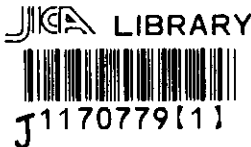


Final Report

(Main Report)

Stock Assessment of Demersal Fish Species in the Republic of Ghana



February, 2003

Japan International Cooperation Agency
Japan NUS Co., Ltd.
Sanyo Techno-marine Co., Ltd.

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Composition of the Report

This report consists of the following three volumes

- (i) Summary
- (ii) Main Report
- (iii) Data Book

Preface

In response to the request from the Government of the Republic of Ghana, the Government of Japan decided to conduct Stock Assessment of Demersal Fish Species in the Republic of Ghana, and entrusted the study to Japan International Cooperation Agency (JICA).

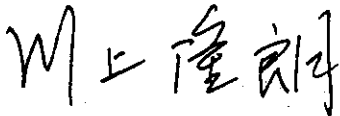
JICA sent to the Republic of Ghana the study team headed by Dr. Tamotsu YONEMORI, JAPAN NUS Co., Ltd., six (6) times between July 2000 and November 2002.

The team held discussions with the officials concerned of the Government of the Republic of Ghana, and conducted field survey and investigation in the study area. After the team returned to Japan, further studies were made and this report was prepared.

I do hope that this report will contribute to the appropriate fisheries management and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Ghana for their close cooperation extended to the team.

February 2003

A handwritten signature in black ink, consisting of the Japanese characters '川上隆明' (Kawakami Takao) written in a cursive style. The signature is positioned above a horizontal line.

Takao KAWAKAMI
President of
Japan International Cooperation Agency

February 2003

Mr. Takao KAWAKAMI
The President of
Japan International Cooperation Agency
Tokyo, JAPAN

Letter of Transmittal

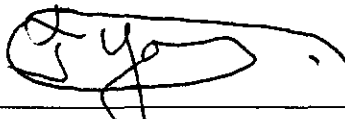
Dear Sir,

We are pleased to submit to you the report for "Stock Assessment of Demersal Fish Species in the Republic of Ghana". This report presents the results of all work performed in both Ghana and Japan over 27 month period from July 2000 to February 2003.

In Ghana, where the consumption of fishery products reaches around 25 kg a year per capita, fisheries industry is playing a very important role in supplying food and securing employment. The Ghanaian Government aims at the development of fisheries incorporating development of aquiculture, management and protection of resources and development of demand for fisheries products in the national development plan. In this project, we assessed the condition of the demersal fish stocks and provided draft management guidelines for those stocks.

We wish to express our deep appreciation and sincere gratitude to the officials concerned of your Agency, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for the courtesies and cooperation kindly extended to our team. We additionally inform you that we had sincere cooperation from the Ministry of Food and Agriculture of the Government of Ghana, especially that our counterparts of the Directorate of Fisheries participated the field surveys very actively. We also express our hearty gratitude to the officials concerned from JICA Ghana Office, the Embassy of Japan in Ghana for the close cooperation and various form of assistance extended to our team during field surveys in Ghana.

Very truly yours,



Tamotsu YONEMORI

Project Manager of Stock Assessment of Demersal Fish Species in the Republic of Ghana

Japan NUS Co., Ltd. in consortium with
Sanyo Techno-marine Co., Ltd.

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Exchange rate and abbreviations

Exchange rates of the Ghanaian currency (cedi) to US\$1 were as follows:

July 14, 2000	:5,800cedis
September, 23, 2000	:6,300cedis
July 25, 2001	:7,300cedis
November, 9, 2001	:6,900cedis
July, 19, 2002	:7,900cedis

Abbreviations

Abb.	Formal Name
CBFM	Community Based Fisheries Management
CECAF	Fishery Committee for the Eastern Central Atlantic
CM	Co-management
CPUE	Catch Per Unit of Effort
FAO	Food and Agriculture Organization of the United Nations
FMOC	Fisheries Management Operations Committee
GDP	Gross Domestic Product
GNP	Gross National Product
ICCAT	International Convention for the Conservation of Atlantic Tunas
IMF	International Monetary Fund
KAFS	Kinetic Analysis of Fisheries System
MSY	Maximum Sustainable Yield
NDC	National Democratic Congress
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
NORAD	North American Aerospace Defense Command
NPP	New Patriotic Party
PNDC	Provisional National Defense Council
PNDCL	Provisional National Defense Council Law
SPR	Spawning stock biomass Per Recruit
TAC	Total Allowable Catch
UNDP	United Nations Development Programme

Stock Assessment of Demersal Fish Species in the Republic of Ghana

Final Report—Summary

1. Background of Surveys

In Ghana, the annual consumption of fisheries products has reached 25 kg per person and the number of people engaged in fisheries-related industries stands at half a million (accounting for approx. 5 percent of the total employable population). With this being the situation, the fisheries industry is playing a major role in providing food and securing employment.

However, in recent years, catch quantity from the entire marine fishery have been leveling off at approx. 370,000 to 390,000 tons. In particular, where demersal fishes are concerned, degradation of the condition of resources has been pointed out.

Being aware of this problem, the Government of Ghana has taken measures such as the freezing of the number of trawl boats permitted and the implementation of a mesh-size regulation targeted at large-sized trawlers which the Government thinks the greatest cause of the deterioration of demersal fish resources. At the same time, the Government of Ghana has requested the Government of Japan to conduct surveys of fishery resources.

