WECAFC (27–30 September 1999). WECAFC IX not only ratified the formation of the group but also recommended that its activities should be continued with the active participation and support of member countries. The meeting was jointly organized by the FAO and the University of the West Indies (UWI) – Natural Resource Management Programme. The Fisheries Department of the Government of Barbados also provided logistical support to the meeting.

4. The objectives of the meeting were to:

- Attempt to standardize the various fields that are common to participating country data sets;
- Perform exploratory analyses of those adjusted National data sets;
- Attempt a standardization of time series of the catch and effort fields of the subregional flyingfish data sets;
- Examine and compare the social and economic status of the flyingfish fishery in the participating countries; and
- Using the results of the foregone activities to inform a subregional strategy for the sustainable management of the Eastern Caribbean Flyingfish resource.

OPENING SESSION

5. The Chief Fisheries Officer of Barbados, Dr Patrick McConney, chaired this session. In his welcoming remarks he reminded participants of the importance of their work to the future viability of the subregional flyingfish stock and encouraged them to approach it with diligence. He also encouraged them to seek to enjoy some of the Bajan hospitality outside the precincts of the meeting place.

6. The Secretary of WECAFC, Mr Bisessar Chakalall, spoke on behalf of the FAO Subregional Representative. He welcomed the participants on behalf of the FAO Director-General. He also thanked the University of the West Indies for agreeing to co-sponsor the meeting and the Government of Barbados for hosting the meeting.

7. Mr Chakalall made reference to the available scientific evidence on the life history and the distribution of the Eastern Caribbean flyingfish resource. He suggested that such evidence should serve as motivation to the countries of the subregion to work together. He also noted that sharing scientific information, analysing catch and effort data and eventually preparing management strategies and an action plan, for the sustainable exploitation of the flyingfish resource were priority issues in the work of the group.

8. Mr Chakalall also spoke with anticipation about the work of the ad hoc Working Group saying "that it will not only translate into more effective management of the flyingfish resource, but that its success will also serve as an example for other shared fisheries resources (such as lobsters, conch, shrimp, sharks and other pelagics) in the WECAFC region".

9. He finally challenged the participants to:

- use their collective expertise and experiences to provide the best possible advice for increasing cooperation among the flyingfish producing countries of the Eastern Caribbean; and
- generate useful information and recommendations for the preparation of an Eastern Caribbean Flyingfish Management Plan, which is one of the goals of the ad hoc working group.

10. Professor Wayne Hunte, Director of the UWI's Natural Resource Management Programme, spoke of the University's past involvement in flyingfish research and of its pleasure in co-sponsoring the present Meeting. He also spoke of his personal pleasure and interest in being part of the present meeting, which seeks to utilize one of the findings of the Eastern Caribbean Flyingfish Project (ECFFP) to resolve an issue of subregional importance – to the flyingfish resource and the countries that exploit it. The specific finding he mentioned was "that the flyingfish appear to move freely among the islands as one stock". He also expressed his pleasure that one of the objectives of the meeting was to initiate discussions on strategies for subregional cooperation in managing the flyingfish resource.

11. Finally Professor Hunte informed the participants of the NRMP's continued interest in the investigation and sustainable management of flyingfish and other marine resources of the region. He also wished them success in their deliberations.

12. Mr Rudolph Hinkson, Permanent Secretary in the Ministry of Agriculture and Rural Development, officially opened the meeting. In his welcoming remarks he congratulated FAO for selecting the UWI–NRMP as a partner for holding the meeting. He spoke of his encouragement in noting the networking between the UWI, FAO and the fisheries authorities in the subregion; he expressed the opinion that such partnerships have possibilities and potential that are yet to be explored.

13. In reference to the agenda of the meeting, Mr Hinkson advised the participants, that "while the importance of flyingfish to economy, culture and society differs among countries, the fact that we should seek to manage this resource ourselves is critical". He also advised participants to take their tasks seriously since the agenda suggest that by the end of the meeting, at least an outline of a regional fisheries management plan for flyingfish will be produced.

14. The Permanent Secretary said that "at technical meetings, such as this, fisheries managers need to be bold enough to come up with objective indicators and measures of the health of and

status of fisheries, in all their dimensions and provide the best information upon which agreements can be concluded".

15. In closing, Mr Hinkson expressed the commitment of the time and talents of the fisheries personnel of the government of Barbados to fisheries management through the WECAFC and the proposed Caribbean Regional Mechanism (CRFM). He further charged the participants to "gear the results of their Meeting and any resulting intersessional activities to project where we want to go and how best to get there in the shortest possible time, because the days without fisheries management are becoming the dark ages of history". He then declared the meeting open.

APPOINTMENT OF CHAIRPERSON AND ADOPTION OF AGENDA

16. Dr Patrick McConney was nominated and confirmed as chairperson of the meeting. The agenda was adopted, with minor adjustments to the order of items. The agenda appears as Annex I of this report.

17. Participants were introduced to the resource persons who were to facilitate the activities of the various agenda items; they were also briefed on how the various activities were to be implemented and how the results of those activities were to be presented.

PARTICIPATION

18. The six original participating countries attended the meeting. In addition, the French Overseas Department of Martinique participated, for the first time.

19. There were eleven participants at the meeting. The Commonwealth of Dominica, Grenada, St Lucia, St Vincent and the Grenadines and Trinidad and Tobago were each represented by one person, while Barbados was represented by three persons and Martinique (French Antilles) was represented by two persons. The UWI–NRMP was also represented.

20. The representatives from Martinique attended the working group's meetings to not only share information on the flyingfish fishery in Martinique but also to introduced a computer program, which was designed to integrate data from several formats into one common numeric standard.

PREPARATION OF NATIONAL MANAGER'S REPORTS: STATISTICAL AND ASSESSMENT ANALYSES

21. A significant portion of the meeting was spent manipulating national flyingfish data sets. Participants attempted exploratory analyses of their data by examining seasonal, spatial and annual trends; they also attempted to determine total catch and effort. General Linear Model (GLM) analysis was used to standardize catch per unit effort (CPUE) and identify gaps in the combined data sets. The national reports and the conclusions drawn by the data managers are summarized below.

BARBADOS

Background

22. Over the period 1989–1999, flyingfish accounted for approximately 59 % of the island's fish catch by weight. The margined flyingfish (*Hirundicthys affinis*) comprises the majority of the

Barbadian flyingfish catch. The guineaman (*Cypselurus cyanopterus*) was occasionally taken while other species were too rare or small to be commercially important. The majority of the catch (86 % in 1999) was taken by day–boats (also called day–launches) and iceboats. In 1999 there were 273 day–boats with overall hull lengths ranging between around 5 m and 12 m registered in the Barbadian fleet. A total of 149 vessels with hull lengths ranging between around 10 m to 17 m comprised the registered iceboat fleet.

Objectives

23. The primary objective of the current analyses were to conduct a preliminary estimation of the status of regional flyingfish stocks through standardized assessments of current trends in total landings, fishing effort and CPUE. Such information is useful for structuring management plans for the fishery.

Data Used

24. Fish landings have been recorded at the island's major markets since the early 1950s. The records included summarized data on daily and monthly totals of fish landed at the sites and the total number of vessels landing the recorded catches.

Results

25. A summary of the number of landings, recorded at the three types of landing sites in Barbados, illustrated that the number of records increases in the order tertiary site to secondary site to primary site. The summary also indicated that the number of recorded landings varied appreciably between seasons. The summarized data on the mean values of vessel length and HP within the dayboat and iceboat fleets over the six seasons showed little variation. Although the mean CPUE (based on untransformed data) does differ between seasons no consistent trend was observed.

26. Residual plots for the GLM models for log transformed CPUE data for dayboats and iceboats were produced. The model used fixed factor variables of season, month and vessel length with interactions between vessel length and season and season and month only. Plots of mean seasonal CPUEs (kg/trip) for the dayboat and iceboat fleets, respectively, were also done. The values plotted were antilogs of the linearized log values estimated by the GLMs. Iceboat CPUEs increased noticeably between the 1996 to 1997 seasons but probably levelled off over the last four seasons.

Recommendations

27. Given the preliminary nature of these assessments a precautionary approach to increased fishing effort in the region is recommended.

28. The models used in the analyses must be critically reviewed and models better suited to the dataset used (e.g. a poisson distribution model). While meetings such as this are very useful, much of the analytical work would have to be continued intersessionally with the assistance of a coordinator to ensure that as far as possible, similar methods continue to be used by all countries within the region.

29. Although the number of trips remains the most accessible and therefore most feasible unit of effort for this fishery, the changes in fishing trends over the years (e.g. number of and design of

nets, length of time fishing, changes in vessel length and power, fishing range etc.) need to be carefully assessed.

DOMINICA

Background

30. The flyingfish fishery of Dominica is artisanal in nature and is characterized by small canoes and keel boats and open fibreglass boats to a lesser extent. These vessels range from 16 to 25 ft in length and are propelled by outboard engines with 25 HP and 48 HP being the most commonly used engines. The main gear deployed in the fishery are handlines, dipnets and gillnets. Flyingfish is caught from the waters around the island both from the Caribbean Sea and from the Atlantic Ocean. The crew is usually 2–3 men per boat. Most of the fishermen in this fishery are either approaching fifty (50) years or over fifty years old. The younger fishermen on the island do not generally target flyingfish, as they prefer to go after the high value large pelagic species.

Objectives

31. The main objectives of the current analyses were:

- to check the data set for errors and omissions and determine its quality;
- to develop a standardized catch and effort series for the Dominican flyingfish fishery;
- to estimate stock status and total effort to determine trends in landings and effort;
- to carry out standardized assessments among countries sharing the flyingfish resource, to make recommendations for a five-year management plan.

Data Used

32. The data used for the analysis were catch and effort data for flyingfish collected over a six-year period 1994 to 1999. The data consisted of landings recorded in pounds landed per boat per landing site. The effort data were collected in hours fished but for the current analysis, effort was measured in boat trips. One trip represented one day fished regardless of the time–spent fishing.

Results

33. The gillnet is the most commonly used gear for catching flyingfish followed by hand line. The pattern of landings over 1994 to 1999 showed a sharp decline over 1995 and 96 with 1997 showing the lowest recorded landing during the period under study. The results showed a moderate increase over the next two years, i.e. 1998 and 1999, which was still well below the landings of the earlier years. Since it appears that many factors affect the landings of this fishery, it is difficult to determine the cause of the decline and the low rate of recovery as indicated by the catches recorded.

34. In an effort to standardize catch per unit effort a General Linear Model (GLM) was used. Variables used in the model were season, month and site location. The factors month and site location were significant but season was not. This observation was due to the fact that flyingfish is not a major target fishery in Dominica, secondly it is part of a multispecies fishery which has some effort expended on it – the value of which is not very well known. Flyingfish therefore, cannot be studied in isolation of the other species along with which it is caught considering that different species are caught on the same trip.

Conclusion and Recommendations

35. The data set was insufficient to warrant any firm conclusion on the flyingfish fishery. A longer time series is required and a study of fishermen's behaviour towards this fishery is required.

36. It is recommended that:

- Available historic data should be used for further analyses.
- A survey independent of the fishery should be done to capture real fishing effort for this species.
- Incentives should be provided to encourage fishermen to target this species more intensely.

GRENADA

Background

37. Grenada's Flyingfish fishery is of significance to the large oceanic pelagic fisheries in which longliners are involved to supply the export market. Since Flyingfish is the main prey of the species in this fishery, it has naturally become the bait of choice for the longliners. As a consequence the Flyingfish fishery has evolved into a valuable bait fishery while it has diminished considerably as a landed food fish – in fact very little flyingfish are presently for sale to the public. It follows, therefore, that it is the longline fleet that needs to be targeted for management. This fleet consists of 163 vessels placed into three categories of (1) Semi-industrial – 60 vessels, (2) Pirogues with cabins – 53 vessels and (3) Open pirogues – 48 vessels.

38. The sudden drop in recorded landings between 1978 and 1979, as well as the failure of flyingfish to recover its 1978 levels as a landed food fish since, deserves explanation. Although there was a significant flyingfish fleet prior to the 1982, Artisanal Fisheries Development Project (AFDP), the advent of that project as well as the introduction to longline by Cuban fishermen and trainers caused this to change. In practice, artisanal fishers become more and more involved in the high value, commercial oceanic pelagic species. The result was to increasingly relegate flyingfish to a lower status as a landed food fish even as its value as a baitfish increased appreciably.

Objectives

39. The objectives of the present exercise are:

- to examine the data set more closely for errors and omissions, including seasonal, spatial and annual trends;
- to develop a standardized catch and effort series for the Grenadian flyingfish fishery; and
- to estimate a stock status, current total landings and total effort determine trends in landings and effort, standardized assessments among countries sharing the flyingfish resource make recommendations for a five-year management plan.

Output and Recommendations

40. The Exploratory analyses of available data and standardization of CPUE (by trip, site, month etc) and the production of analytical graphs and tables upon which to draw conclusions were attempted. The results were inconclusive.

41. A Draft proposal to improve the data collection regime in Grenada is strongly recommended. This should be aimed at achieving compatibility with other islands as well as permitting greater accuracy in assessing the status of the stock (abundance) of flyingfish – this information is also critical to the commercial large pelagic fishery.

SAINT VINCENT AND THE GRENADINES

Background

42. The flyingfish fishery does not constitute an important or significant component of the commercial fisheries of Saint Vincent and the Grenadines. Flyingfish is taken opportunistically by the pelagic fleet, which comprises 300 open boats and 1 500 full and part-time fishermen. It is used as bait, when there is a scarcity of the small coastal pelagics (jacks and robin). Less than 1 metric tonne is landed and recorded annually and this accounts for less than 1 % of the total pelagic landings.

Objective

43. The main objectives of the current analyses were:

- to examine the data set more closely for errors and omissions and to examine seasonal, spatial and annual trends in fishing activities;
- to develop a standardized catch and effort series for the St Vincent and the Grenadines flyingfish fishery;
- to attempt to use the national data sets to estimate total landings and to determine stock abundance trends; and
- to prepare flyingfish stock management advice based on the results.

Data Analysis

44. A proper national Flyingfish data set for St Vincent and the Grenadines does not exist by virtue of the little harvesting effort that fishers direct toward the resource. Data on landings of flyingfish seldom shows up on market forms and in the catch and effort data collected at the landing sites around Saint Vincent and the Grenadines hence, the unavailability of data to be analysed. At present the resource remains underutilized and there are no specific management regulations in place.

SAINT LUCIA

Background

45. The majority of fishing vessels in Saint Lucia catch flyingfish during the flyingfish season. Under the current data collection system, data are not collected from at least three primary sites where flyingfish landings are important components of the landings. The annual landings for the island vary considerably from year to year but on average contribute between 3–10 percent of the total landings (George, 1999).[1]

[1] George, S. 1999. National report of Saint Lucia: Characteristics and status of the flyingfish fishery, *In* FAO Fisheries Report No. 613, Rome

Objective

46. The main objectives of the current analyses were:

- to examine the data set more closely for errors and omissions, including seasonal, spatial and annual trends;
- to develop a standardized catch and effort series for the St Lucian flyingfish fishery; and
- to attempt to use the standardized national data sets to estimate total landings and to determine stock abundance trends and
- to prepare flyingfish stock management advice, based on the results.

Data Used

47. Data used in the analyses for Saint Lucia included information from observed fishing trips (landings and effort) from various landing sites over a five-year period (1995–1999). The data also included information on vessel type, which were all classified as day–boats, number of crew, season, vessel length and engine horsepower, in addition to, annual estimated flyingfish landings. Hard data sets for 1990 to present are available on flyingfish landings for Saint Lucia whereas data sets from 1995 to 2000 are stored in TIP vs. 3.4.