In response to this, the Japanese Government dispatched a preliminary survey team in February 2000. In a document known as a Scope of Work (S/W) concluded in the same month, it was decided to conduct the current full-scale survey.

2. Objectives of Survey

The survey aims to assess the standing stock of demersal fish, devise fishery resources management guidelines conducive to proper fishery based on the results of those assessments, and transfer technologies to Ghana concerning a series of tasks including the monitoring of effects that arise from the implementation of fishery management.

3. Descriptions of Survey

Where marine surveys are concerned, a commercial fishing vessel (equipped with a stern trawl, 297.6 tons) has been chartered for use as a survey vessel. In the waters off the coast of Ghana, a total of four trips were made to conduct oceanographic observations and trawl surveys as follows: October 2 through October 20, 2000 (Second field survey, stable period), July 25 through August 13, 2001 (third field survey, upwelling period), October 29 through November 16, 2001 (fourth field survey, stable period), and July 20 through August 5, 2002 (fifth field survey, upwelling period). From the third field survey onward, mesh selectivity test fishing operations were conducted. Using mesh sizes of 60 mm and 70 mm, mesh selectivity test had been conducted in a total of 12 operations from the third to fifth field surveys.

As to the oceanographic observations, after arriving at each planned survey location, ocean floor conditions were investigated using fish-finding equipment. Then, staying for a while at a point where an operation was possible, measurements were made for the following items: water temperature, salinity and chlorophyll.

As for trawl surveys, towing was conducted for 30 minutes using a 60mm-mesh commercial trawl net. Harvested catch was sorted by species, then a count of individuals in each species was taken, and thence the weight of each species was measured. After that, body-weight and body-length measurements were taken of target species. In addition, so long as the evaluation target species were concerned, their age, gonads and stomach contents were analyzed. In mesh selectivity test, body-length measurements were taken of individual fishes of evaluation target species by making a distinction between those captured in the inner net and those in the outer net.

On-land surveys consisted of Ghana's general condition survey (second field survey) and fish market research (second through fifth field surveys) conducted in the vicinities of major fishing ports. For the fish market research, Tema, Mumford, Apam, Elmina and Sekondi were decided upon as target survey places. At these cities' fish markets, surveys were conducted on the state of affairs with fishery resources, fishery household management, fishery operations, resources management, and the like.

4. Survey Results

(1) Stock Status of Evaluation Target Species

Catch quantity, exploitation rate and fishing mortality coefficient of each evaluation target species are as follows:

	Average annual catch q'ty (ton)	Exploitation rate (%)	Fishing mortality coefficient	Stock status
<i>Decapterus rhonchus</i>	7,387	71.8	1.032	Endangered level ?
<i>Brachydeuterus auritus</i>	13,695	41.8	0.699	Sound level
<i>Pomadasys incisus</i>	112	32.0	0.578	Sound level
<i>Dentex canariensis</i>	676	50.6	0.864	Warning level
<i>Sparus caeruleostictus</i>	1,076	57.1	1.295	Endangered level
<i>Pagellus bellottii</i>	7,387	56.6	1.032	Warning level
<i>Galeoides decadactylus</i>	1,534	81.4	2.566	Endangered level
<i>Pseudolithus senegalensis</i>	1,140	58.4	1.118	Endangered level
<i>Pseudupeneus prayensis</i>	348	51.2	1.108	Sound level
<i>Sepia officinalis</i>	3,033	46.6	0.916	Sound level

Endangered level: In a state of overfishing. %SPR is below 20%.

Warning level: State short of overfishing. %SPR is slightly over 20%.

Sound level: Present catch may be maintained or greater catch may be possible. %SPR is considerably higher than 20%.

(2) Gist of Draft Management Guidelines

As a resources management strategy, we suggest to adopt a constant harvest rate strategy (exploitation rate control) at the outset by implementing measures, which the Government of Ghana has been contemplating, such as the fixing of closed seasons and the enforcement of a mesh size regulation. After the

stock status has improved and the management has gotten on the track, we propose to switch over to a constant escapement strategy such as TAC (total allowable catch) system (which aims to maintain at a constant level of the amount of parent fish left in the sea after completion of harvest each year).

As fishery types to be subjected to management, we consider it preferable to cover all fishery types in the future based on the results of simulations run on varying combinations of mesh size regulation and closed seasons. However, given the present state of affairs where the Government of Ghana is making preparations with industrial fisheries as a sole fishery type to be subjected to management, it is difficult to start imposing management on all fishery types at a time. Under the circumstances, we propose incremental phase-in of resources management. In other words, as an initial phase, a mesh size regulation is to be introduced to industrial fisheries. Then, several years down the road as a second phase, more of the same fishery control is to be introduced to semi-industrial and artisanal fisheries.