Output /Results

48. Exploratory analyses of the data set were undertaken to examine more closely for errors, omissions and seasonal, spatial and annual trends.

49. Summaries of data were undertaken in EXCEL and SPSS which included summarizing observed and estimated catch and effort by month, site location gear season and year. Graphical representation of data in various formats including box plots, leaf and stem plots, bar charts and line graphs were done. In addition, conversion of landings (weight) to a log scale, then performing the above summaries and construction of the various plots. Considerable variation in estimated annual landings was observed over the 17-year period. A general trend of decrease in estimated landings was noted between 1985–1997 however an increase in landings was observed in 1998.

50. Attempts to standardize catch rates (landings per trip) using factors such as gear, season, month and site were undertaken using the formula log landings = log (Landings +1) to convert the observed weight of flyingfish. Log landings were then used in a GML model (SPSS v.8.0.). The contribution of each factor was quite low resulting in insignificant effect by each of these factors. Both R squared and Adjusted R squared values were extremely low probably because the assumptions of the model were not being satisfied.

51. Comparison and aggregation of CPUE data for the Eastern Caribbean region were not done due to several issues that needed to be resolved such as:

i) difficulties in standardizing effort regionally, for example equating a Tobago or Barbados day-boat with a Saint Lucia or Dominican pirogue or canoe;
ii) differences in data collection efforts and strategies; and
iii) differences in flyingfish fishery throughout the region.

Recommendations

52. For future analyses, in order to obtain a longer time series of catch and effort for the flyingfish fishery of Saint Lucia, the Department of Fisheries should consider converting hard copy data sets (archived) into digital data sets.

53. In order to have a better idea of effort, in terms of the number of fishers/vessels involved (targeting) in this fishery; the Department should consider conducting a survey to gather during their annual vessel-licensing programme.

TRINIDAD AND TOBAGO

Background

54. The oceanic pelagic fishery has historically been the most important commercial fishery of national importance in Trinidad and Tobago. The flyingfish fishery accounts for about 70–90 % of the total weight of pelagic landings at beaches on the leeward side of Tobago (Pandohee, 1996). Fishing effort is seasonal from November of one year to July of the next year. The flyingfish fleet consisted of about 75 pirogues and one iceboat between 1988–1991. It employed approximately 125 fishermen. Fishing practices involved the use gillnets, small dipnets and the occasional hook-and-line method. The latter was used to obtain fresh bait needed in the capture of larger pelagics.

Objectives

55. The objectives of the present exercise were:

- to estimate the status of the flyingfish fishery in Tobago, including Current total landings and total effort;
- to examine monthly, seasonal, spatial and annual trends;
- to standardize assessments among countries sharing the flyingfish resource; and
- to recommend management advice based on the results.

Data Used

56. The data used included data from observed and recorded landings taken by two data collectors only on official working days. The effort data used was derived from the observed and recorded trips taken by the said two data collectors on official working days. CPUE was calculated from the data recorded by the collectors.

Outputs of the Assessment/Analysis

57. The results of the analyses showed a general increase in the mean CPUE over time. Although there was evidence of some fluctuation between seasons, the general trend towards an increased CPUE appeared to have coincided with the introduction of iceboats to the Tobago fleet. It also appears that the observed dips in the CPUE may have been caused by changes in marketing arrangements and facilities during the Mid-nineties.

Recommendations

58. Base on the results of this exercise it is recommended that:

- The present level of coverage and data collection-practices need significant improvements.
- Special attention should be given to differentiation of vessel types in the fishery.

PRELIMINARY ANALYSIS OF THE EASTERN CARIBBEAN FLYINGFISH FISHERY and RECOMMENDATIONS FOR IMPROVING FUTURE STOCK ASSESSMENTS

Background

59. During the first Meeting, of the WECAFC ad hoc Flyingfish Working Group, the Group identified certain tasks to be completed, in preparation for a second Meeting of the Working group. It supported the need to coordinate a further refinement and assessment of the quality of the data collection and storage procedures in each participating country. It also supported the collection and of social and economic data on the flyingfish fishery to compile a regional perspective foe analysis.

60. In terms of catch and effort data analysis, it was agreed that available catch and effort data from all participating fisheries should be assembled and evaluated prior to the second Meeting of the Working Group. If possible, countries would try to improve their data in order to facilitate estimation of total catch and abundance trends.

61. Some data were reviewed prior to this Meeting and country representatives were advised of a suitable format for preparation of their data for analyses. However, most data were not ready before the Meeting. During this Meeting, therefore, participants focused mainly on evaluating the quality of catch and effort data, preparing datasets for catch rate standardization and developing and interpreting standardized catch rate time series for each participating country's fishery. The analyses conducted were preliminary, but highlighted certain deficiencies in the data collection systems, which would need to be addressed in the near future.

Objectives

62. The aims of the second Meeting of the Working Group were:

- to examine and to determine the quality of available landings and effort data,
- to estimate annual total landings,
- to standardize effort data,
- to develop and examine standardized annual catch rate series for each fleet/country,
- to prepare fish stock management advice based on results of analyses.

Data Used

63. Barbados – Landings and fishing trip data were available for the period 1959–2000. The adoption of the TIP database system in 1995 encouraged collection of additional data on vessel type and length, gear type, area fished and crew size. Data on fishing time (i.e. hours fished) and depth fished were not collected, although the TIP database accommodates these data. Catch rate was therefore estimated as weight of flyingfish caught per fishing trip.

64. Tobago – In the present analysis, data were available on monthly landings and fishing trips at three major landing sites (Pigeon Point, Buccoo and Mt. Irvine) during the years 1988–1999. At

the time of the present study, the available data did not permit distinction of boat type and this was therefore a significant confounding factor in the analyses.

65. Dominica – Landings data for the period 1994–1999 only were available for the present analysis. Fishing trips were one-day trips. Catch rate was estimated as weight of flyingfish caught per fishing trip. Sampling coverage was estimated to be approximately 70 % during 1994–1995 and 60 % during 1996–1999.

66. Grenada – At the time of analysis, landings data only were available for the years 1984–1999. During the 1980s, the data collection system did not capture substantial landings, which were not sold within the main markets. During the 1990s, flyingfish became more important as bait for the large pelagic fishery than as a food fish and so much of the catches were again not recorded.

67. Saint Lucia – Landings data for the period 1995–1999 only were available in a format suitable for the present analysis. Flyingfish were normally harvested as part of a multispecies fishery

68. Saint Vincent and the Grenadines – There is no target fishery for flyingfish in Saint Vincent and the Grenadines. Some flyingfish catches were recorded for two months in two years only during the middle to late 1990s. Given the amount of available data, a crude estimation of total annual landings was attempted only.

69. Martinique – The sampling program for the flyingfish fishery is now being developed, along with the database used for storing the data.

Statistical and Assessment Analyses

70. Individual country reports describe a number of descriptive and exploratory analyses of available catch and effort data.

Exploratory Analyses

Objectives

71. The objectives of this exercise were:

- to examine frequency tables of the variables/factors vessel type, vessel length, crew size, gear type and other available effort data fields
- to examine cross-tabulations of data field combinations believed to be significant. e.g. vessel type*gear type, vessel type*landing site, gear type*site, landing site*month, and month*year
- to obtain basic descriptive statistical measures of the available landings and effort data,
- to examine the distribution of both untransformed and transformed landings data to determine which type of data would be more appropriate for catch rate standardization trials using General Linear Model (GLM) analysis
- to examine spatial and temporal trends in reported catches and effort.

Methods

72. Prior to commencement of exploratory analyses, most country representatives required time to prepare their data sets in an appropriate format for analysis. The Tobago data had to be retyped

and the data set from Dominica was incomplete at the start of the Meeting. Participants therefore spent almost 2 days to prepare the data sets for Tobago and Dominica. In the case of Barbados, the representative also spent almost 2 days to incorporate a number of revisions, involving a large part of the data set.

73. Standard exploratory analyses were conducted using the statistical package SPSS. Frequency tables were generated to determine the categories of gear, vessel type and size and crew size involved in the fishery, to determine the extent and regularity of sampling through time (months and years) and space (landing sites) and to perform general quality checks on the data. Cross-tabulations of combinations of key factors were constructed to determine potential significance of these interactions to fishing activities.

74. The Group also examined Stem and Leaf and Box and Whisker plots of untransformed and transformed landings data by the lowest time stratum available, i.e. month. Observed changes in landings with changes in month, year and landing site were examined graphically for each country's fishery. Total annual effort by country was also estimated, using the formula: total effort = total catch/catch per trip.

Results and Discussion

75. In all data sets, a number of incorrect gear codes were identified and corrected during the workshop. The Stem and Leaf and Box and Whisker plots of Barbados and Tobago flyingfish data indicated skewed distributions for untransformed catch rates (catch per trip), with large numbers of 'zero' values recorded. Removal of zero data records reduced the skewness of the distributions. Additionally, the non-zero data were transformed by calculating the logarithms of the observed values. Corresponding Stem and Leaf and Box and Whisker plots of the log-transformed non-zero catch data approached normal distributions.

76. Except for Barbados, it was not possible to distinguish neither among the various vessel types, nor between those vessels which targeted flyingfish and those vessels for which flyingfish was a bycatch species only. It should be noted that participants concluded that the targeting of flyingfish would have been affected by factors such as time of year, market prices and abundance of other higher-value species. In the case of the Barbados iceboats, it was also noted that flyingfish was not the primary target species during the first 2–3 days of a fishing trip. The results of the exploratory analyses were therefore limited by the available data, but were useful for general data quality checks and to obtain basic descriptive statistics such as mean catch by month and by year. Further details are noted in individual country logs.

77. The Group examination of a clustered bar chart showing trends in total annual fishing effort. However, participants queried the accuracy of the results, which indicated that Saint Lucia carried out an unrealistically large number of fishing trips during 1997–1999. Additionally, the amount of effort obtained for the different categories of vessels within the Barbadian fleet appeared incorrect and would have to be re-checked. In view of limited time, it was not possible to redo the analyses of total effort during the Meeting. The estimates of total annual effort for Barbados and Saint Lucia would therefore have to be re-done prior to the next Meeting of the Working Group.

78. It was decided to use only non-zero catch rate data, both untransformed and log-transformed for input into the GLM standardization analyses. This accommodated the underlying assumption of a normal error distribution.

Development and Standardization of Catch Rate Time Series

Objectives

79. The objectives of this exercise were:

- to develop and standardize time series of catch rate data,
- To determine trends in flyingfish abundance for the time periods investigated.

Methods/Models

80. Given that flyingfish is considered to be an annual species and the well-documented seasonality of fish availability and abundance, the time series of catch rates were developed for fishing seasons rather than calendar years. A fishing season was defined as the time period commencing in October of one year and finishing in September of the following year.

81. Weight of flyingfish landed per fishing trip was used as the measure of catch per unit of effort (CPUE) or catch rate in all instances. Except for the iceboats, the length of a fishing trip for other fishing vessels normally ranged from 8 to 11 hours. Notwithstanding and given the possibility of country differences in fishing techniques and areas fished, a separate annual CPUE series was developed for each country using available monthly data on landings and fishing trips. As noted previously, the data currently available from Tobago did not distinguish between dayboats and iceboats and so the time series developed for Tobago was mixed. In the case of Barbados, two annual catch rate series were developed: a dayboat catch rate series for the seasons 1995–2000 and an iceboat catch rate series for the seasons of 1995–2000. The dayboat catch rate data for the seasons of 1995–2000 were also used to update a historical time series of CPUE data (26 years) which had been developed from manual examination and extraction of data records kept by the main flyingfish markets operating during that time (Mahon, 1989)[2].

82. Available CPUE time series were standardized using the technique of General Linear Modelling (GLM) available within SPSS (see also McCullagh and Nelder, 1989[3]). The consultant briefly presented and reviewed the methodology. GLMs are of the form: $Y = \Sigma\beta_i X_i + \varepsilon$, where the variable Y is modelled assuming a multilinear regression relationship with several significant factors or variables (X_i) and the error (ε) follows an exponential distribution. In the case of the present study, season was included as a factor in order to obtain standardized CPUE estimates through time. There was a general and lengthy discussion about patterns of changes in catchability and the possible ways in which these patterns may be relevant to the Eastern Caribbean flyingfish fishery. It was noted that catch rates varied on a monthly basis and that they were also affected by moon phase and time of day. Participants discussed the need to include any other factors or variables believed to influence catchability of flyingfish. Fishing area may affect catchability, but no detailed data on area were available. In addition, it was assumed that fishing techniques have not changed over time for the different types of boats. This assumption was probably not valid and data should be gathered in future to facilitate some measure of increases in fishing efficiency.

83. In the case of Barbados, the factors/variables included in the GLMs were season, month and vessel length. In other instances, the following factors were examined: season, month and landing site. All 2-way interaction effects were also investigated for all CPUE series. The terms included in

[2] Mahon, R. 1989. *Developing a management strategy for the flyingfish fishery of the Eastern Caribbean.* Proceedings of the 39th Annual Gulf and Caribbean Fisheries Institute, p 389-402.
[3] McCullagh, P. and Nelder, J.A. 1989. *Generalized Linear Models* 2nd edition. Chapman and Hall: London

the final models adopted depended mainly on their contribution to the sum of squares explained, the significance of the effect (F-test) and the reduction in R-squared value due to their omission.

Results and Discussion

84. Barbados – The final GLM for the Barbados day boat and CPUE data collected during the seasons of 1995–2000 included the factors season and month and the variable vessel length. The GLM of the historical day boat CPUE series included the factors season and month only, as data on vessel length were not available. The shorter time series for the Barbados day boats and iceboats showed increases from 1996–1997 onwards, but these increases appear to be either levelling off or decreasing to previous levels during the most recent years (see figs. 6 and 7 of Barbados' log). Given the short time period investigated, the observed trends must be interpreted with caution. The updated historical CPUE series showed a clear increase from 1979 to 1988, after which the CPUE values dropped to pre-1979 levels. It was suggested that the upgrade of several day boats to iceboats during the early 1990s could have caused the apparent decline, as the more successful day boats were probably the first dayboats to upgrade to iceboats. The establishment of the Bridgetown Fisheries Complex encouraged boats from smaller landing sites to land their flyingfish at the larger market. It is possible, therefore, that the increased sampling coverage of the less successful vessels from smaller landing sites could also have contributed to the decline observed after 1988.

85. Tobago – The series showed little fluctuation during 1989 to around 1993, after which mean CPUE generally increased, although the fluctuations between seasons also became larger. The highest CPUE was observed in 1999. The apparent increase in CPUE in the later years was likely due to the gradual introduction of iceboats into the Tobago fishing fleet during this time and the lack of separation of these boats within the present dataset. Changing market facilities during the middle to late 1990s could also have affected fishing practices and so contributed to the larger fluctuations observed at that time.

86. Dominica and Saint Lucia – These data showed such wide inter-seasonal variation, that the GLMs did not produce any meaningful results. This was probably due to the fact that flyingfish was not a primary target species for most vessels and CPUEs appeared to be influenced by different factors or combinations of factors and these also varied randomly within season and among seasons.

Standardization of Fishing Effort

Objectives

87. The objectives of this exercise were:
- to develop a standardized measure of fishing effort by country and if possible for the entire fishery
- to estimate total fishing effort in standard units.