Where resources management systems are concerned, we support the Co-management (CM) approach which the Government of Ghana is adopting for the management of artisanal and semi-industrial fisheries. At this juncture, a system of cooperation between the competent Government agency and the fisherfolk is indispensable. As such a system of cooperation, it is considered necessary to establish a consultative organization comprised of concerned organizations such as the Fisheries Department of the Ministry of Food and Agriculture which is the responsible authority of the Government, the FAO, and representatives from the industrial fisheries. Looking ahead, it is to be desired that consideration be given for such a consultative organization to include those who are involved in semi-industrial and artisanal fisheries. Furthermore, since the judgment of the effects of resources

management, the performance of verifications and the making of course corrections become agenda to be deliberated by the above-mentioned consultative organizations, the participation of not only staffers who are concerned with administrative affairs but also resources researchers and the like who are capable of making scientific assessments is required. For this reason, it is considered to be desired that several working parties such as study groups made up of scientists be installed within the consultative organizations.

(3) Technology Transfer

Area for technology transfer	Descriptions of technologies to be transferred
Biology	Fish identification, Gonad/maturity determination, Assessment of stomach contents, Sample photographing methods, Otolith polishing and reading of age information, Data collection and processing methods
Oceanographic observation	Directions for using observation equipment, Maintenance, Data handling methods, Data processing, Computer programming (Methods for solving arbitrary monotone function equations by binary search), Salinity calibration, Water mass analysis
Fishing technologies	Fishing gear structure, Fishing methods, Handling of navigation instruments/equipment, Improvement of fishing gear, Drawing of nautical charts, Mesh selectivity test fishing operations
On-land survey	Market research, Devising interview questions, Keeping track of resources status factors, Collecting fisheries information without making purchases, Collecting data using photography, Processing of data, Monitoring techniques
Survey plan devising	Resources study as basic knowledge for the stock analysis, Ways of grasping populations, Growth laws of population dynamics, Estimation of mesh size selectivity curves, Analytical models, Assessment methods, Feedback methods, Concepts of resources management systems, Management guideline devising methods, Monitoring systems

1. Background of survey

In Ghana, the consumption of fishery products reaches around 25 kg a year per capita. At present, approximately 500,000 persons (about 5% of the total labor force of the country) are engaged in fishery-related businesses. In this way, fisheries industry is playing a very important role in supplying food and securing employment in Ghana.

The following plans in the field of fisheries are incorporated in the "Ghana Vision 2020, National Development Planning" published in 1994 by Ghana's National Development Planning Commission (NDPC).

- Promotion of development of aquiculture
- Introduction of a monitoring system of fisheries resources and restriction on fishing methods for the protection of the resources.
- Development of demand and expansion of domestic market.

Recently, the total catch quantity from sea fishery, however, leveled off at around 370,000 to 390,000 tons per year from 1996 to 1998. Professor Armah of Ghana University as well as the Department of Fisheries, trawler crew, fishermen, and brokers has pointed out that the catch quantity of demersal fish (snappers, sea breams, croaker, etc.) in particular has been showing signs of decreasing. Survey results by the R/V Fridtjof Nansen revealed that the body length of many kinds of demersal fish caught in Ghanaian waters is smaller than that in waters of Togo or Côte d'Ivoire. This fact indicates the resource level of demersal fish in Ghanaian waters is deteriorating.

The Ghanaian Government also recognizes this problem. The major cause of this deterioration of the demersal fish resources may be the practice of trawling by large trawlers. The Government, while implementing such measures as the freezing of the number of licensed trawlers, mesh size regulation, prohibition of trawling in shallow waters (less than 30 m in depth), requested the Japanese Government to conduct a survey of fisheries resources.

In response to this request, the Japanese Government dispatched a preliminary survey team in February of 2000, and it has been decided to conduct a full-scale survey (the one performed this time) in a Scope of Work (S/W) which was concluded in the said month.

This report is the final report summarizing the results of all the field surveys.

2. Purpose of Survey

As described in the previous chapter, the management of fisheries resources should be performed urgently in Ghana. In order to manage the resources, it is indispensable to make a proper evaluation whether the current resources are being overfished, properly utilized, or undeveloped. Management guidelines will be drawn up based on the results of this resource evaluation. On this occasion, in addition to the prevention of depletion of resources, it is also important to consider the fishery's primary functions such as the provision of animal protein sources and the economic aspects such as fishery household management. In other words, a rigid management policy emphasizing only the protection and restoration of resources cannot be put into practice without solving problems of a decrease in the catch quantity and the earning from fish on landing and the economic pressure this decrease applies on fishery household. Therefore, before the introduction of the resource management, it is necessary to predict the effect and influence of the management by conducting simulations of change process in the catch quantity and earning from the catch.

Furthermore, the data for monitoring the effects of resource management after the completion of this project are mostly composed of fishing statistics and survey results of the catch in the market. It is very important to transfer survey, analysis, and evaluation technologies to the parties concerned of the Ghanaian Government including Department of Fisheries.

Taking the above aspects into consideration, this survey has three main purposes: to make an evaluation of the standing stock of demersal fish, to draw up fisheries resource management guidelines which will serve for proper fishing operations, based on the results of the evaluation, and to transfer the technologies relating to a series of activities including the monitoring of the effects after the implementation of resource management.