Methods/Models

88. The method described by Robson (1966)[4] was reviewed and discussed. This method essentially compares catch rates of vessels operating within the same fishing area and at the same time, in order to estimate fishing power relative to a specified standard. It accommodates for comparisons between different types of vessels at different times. For instance, vessel type 'm' can be compared with vessel type 'n' at one time and then vessel type 'n' could be compared with the

[4] Robson, D.S. 1966. *Estimation of the relative fishing power of individual ships*. ICNAF Research Bulletin, 3, p 5-14.

specified standard vessel 's' at another time. Additionally, the consultant also reviewed and discussed the possibility of developing a simple linear regression equation which would explain fishing power in terms of some characteristic of effort, say engine horse power or vessel gross tonnage (Gulland, 1983)[5]. The use of GLMs to standardize effort was also noted. Assuming that all vessels in the subregion are fishing on one stock and the subregion could be treated as an uniform fishing area, comparison of the mean CPUEs of Groups of vessel types could be used to develop estimates of fishing power relative to a specified standard. However, flyingfish are believed to be rather patchily distributed and hence the assumption of a uniform distribution of the stock and hence a uniform fishing area within the subregion would probably not be valid.

89. While the importance of effort standardization was noted, there was insufficient time to conduct these analyses during the Meeting.

Recommendations

90. Arising from the group discussions of the activities and the results described above the following recommendations were offered:

Statistics and Research

1. The Group recommended that an interview or study should be carried out to determine and quantify changes in the day-boat fishery (gear and vessel characteristics and fishing strategies), for as many years as possible. They felt that it should focus, particularly for the periods of when substantial and steady increases were observed in the standardized historical CPUE.

2. The interview study noted in 1 should be also carried out on the Barbados and Tobago fishery.

3. The standardized CPUE series for Tobago showed a notable increase in recent years, with larger interseasonal fluctuations. In future catch rate standardization analyses, it would be necessary to distinguish among the different types of vessels in the Tobago fleet.

4. In other countries where flyingfish is harvested by a multispecies and multigear fishery, the sampling programme should be modified to ensure greater sampling coverage of the main fishing sites and to permit identification of fishing trips for which flyingfish is a main target species.

5. Field sampling programmes also need to ensure that the species of flyingfish is correctly identified during sampling. This recommendation is particularly important for countries like Saint Lucia, which noted that at least 3 species of flyingfish are usually harvested by the local fishery.

6. Following discussions about the expected effect of increases in fishing efficiency on catchability, the Group recommended that more detailed effort data and updated Licensing and Registration systems should maintained in order to monitor and quantify changes in fishery characteristics.

[5] Gulland, J.A. 1983. *Fish Stock Assessment: A Manual of Basic Methods.* Wildey: New York.

7. Given the potential influence of environmental conditions on catchability and recruitment of flyingfish, the acquisition of environmental data such as sea surface temperature was recommended. These data would also be useful for refining the stock–recruit analysis and risk assessment conducted by Mahon (1989).

8. The Group also recommended that studies should be conducted to identify and determine the existence of preferred spawning grounds for flyingfish. This information would contribute to a better understanding of flyingfish distribution and vulnerability to the fishing gear, as well as to management.

Management

91. a) Given the uncertainties in the quality of current data, the Group recommended that future expansion of the fishery should be approached with caution. b) Additionally, the Group recognized the need for further thought and action in implementing the institutional arrangement for handling shared management and for strengthening the current Working Group in analysing and interpreting data analyses.

REVIEW OF THE SOCIAL AND ECONOMIC ISSUES OF THE EASTERN CARIBBEAN FLYINGFISH FISHERY

92. Each participating country submitted a National Report on the Social and Economic conditions in their flyingfish fishery, using the common methodology supplied by the WECAFC secretariat. The full texts of those reports will appear as annexes to this report.

Introduction

93. This regional level perspective of the social and economic aspects of the Eastern Caribbean Flyingfish Fishery was compiled based on national sector reviews (for Dominica, Martinique, Saint Lucia, Saint Vincent and the Grenadines, Barbados, Grenada, Trinidad and Tobago). It assesses information collected on the structure and functioning of the fishery, identified the main limitations and potentials for the sustainable development of the fishery; and identified key issues relevant to the management of the fishery.

Results

94. The contribution of fisheries to the national economies of these countries is below 2 % of the GDP. In terms of the level of education of fishers, the majority (70 % to more than 90 %) of them reportedly possessed only the primary level. Most of the countries indicated that education was free and compulsory up to the secondary level. While some countries indicated that the fishing industry was not attracting the young recruits, others indicated that in recent years more young persons were entering the fishery. More details on the living conditions of fishers in terms of access to housing, health, as well as access to credit and fishing incentives are provided elsewhere in this document.

95. From the reports, it was estimated that the number of fishers involved in the flyingfish fishery in the subregion was about 3 300. About one third of these fishers operate out of Barbados and about 28 % out of Saint Lucia. These fishers operate about 1 575 fishing vessels; the vessels range from wooden canoes (<5 metres) to semi-industrial iceboats (>10 metres). The total investment in the harvest sector of the flyingfish fishery, in terms of boats, engines and gear, was

estimated to be over EC$15 million in Saint Lucia and Grenada; in the case of Dominica the estimate was EC$6.6 million. Similar statistics were not available for the other countries.

96. It is estimated that the total annual catch of flyingfish from the seven countries is in the region of 3 700 metric tonnes valued at around EC$11.8 million, with Barbados alone taking over half of this figure.

Analysis of Costs and Benefits

97. The total investment value per unit (boat, engine and gear) ranges from just over EC$9 000 for a 25 HP outboard engine and a canoe in Dominica, to EC$340 000 in the case of an iceboat in Barbados. Annual revenues from flyingfish range from about EC$400 from an open pirogue in Grenada to about EC$340 000 from a day-boat in Tobago. The revenues from flyingfish reportedly amount for 30–100 % of total revenues earned from fishing. Total expenditure including fuel, maintenance and repairs of vessel and gear and crew shares can reach as high as EC$315 000 annually as in the case of an iceboat in Tobago. The gross cash flow ranges from –EC$13 000 for a 75 HP powered fibreglass vessel in Dominica to EC$195 000 for a Tobago day-boat. The net cash flow ranged between –EC$20 700 and EC$187 000, respectively after taking depreciation and interest charges into consideration. The rate of return on investment ranged from –62 % for a 75 HP powered fibreglass vessel in Dominica to 612 % for a Tobago day-boat.

Management Issues

98. The following management issues were identified in one or more of the country reports as being relevant to the management of the Flyingfish Fishery in the Eastern Caribbean:

1. Socio-economic importance of flyingfish fishery in coastal communities – The flyingfish fishery is a major contributor to food security and social stability in many of the countries.

2. Illegal fishing – Reports of illegal fishing by the French fishers from Martinique and Guadeloupe in Dominican waters and by the Barbados fishers in Trinidad & Tobago waters were of particular relevance here.

3. Inadequate fisheries surveillance and enforcement capability – This is linked to the issue of illegal fishing. In addition, a capability for fisheries surveillance and enforcement goes hand in hand with the implementation of a subregional Flyingfish Fishery Management Plan

4. Inadequate data collection systems – Accurate data on the fishery, in particular landings and fishing effort data, provides the basis for informed decision-making with regard to fishery management.

5. Inadequate infrastructure (fish landing & marketing facilities) – Substandard landing port, cold storage and fish-holding facilities was identified by Tobago in particular as an issue to be addressed.

6. Inadequate post-harvest technology – This is necessary to ensure a good quality product and reduce wastage of fish.

7. Potential for fishery development – Targeting flyingfish exclusively is not considered to be as viable as targeting the larger oceanic pelagics. This is the case particularly in Saint

Vincent and the Grenadines but also in Saint Lucia and Dominica. However there is a demand for flyingfish in these countries and they consider the resource to be underutilized.

8. Potential for product development – Saint Lucia and Grenada indicated the potential for increased earnings from the flyingfish fishery by adding value to the product by filleting, etc for the local and export market.

9. Ageing population of fishers – In Dominica, for example, there is recognition of the need to attract younger persons to the fishing industry since many are over the age of 50 years. Investment in the fishery is likely to be hampered since lending institutions may consider it too risky.