3. Survey Contents and Methods

3-1. Sea Survey

Aboard a chartered vessel (stern trawler) called "LAIDA" (297.6 tons) owned and operated by Holiday Fishing Co., Ltd. headquartered in the city of Tema, Ghana, marine observations and fishery surveys were conducted four times in waters along the coast of Ghana (Fig. 3-1) from October 2 thorough October 20, 2000 (for the second field survey during a stable period), from July 25 through August 13, 2001 (for the third field survey during a upwelling period), from October 29 thorough November 16 (for the fourth field survey during a stable period), 2001 and from July 20 thorough August 5, 2002 (for the fifth field survey during a upwelling period). Although 50 observation stations were planned, fishing operations were not conducted at three stations (St. 13, St. 42 and St. 43) during the second survey, two stations (St. 45 and St. 50) during the third survey and at two stations (St. 32 and St. 42) during the fifth survey for such reasons as operation postponements caused by obstacles like off-shore reefs and/or operation suspensions caused by damage done to fishing gears. In addition, it has been decided to conduct mesh selectivity-test fishing operations from the third survey onward, and twelve mesh selectivity tests were performed for each of the following mesh sizes: 60 mm and 70 mm.

The oceanographic observations were conducted as follows: after reaching each preplanned survey station, the conditions of the seafloor were surveyed using a fish finder and a decision as to whether or not a fishing operation was possible was made by consultation with fishery experts and the LAIDA's chief fisherman. If the site is found to be suitable for fishing operation, the vessel was brought to a halt and measurements were made for the following items; water temperature, salinity and chlorophyll. The observation equipment used is the CLOROTECH DCL1180-PDK (equipped with a 180-meter-long plumb cable). At the fifth field survey, chlorophyll data was not obtained because of the deterioration of the sensitivity of the device.

In preparation for observation, chains and lead weights were attached to the rope of the CLOROTEC sensor so as to prevent the sensor from being carried away by current, and then the sensor was vertically dropped from the stern to a depth of 50 cm, and thence equipment

calibrations were performed. After completion of the above preparations, continuous observations were conducted and recorded for the observation items by lowering the sensor at a velocity of 1 meter per second based on water-depth readings shown on the fish finder. Water depths of interest were up to approximately 3 meters above the ocean floor. However, there were cases where observations down to those depths could not be conducted because the plumb cable was swept away by strong current and, as a result, the cable could not reach the depths of interest. In those cases, observations were made at the deepest possible depths as permitted by the length of the cable. Recorded data was converted into Excel format and imported into a computer used at the Tema branch office of the Fisheries Department. For information, since it became impossible to conduct periodical checkups on the above-mentioned observation equipment out in the field, corrections were conducted using a salinometer from the third survey onward.

The trawl survey was conducted by using the LAIDA's commercial trawl net with a 60-mm mesh cod end (Data book Fig. 1-3-1) and by tagging it for 30 minutes as a rule. However, at some sites, tagging had to be curtailed before the expiry of the 30-minute time frame depending on the condition of the sea floor. After completion of marine observations, fishing operation was commenced with the throwing of the trawl net and dragging was started after the trawl net settled on the sea floor had stabilized. (This shall be referred to as a dragging start time and a dragging start point.) After the net was dragged for 30 minutes or for the longest possible duration within 30 minutes, the net was lifted. (This shall be referred to as a dragging finish time and a dragging finish point.) Furthermore, as has been discussed already, mesh size selectivity test was commenced from the third survey (during a period of upwelling) onward, using the two mesh sizes of 60 mm and 70 mm in order to obtain information for mesh-size restrictions which the Government of Ghana contemplates to introduce as a management strategy in the future. To this end, a cover net with a mesh size of 40 mm was used (Data book Fig. 1-3-2). It is a foregone conclusion that the greater the number of fishing operations, the better. However, since there was only one reserve cover net, test fishing operations were conducted by choosing the safest possible sea-floor locations.

What has been caught was divided according to species, and then counts were taken of the individual species, and thence weight measurements were conducted on a species-by-species basis. After that, for each target species (Table 3-1), individual pieces of fish were weighed (in grams). They were also measured in body length (total body length in mm. However, squids were measured in mantle length in mm.) by direct measurement or with the help of photographic images. Photographic body length measurements were performed by capturing photographed images into a computer using software written in Visual Basic. Furthermore, for each evaluation target species, sex-determination was performed, and age characters (otoliths), reproductive glands (of females) and stomachs were extracted and frozen for preservation. In the mesh size selectivity test, those caught in the inner net and those caught in the outer net were separately subjected to body-length measurements for each evaluation target species. (Also for the purpose of determining body length-weight relationships, body weight measurements were taken as much as possible during the third survey.) For information, two marine scales (6 kg max. with 2g resolution and 60 kg max. with 20g resolution) manufactured by Marel have been used for body weight measurements.

The otolith, reproductive gland and stomach samples were brought back to the Tema laboratory of the Fisheries Department for analysis. In the case of the second survey, otoliths were ground using grinding stones and subjected to age determination under a stereomicroscope. However, difficult-to-determine samples were brought back to Japan and closely investigated. The reproductive glands were subjected to weight measurement (in mg) and their gonado-somatic indices were determined. Furthermore, their degrees of maturity have been visually assessed. As for the stomach samples, their ingredients were transferred to petri dishes. Individual preys were examined under the stereomicroscope for the determination of their constituent ratios of prey.

Of the target species determined during the preliminary survey (conducted in February, 2000), *Lutjanus goreensis* (a synonym of *Lutjanus dendatus*) and *Caranx hippos* were dropped from the list after consultation with the Fisheries Department on the occasion of the first survey because these two species were small in terms of catch quantity.

In place of them, it has been agreed to add *Lutjanus agennes* and this fact has been expressly stated in the Inception Report. For information, *Caranx hippos* did not occur through out all the surveys. Only ten individuals of *Lutjanus goreensis* was caught (3 at third survey, 3 at the fourth survey and 4 at the fifth survey).

3-2. Land Survey

The land survey consisted of a general-conditions survey of the country of Ghana (i.e. the second field survey) and an aquatic-product survey of aquatic-products markets located in the vicinities of major fishing ports (i.e. the second to fifth field surveys).

The general-conditions survey has been conducted under the following headings by collecting and using reference materials and information obtained from Government agencies and the like:

Information concerning nature-related general conditions (Geographic features, weather, waves, oceanographic conditions, physical/chemical characteristics, etc.)

Information about general socioeconomic conditions (Population, income, social structure, employment, regional economy, fishery economy, social fabrics of fishing villages, regional development, laws and regulations, etc.)

Statistical information on fisheries (Fishing-ground charts, nautical charts, actual conditions of fisheries (targets to work toward by fish species, fishing method, area, market and month, catch quantity, sales amounts), fishing population, fauna and flora, distribution and ecology)

Information regarding fisherfolk society (Fishing gear, fishing methods, operating patterns, fishermen's organizations, the state of affairs of resources management and fishing regulations, etc.)

Information concerning marine-product-related economy (Distribution channels/methods/handling volumes/amounts, added value by processing type, fisherfolk income, markets, production volumes, export volumes, structure of marine-product-related industries, employment, promotional policies, systems, the state of affairs, etc.)

Information as to environments surrounding fishing villages (Environmental administrative organizational system, environmental legal system, the actual conditions of protection, the state of affairs of

participation in international treaties such as the Ramsar Convention)

As to marine-product market research, it has been decided to take up the following cities/towns as areas of interest to be surveyed after consultation with the Fisheries Department: Tema, Mumford, Apam, Elmina and Sekondi. In each individual market, fact-finding studies were conducted concerning fishing resources, the business end of fisherfolk households, fishing operations, resources management, etc.

The survey was conducted by observation tours through marketplaces under the guidance of our counterparts from the Fisheries Department, inspecting photographs of caught fishes, interviewing fishery-related people (such as artisanal workers and employees of semi-industrial and industrial fishing companies). As to the contents of the hearing survey, interviews were conducted in accordance with predetermined inquiry items (Table 3-2).