10. Non-participation of some countries of the Eastern Caribbean in regional management initiatives – Effective management of the flyingfish fishery requires collaboration among all countries exploiting the resource. It is thus important that the French territories become involved in regional management initiatives including stock assessment workshops.

11. Fishery Interactions – The importance of flyingfish in supporting the larger pelagic fishery is recognized. Flyingfish is used as bait for the latter fishery. Flyingfish may also be taken opportunistically.

12. Gauntlet nature of fishery – The larger boats capture flyingfish leaving less for the smaller vessels.

13. Market constraints – Barbados indicated that flyingfish is sometimes left in the water if fishermen think there may be a glut on the market.

Comments and Recommendations

99. Based on a review of the information presented the following recommendations emerged from the discussions:

- Specific indicators should be identified which would determine the access of fishers to housing, health and education.
- Improve data quality. Refine social and economic parameters. Fill in gaps.
- Ensure harmonization of the methodology among countries to facilitate accurate comparisons.
- Examine the issue of 'ownership–of fishing vessel to determine the relative importance (to costs and earnings) of a non-fisher vessel owner, versus a vessel which is owned and operated by a fisher.

DRAFT SUBREGIONAL FLYINGFISH MANAGEMENT PLAN (SRFFMP)

100. The chairman introduced the topic by inviting participants to give an update on the status of their national plans for managing their flyingfish fishery. None of the countries had formal management plans for their flyingfish fisheries. The chairman then suggested that a generic outline with proposed chapter headings should be circulated for participants to add suggested contents overnight. At the same time the chairperson co-opted the representative from the UWI–NRMP to assist in drafting alternative contents for the 'generic outline' to complement the suggestions from the other participants.

101. When the group reconvened to discuss the generic SRFFMP there were many suggestions for "inclusions" and "exclusions" to the draft outline FMP. For example, an Iceboat Captain, in the Barbados delegation suggested that "the provisions for fishing access agreements in the FMP should not be restricted exclusively to flyingfish". He further stated that 'long' fishing trips that only targeted flyingfish were not economically attractive, hence the need to allow for targeting large pelagic species on such trips.

102. Most of the participants were reluctant to proceed beyond the draft outline of the FMP until the difficulties such as the regional standardizing of data collection strategies and fishing effort were minimized or eliminated.

Recommendations

103. The group recommended that technical assistance should be sought through the WECAFC secretariat to use the available information on the subregional flyingfish resource to further develop the outline and also to propose alternative strategies for their implementation.

PROPOSAL FOR A LESSER ANTILLES WORKING GROUP ON THE SUSTAINABLE DEVELOPMENT OF MOORED FAD FISHING

104. The representatives from Martinique presented the proposal and demonstrated a computer programme with modules to process and integrate data from several formats and fisheries – including flyingfish fishery. They reported that the software had been distributed to regional organizations and countries for examination. They also extended an invitation to the following countries to participate in discussions to form a "Lesser Antilles working Group on the Sustainable Development of Moored FAD Fisheries: Antigua and Barbuda, Barbados, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago.

105. Countries were invited to arrange successive visits to Martinique, prior to the inaugural meeting, to take advantage of the available training in the use of the software and to exchange information. The aim of the pre-meeting training was to allow individuals to import national data into the computer programme and perform standardization exercises.

INTERSESSIONAL ACTIVITIES

106. It was agreed that the participants will facilitate the improvements to their national data by initiating efforts to implement the recommendations they made in their Managers' reports (e.g. filling the identified gaps and improving their data collection coverage).

107. It was agreed that the IFREMER proposal to organize and host the first meeting of a Moored FAD Working Group should be perused in collaboration with FAO.

FUTURE MEETING

108. The Trinidad and Tobago representative repeated his offer to host the next meeting of the group in Tobago. It was the consensus of the meeting, however, that the timing of the next meeting should be precedent on progress in implementing the recommendations, for improvements to national data sets and technical assistance from the WECAFC Secretariat in fleshing out the "Outline of the Draft Regional Flyingfish Management Plan".

ANNEX I

Agenda of the Meeting

Monday, 8 January

9.00–9.30	Registration of Participants.
9.30–9.50	Opening of Meeting: Welcome by host and SRR–SLAC.
9.50–10.15	Review and Adoption of the Agenda, objectives and Workplan of the Workshop.
10.15–10.30	*BREAK*
10. 30–12.30	Separate by country, for updating of catch and effort data sets and commencing statistical analyses.
12.30–13.30	*LUNCH*
13.30–15.30	Continue work on national catch and effort data sets.
15.30–15.45	*BREAK*
15.45–17.00	Group Discussion of the results of their work on the catch and effort data sets. Discussion and preparation for comparative analyses of the 'improved' data sets.

Tuesday, 9 January

9.00–10.00	Presentation by IFREMER Technical Assistance package.
10.15–10.30	*BREAK*
10.30–11.30	Participants to begin manipulating/analysing National Flyingfish data-including attempts to perform a synthesis and comparative analysis, using the procedures and models supplied.
12.30–13.30	*LUNCH*
13.30–14.30	Continue catch and effort adjustment and analyses.
15.30–15.45	*BREAK*
15.45–17.00	Continue catch and effort adjustment and analyses.

Wednesday, 10 January

9.00–10.15	Preparation of group reports for presentation and discussion.
10.15–10.30	*BREAK*
10.30–11.45	Presentation of group reports.
11.45–12.30	Participants to discuss/examine the results of the syntheses and comparative analyses and recommend what future actions and improvements are necessary.
12.30–13.30	*LUNCH*
13.30–15.30	Presentations of Summary Report on the sociology and economics of the Subregional flyingfish fishery.
15.30–15.45	*BREAK*
15.45–16.45	Discussions of the National and Common Regional issues that emerged from the Summary Report.

Thursday, 11 January

9.00–10.30	Discussion of the Results of the preliminary Analyses of Country data sets and Interim recommendations for Improvements; Discussion on the feasibility of standardizing sub-regional catch and effort.
10.30–10.45	*BREAK*
10.45–12.30	Preliminary attempts to standardize catch per unit effort the Eastern Caribbean Flyingfish fishery.
12.30–13.30	*LUNCH*
13.30–15.00	Participants to discuss future for management options of the Eastern Caribbean Flyingfish resources and make recommendations for regional flyingfish fishery management plan.
15.00–15.15	*BREAK*
15.15–17.00	Continue work on flyingfish resources and management plan.

Friday, 12 January

09.00–10.30	Follow discussion on the proposed Subregional flyingfish fishery management plan; outline draft regional FMP.
10.30–10.45	*BREAK*

10.45–12.15	Synthesis of Workshop recommendations.
12.15–12.45	Confirmation of recommendations; Any Other Matters; Time and venue of next meeting; Conclusion of the workshop.

ANNEX II

List of Participants

Name	Address
BARBADOS	Dr Patrick McConney Fisheries Division Princess Alice Highway Bridgetown Barbados e-mai:l fishbarbados@caribsurf.com Tel.: 246 4263745; Fax: 246 430 9068
	Mr Gregory Franklyn Data Collector Fisheries Division Princess Alice Highway Bridgetown, Barbados e-mail: fishboff@sunbeach.com Tel.: 246 426 3745; Fax: 246 430 9068
	Mr Christopher Parker Fisheries Biologist Fisheries Division Princess Alice Highway Bridgetown, Barbados e-mail: fishoff@caribsurf.com Tel.: 246 426 3745; Fax: 246 436 9068
	Mr Kurt Baines Captain Flyingfish Iceboat Oistins Fisherfolk Association Ashby Land, Oistins Christ church Barbados Tel.: 246 420 6190
COMMONWEALTH OF DOMINICA	Mr Harold Guiste Chief Fisheries Officer (Ag) Fisheries Division Min. Agriculture and Environment Bay Front, Roseau Commonwealth of Dominica e-mail: cfra@cwdom.dm Tel.: 767 448 2401; Fax: 767 448 0140