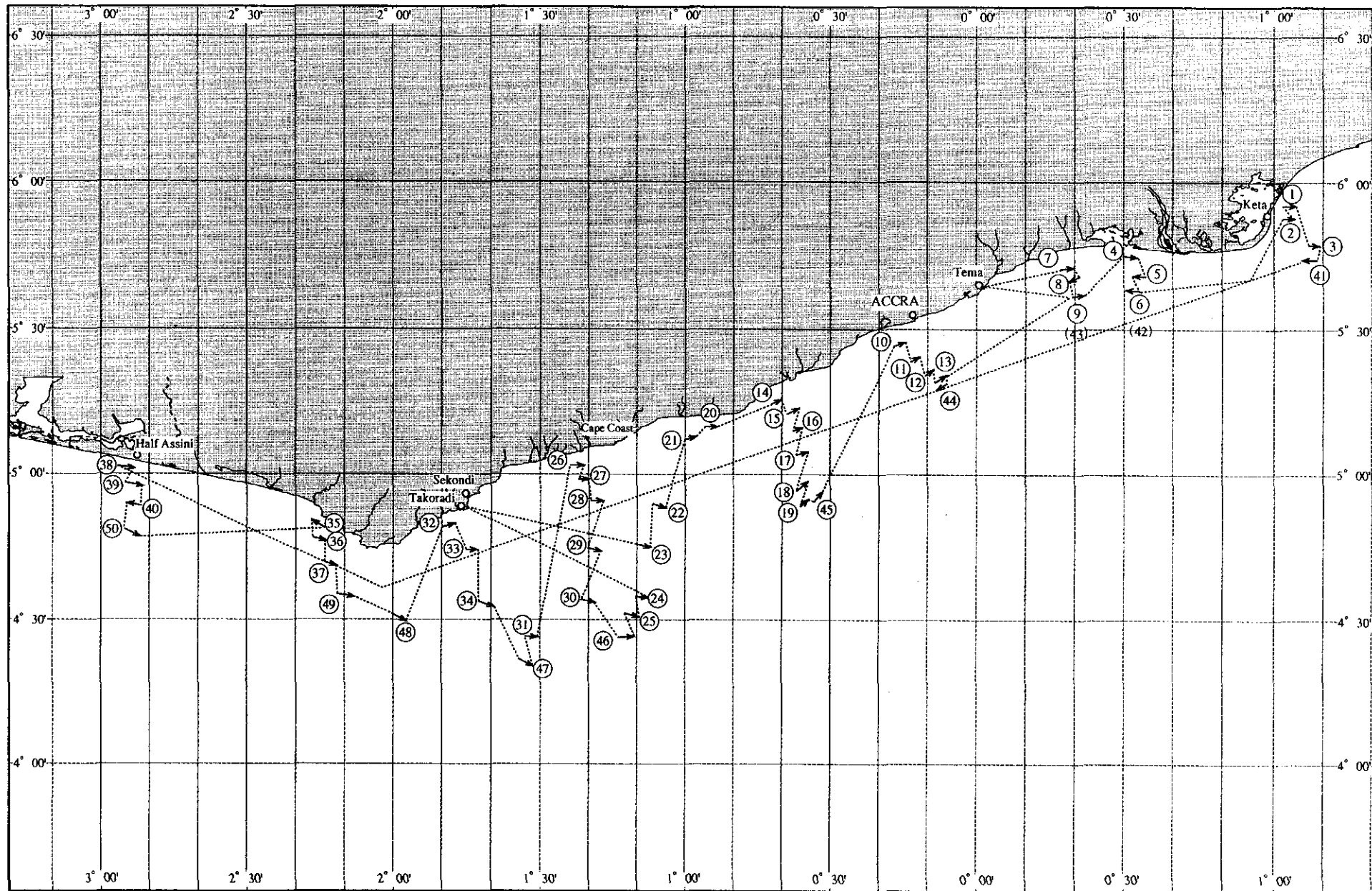


Figure 3-1 (1) Cruise course of the sea survey in the 2nd survey (Numbers indicate survey stations)

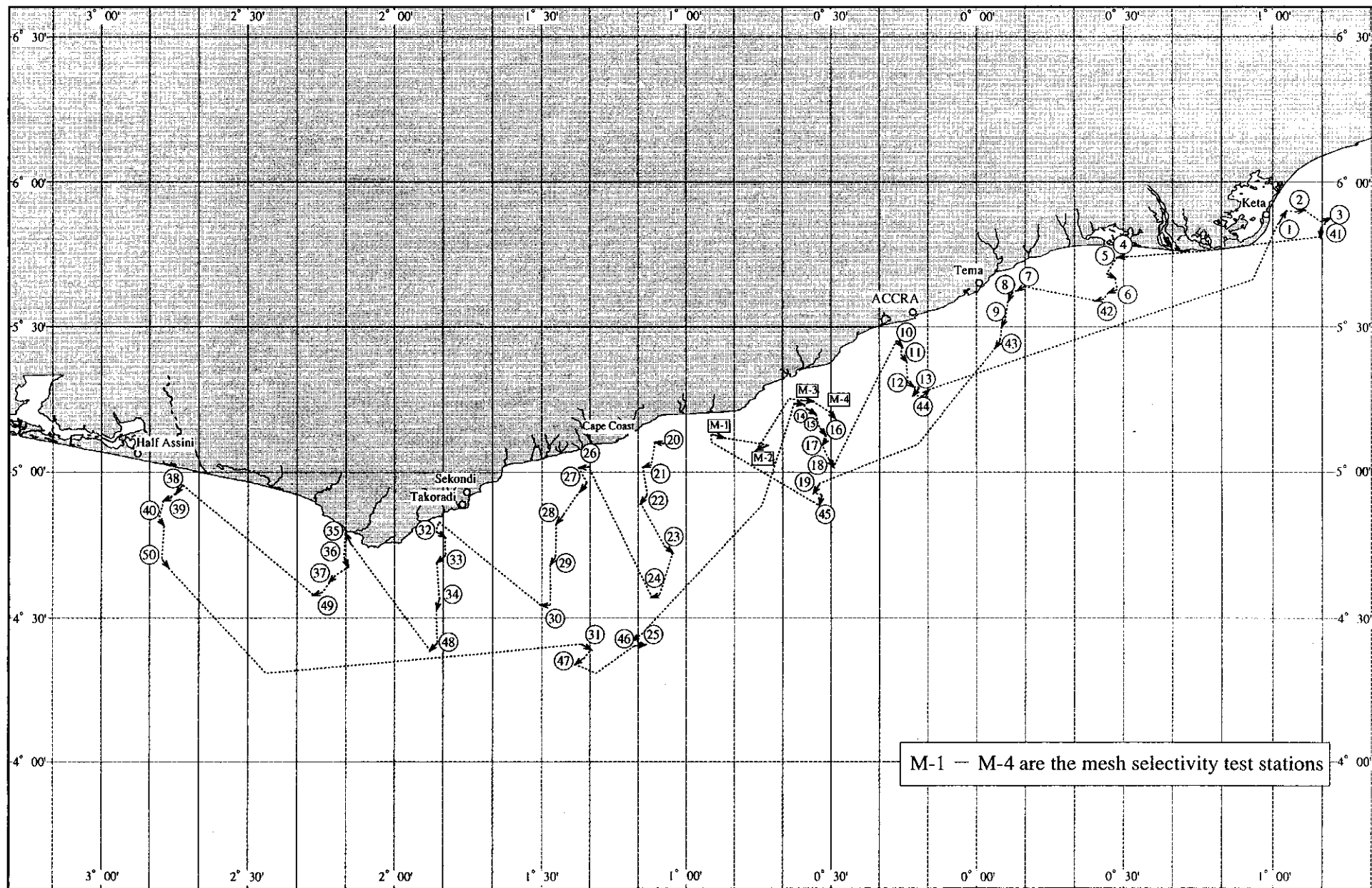


Figure 3-1 (2) Cruise course of the sea survey in the 3rd survey (Numbers indicate survey stations)

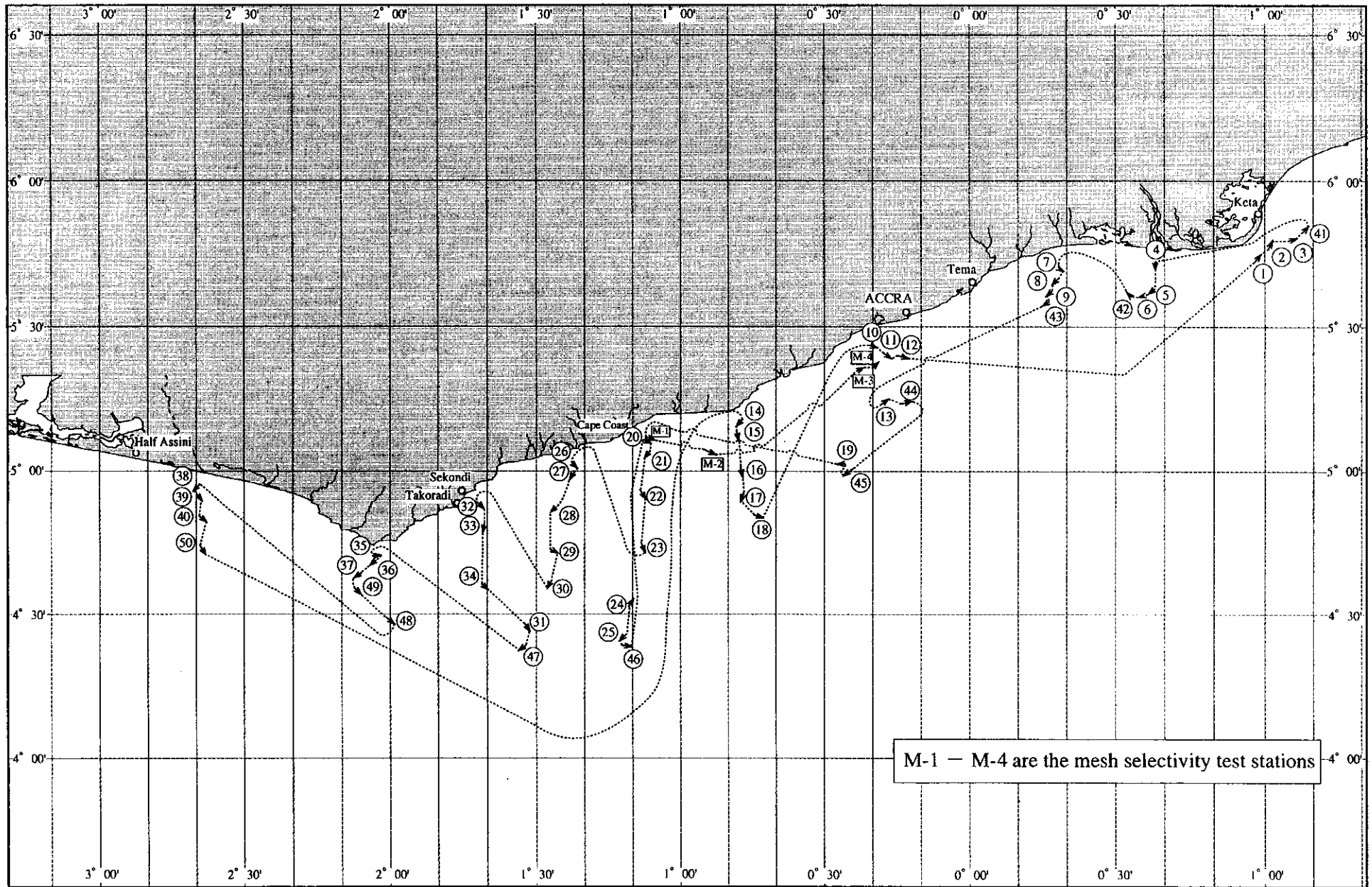


Figure 3-1 (3) Cruise course of the sea survey in the 4th survey (Numbers indicate survey stations)