GRENADA	Mr Crafton Isaac Fisheries Officer II Fisheries Division Min. Agriculture Ministerial Complex, Botanic Gardens St Georges Grenada e-mail: grenfish@caribsurf.com Tel.: 478 440 3814/478 440 3831 Fax: 478 440 6613
SAINT LUCIA	Ms Williana Joseph Fisheries Biologist Department of Fisheries Min. Agriculture Forestry, & Fisheries Waterfront, Castries Saint Lucia e-mail: depthfish@slumaffe.org Tel.: 758 486 4138; Fax: 758 452 3853
SAINT VINCENT AND THE GRENADINES	Ms Cheryl Jardine Senior Fisheries Assistant (Data) Fisheries Division Min. Agriculture and Labour Kingstown Saint Vincent and the Grenadines e-mail: fishdiv@caribsurf.com Tel.: 784 456 2738; Fax: 784 457 2112
TRINIDAD AND TOBAGO	Dr Arthur Potts Director Dept. Marine Resources & Fisheries TLF Building, Scarborough P.O. Box 516, Scarborough Scarborough, Tobago, Republic of Trinidad and Tobago e-mail: artpotts@hotmail.com Tel.: 868 639 1382; Fax: 868 639 1382
MARTINIQUE	Mr Lionel Reynal IFREMER (Martinique) Pointe Fort, 97231- le Robert Martinique, French Antilles e-mail: Lionel.Reynal@ifremer.fr Tel.: 596 65 07 51; Fax: 596 65 11 56

Mr Mathieu Doray
IFREMER (Martinique)
Pointe Fort 97231- le Robert
Martinique, French Antilles
e-mail: mdoray@ifremer.fr
Tel.: 596 65 07 51; Fax: 596 65 11 56

Dr Hazel Oxenford
Senior Lecturer
NRM
CERMES Building, UWI
Cave Hill Campus
P O Box 64, St Michael
Barbados
E- mail: maremp@sunbeach.net
Tel.: 246 417 4571; Fax: 246 424 4204

Dr Susan Singh-Renton
FAO Consultant
CARICOM Fisheries Unit (SVG)
c/o Fisheries Division
Min. Agriculture and Labour
Kingstown
Saint Vincent and the Grenadines
e-mail: ssinghrenton@vincysurf.com
Tel.: 784 457 3474; Fax: 784 457 3475

Ms Lara Ferreira
FAO- TCDC Consultant
Fisheries Division, Head Office,
35 Cipriani Boulevard
Port of Spain
Republic of Trinidad and Tobago
e-mail: mfau2fd@tstt.net.tt
Tel.: 868 634 4504/868 634 4505
Fax: 868 634 4488

Mr Randolph Walters
Fishery Officer
FAO Subregional Office for the Caribbean
P. O. Box 6312 – C
Bridgetown
Barbados
e-mail: randolph.walters@fao.org
Tel.: 246 426 7110; Fax: 246 427 6075

ANNEX III

Opening Address
by the
Permanent Secretary, Mr Rudolph Hinkson on behalf of
The Honourable Anthony P. Wood, Minister of Agriculture and Rural Development

Master of Ceremonies, Dr McConney; Mr Chakalall and Mr Walters of the FAO; Professor Hunte and Dr Oxenford of the university; fisheries officers and participants; resource persons; ladies and gentlemen:

Since this is a technical and rather informal meeting I will make my address brief. I know that you are keen to get on with the tasks that brought you to this meeting, which I am pleased to have taking place in Barbados.

Let me first congratulate the FAO in selecting the University of the West Indies and the Natural Resource Management Programme in particular, as the partner for holding this meeting. The role of the University in turning out well-rounded fisheries officers throughout the region is a secret that is perhaps too well kept.

I am encouraged by this networking between the FAO, fisheries authorities in the region and the premier regional academic and research institution. Such partnerships have possibilities and potential not yet explored. It has not escaped my attention that the university's fisheries staff and students have forged close links with the local fishing industry and wish to have even closer integration into the management of fisheries, as expressed at the industry's recent national consultation on this subject.

The politics of regional integration; the movement of Caribbean people, boats and fish among the islands; the views we have of each other and what we wish to project to the world beyond our shores were also discussed at the industry's national consultation on fisheries management. It seems clear to me that our perspectives on and approaches to, the management of flyingfish nationally and regionally resonate with much of the above. I understand from your agenda that by the end of the week you will have at least an outline of a regional fisheries management plan for flyingfish. Take the task of formulating its contents very seriously. While the importance of flyingfish to economy, culture and society differs among our countries, the fact that we should be able to manage this resource ourselves is critical.

Last month, the FAO Workshop on the Effects of Globalization and Deregulation on Fisheries in the Caribbean, held in Saint Lucia, determined that we need a Caribbean Fisheries Agenda on Globalization. Changing international fisheries trade and management regimes impose as many constraints as they provide opportunities to small island states such as ours. We need to develop an agenda or strategy for dealing with international fisheries issues that affect us as we are for trade, services, agriculture and other sectors of the economy. It is up to the fisheries officers of the region to identify the areas that are priority and to map out the means for formulating or implementing technical solutions that can be fed into the regional negotiating machinery at appropriate junctures.

We also need a much more coherent agenda on regionalization. The proposed Caribbean Regional Fisheries Mechanism is a promising start, but make no mistake that we need to be clear on our regional agenda before we can effectively and confidently tackle the issues of globalization. Much closer integration between the work of this group on flyingfish and the priority areas of the Caribbean Regional Fisheries Mechanism needs to be achieved in order to consolidate our various

avenues for dealing with similar tasks. Consider the priority areas in your regional plan for flyingfish and consider flyingfish as a test case for identifying the effects of globalization on a regional fishery. Like skilled gemstone artists, you must chip away at the matter of flyingfish management to reveal its various facets and discover the angles that provide the best perspective for managing the fisheries. Examine the issues from all sides and be receptive to new ideas, perhaps inspired by the university setting.

The need for new perspectives applies especially to our approach towards developing fisheries access agreements among ourselves in the eastern Caribbean. The role of any government is to make certain that fisheries resources are harvested in ways and amounts that facilitate their availability for perpetuity if possible. Generations of fishermen, their families and the public at large should regard the resources in the waters around us as key ingredients for maintaining or improving their livelihoods through harvest and the linked economic activities that range from boat building to processing to consumption.

I am sorely disappointed that in this region we have not been able to ensure that fisheries access is an integral part of both the conservation and development aspects of fisheries management. My understanding is that through properly crafted access agreements not only do monitoring, control and surveillance operations plus economic benefits improve, but the prospects for effective fisheries management increase substantially. There is no benefit from not concluding fishing agreements, regardless of the management objectives, when it comes to shared fish stocks like flyingfish once sufficient fish are available in surplus. It is therefore important that the access agreement between Barbados and Trinidad and Tobago over flyingfish is finalized.

At scientific and technical meetings such as this, fisheries managers need to be bold enough to come up with objective indicators and measures of the health and status of fisheries, in all their dimensions. In doing so they will provide the best information upon which access agreements can be concluded based on mutual interest in sustainable management. Leave it then to the negotiators to work out the modalities and conditions of fisheries access. You would have done your jobs.

In closing, let me reiterate that as we commit our time and talent to fisheries management through the Western Central Atlantic Fisheries Commission and the Caribbean Regional Fisheries Mechanism our ultimate objective should be improvement in our quality of life. Fish is a natural resource that we expect to be available to us and to future generations. Your task is to help keep our future bright by being proactive. Gear your meeting and intersessional activities towards projecting where we wish to be and how best we should get there. The planned path cannot be a long one, for the days of fisheries without management are becoming the dark ages of history. I wish you good fortune for the days ahead and look forward to seeing a path for regional progress to be revealed with the least number of pitfalls. I thank you.

ANNEX IV

Address by Mr Bisessar Chakalall, WECAFC Secretary

Mr Chairman, Permanent Secretary, Mr Rudolph Hinkson, Professor Wayne Hunte, Dr Hazel Oxenford, Participants, Fishermen, Colleagues, Ladies and Gentlemen, Welcome, happy, healthy and successful New Year.

It is indeed an honour and a pleasure to address you on behalf of the Director–General of FAO, Dr Jacques Diouf. On his behalf and on my behalf and that of my FAO Colleagues, I would like to extend greetings to you and to welcome you this opening ceremony.

Mr Chairman, first, I would take this opportunity to publicly express our appreciation and sincere thanks to the Government of Barbados and the University of West Indies for graciously agreeing to host this meeting. Special thanks also to the Fisheries Division of Ministry of Agriculture and the Natural Resources Management Programme NRM of UWI for co-coordinating all the local arrangements for the Workshop. They did an excellent job.

Mr Chairman, this is the second workshop in the series we have had on Flyingfish held under the auspices of the WECAFC Ad Hoc Working Group on Flyingfish and sponsored by FAO. The first was also held in Barbados in September 1999.

The main objectives of the second workshop are to further analyse the existing flyingfish catch and effort data which would serve as a scientific data base for the preparation of management strategies and an action plan for the sustainable utilization of the Eastern Caribbean flyingfish resource. Fisheries scientists from Barbados, Dominica, Grenada, Saint Lucia, French Antilles (Martinique) will be attending this workshop.

It is clear from the available scientific information that the flyingfish resource in the Eastern Caribbean should be managed as single stock. Given the short annual life span and the relatively low fecundity of flyingfish, the high inter-annual variability is to be expected. The implications of this life history are that the resource could result in a precipitous collapse, if exploited beyond a certain threshold where recruitment declines rapidly. The analyses indicate that such a threshold exists, but so far it has not been determined. The aim is to provide scientists with the opportunity to work together and share scientific information on a fishery resource that is shared between the countries of the subregion for the purposes of determining this threshold in order to avoid the socio-economic implications of a collapse in the fishery.

Mr Chairman, the mandate of FAO is to contribute towards ensuring humanity's freedom from hunger, by improving the efficiency of the production and distribution of all food and agricultural products, including fisheries, in a sustainable manner and by raising the levels of nutrition and standards of living of the peoples and bettering the condition of rural populations.

Given the outstanding need to safeguard the planet's natural resources, FAO's mission can be summed up as "ensuring sustainable food security for all". Fish is a vital source of food for the peoples of the Caribbean and thus, we have the responsibility of ensuring sustainable fisheries production in order to have food security. According to FAO statistics, the average global consumption of fish protein has risen from 2.7 g per caput per day in 1960 to 4.0 g today, representing around 15 percent of all animal protein consumed by the world 's population of six billion people. The per capita consumption of fish in the Eastern Caribbean is approximately 25 kg per year. Regional approaches to fisheries management and conservation, such as the one being

promoted for flyingfish, are essential for sustainable production in order to meet the demands for fish as food.

According to FAO, the demand for food fish by year 2010 is estimated at 110 to 120 million metric tons, compared to food fish production for 1999 of about 92 million metric tons, almost 30 percent of which were derived from aquaculture. By 2010 production shortfall between demand and supply for human consumption could amount to 10 to 40 million metric tons.

In the last decade, capture fishery production for both food and non-food utilization has been levelling off. The increase in food fish production in recent years has been entirely due to aquaculture. Despite increases in aquaculture production, future demand for fish production cannot be met without better management of the world's ocean resources.

FAO estimated that marine fishery production could reach 93 million metric tons, a gain of about 10 million metric tons, if the resources were better managed. This comprises four million metric tonnes from improved management in each of the Atlantic and Pacific Oceans and two million metric tonnes from further developments in the Indian Ocean. FAO estimates that the benefits of effective management could be high, of the order of 10 to 20 per cent of present landings with a value of over US $80 billion.

The Code of Conduct for Responsible Fisheries, which was unanimously adopted in October 1995 by the FAO Conference, seeks to facilitate change and adjustment within the fisheries sector, so as to ensure that resources are utilized in a sustainable and responsible manner. The adoption of sound, national and international fishery practices through the implementation of the Code will serve to counteract the adverse trends in the fisheries sector and to address certain fundamental management and utilization of the sector.

Mr Chairman, I mention this scenario because it is directly linked to the objectives of Workshop. We anticipate that the results of this workshop will translate into more effective management of the flyingfish resources that will ultimately lead to an increase in production. The flyingfish fishery is probably one of the most valuable fisheries in the Eastern Caribbean region, especially from the social and economic perspectives.

We are hoping that the approach being currently employed for the improved management of the flyingfish fishery in the Eastern Caribbean will be successful and that similar approaches could be used for the other fisheries, such as lobsters, conch, shrimp, sharks, large and small pelagics, of the region. The WECAF Commission's support to the establishment of an ad hoc Working Group on the Flyingfish, at its Ninth Session held in Saint Lucia in September 1999, represents an important starting point for regional cooperation in the management of this shared resource. This approach, using ad hoc working groups, endorsed by the Ninth Session of the Commission, will provide member countries with the opportunity of participating only in activities which are of interest to them and from which they will derive direct benefit. This method of operation will require more commitment and resources from the member countries, but the benefits will by far outweigh the additional resources required. It will also provide the countries with the opportunity to effectively implement the Code of Conduct for responsible fisheries.

Mr Chairman, the challenge of providing the best advice for greater participation and cooperation by the flyingfish producing counties of the Eastern Caribbean in research and management of this species rest with the fisheries experts attending this workshop. I am certain that, with their collective expertise and experience, they will do an excellent job. The information

generated would be extremely useful in initiating the preparation of an Eastern Caribbean flyingfish management plan, which is one of the primary goals of the ad hoc working group.

I wish you success in your work during the week. I would also suggest that one cannot work without recreation and that you should some find some time to enjoy beautiful Barbados.

Mr Chairman, Ladies and Gentlemen, closing, I would like to thank you for attending this opening ceremony and for your attention.

ANNEX V

Draft Outline of a Regional Flyingfish Management Plan

1. GUIDING PRINCIPLES AND GOALS
- Code of conduct
- Linkages with the CRFM

2. VISION OF THE FUTURE

3. LEGAL CONTEXT
- International law and agreements
- Regional and bilateral arrangements
- CRFM, CARICOM, WECAFC

4. GEOGRAPHY AND OCEANOGRAPHY OF THE REGION
- Physical geography
- Political geography / demography
- Hydrography, currents and bathymetry
- Climate and weather

5. BIOLOGY AND ECOLOGY FLYINGFISH
- Description and distribution of the species
- Age and growth
- Reproductive characteristics
- Mortality
- Recruitment
- Species interactions
- Critical habitat

6. MANAGEMENT UNIT

7. FISHERY CHARACTERISTICS
- By country
- Development
- Social and cultural
- Contribution to economy
- Fleets and interactions
- Catch and effort
- Gear and methods
- Policy
- Economic linkages
- Legislation
- Safety
- Insurance, credit
- Post-harvest sector
- Handling, processing, marketing, trade
- Regional summary

8. STATUS OF FISHERIES
- Catch and effort trends
- Social and economic trends

9. ISSUES, OPPORTUNITIES AND CONSTRAINTS
- Environmental issues
- Physical
- Biological
- Social

- Economic
- Political
- Opportunities for expansion
- Markets
- Fishing range
- Species
- Technology
- Constraints
- Financing
- Multilateral collaboration

10. MANAGEMENT OBJECTIVES

- Target and limit reference points
- Biological
- Social
- Economic

11. MANAGEMENT STRATEGIES AND TOOLS

- Output controls
- TACs / Individual quotas
- Bag limits
- Size limits
- Input controls
- Limited licensing
- Closures (seasonal, moratorium, MPAs)
- Gear limits
- Monetary
- Co-management

12. IMPLEMENTATION PLAN

- Institutional arrangement
- Time frame
- Monitoring, control and surveillance
- Data collection, sharing, analysis
- Participation
- Financing
- Research