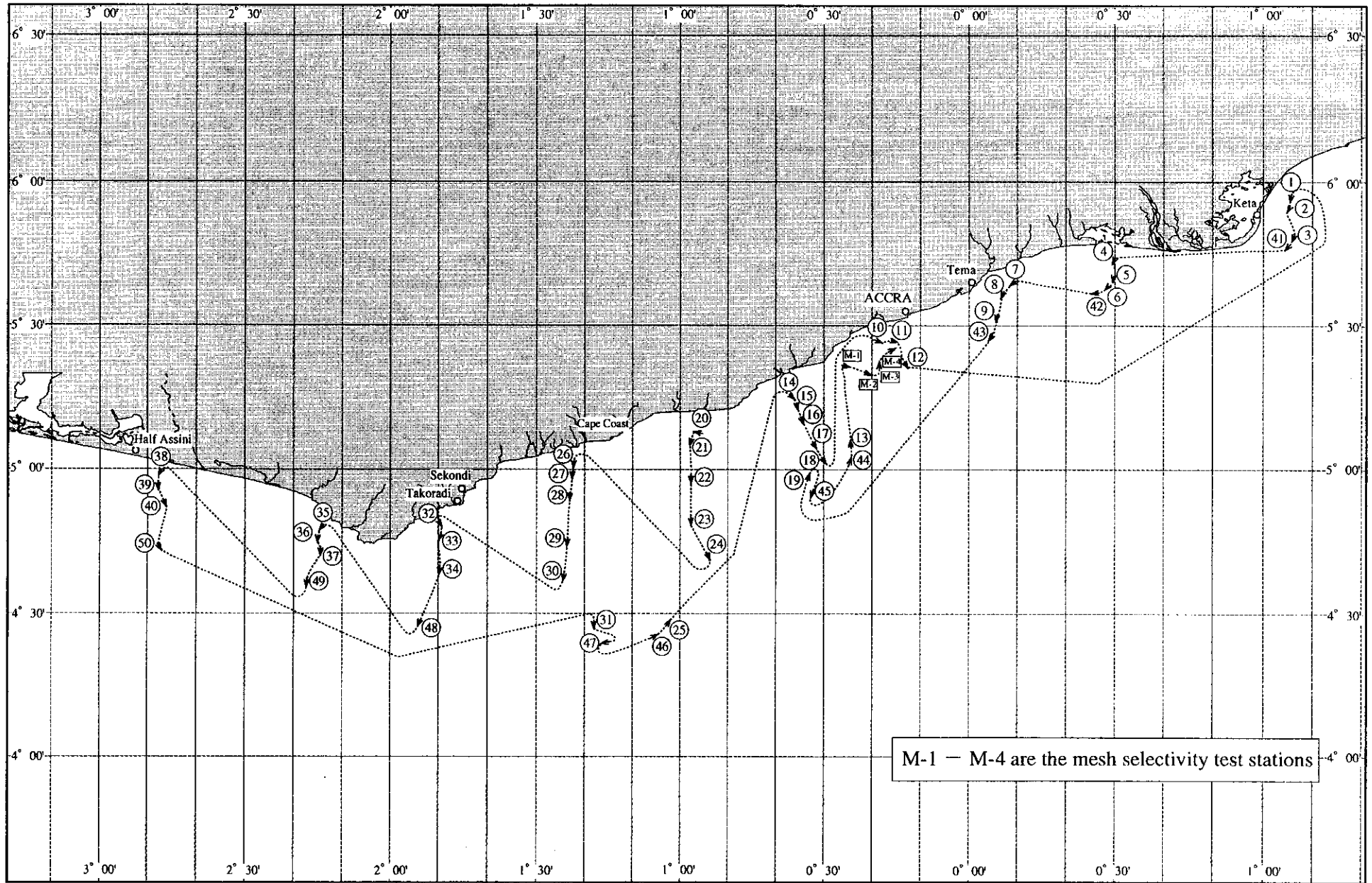


Figure 3-1 (4) Cruise course of the sea survey in the 5th survey (Numbers indicate survey stations)

Table 3-1. Target species of the survey

Survey target species

No.	English name	Scientific name
1	Bigeye grunt	<i>Brachydeuterus auritus</i>
2	Cassava fish	<i>Pseudotolithus senegalensis</i>
3	Red pandora	<i>Pagellus bellottii</i>
4	White grouper	<i>Epinephelus aeneus</i>
5	Golden snapper	<i>Lutjanus fulgens</i>
6		<i>Lutjanus agennes</i>
7	Angola dentex	<i>Dentex angolensis</i>
8	Congo dentex	<i>Dentex congoensis</i>
9	Canary dentex	<i>Dentex canariensis</i>
10	West African goatfish	<i>Pseudupeneus prayensis</i>
11	African sicklefish	<i>Drepane africana</i>
12	Grey triggerfish	<i>Balistes capriscus</i>
13	Lesser African threadfin	<i>Galeoides decadactylus</i>
14	False scad	<i>Decapterus rhonchus</i>
15	African moonfish	<i>Selene dorsalis</i>
16	Atlantic bumper	<i>Chloroscombrus chrysurus</i>
17	Blue-spotted seabream	<i>Sparus caeruleostictus</i>
18	Roncador	<i>Pomadasys incisus</i>
19	Spotted burro	<i>Pomadasys jubelini</i>
20	Cuttle fish	<i>Sepia officinalis</i>
21	Pink shrimp	<i>Penaeus notialis</i>

Evaluation target species

No.	English name	Scientific name
1	Bigeye grunt	<i>Brachydeuterus auritus</i>
2	Red pandora	<i>Pagellus bellottii</i>
3	Cassava fish	<i>Pseudotolithus senegalensis</i>
4	Canary dentex	<i>Dentex canariensis</i>
5	West African goatfish	<i>Pseudupeneus prayensis</i>
6	False scad	<i>Decapterus rhonchus</i>
7	Lesser African threadfin	<i>Galeoides decadactylus</i>
8	Roncador	<i>Pomadasys incisus</i>
9	Blue-spotted seabream	<i>Sparus caeruleostictus</i>
10	Cuttle fish	<i>Sepia officinalis</i>

Table 3-2(1) Items of interview inquiry with artisanal and semi-industrial fishermen

Recorder: Date: Port(Market):

Name	
Age and duration of engagement in fishery	
Family make-up	
Main income source	
Annual income	
Union	
Union dues	
Ship owner	
Date of purchase of ship	
Price of ship	
Tonnage	
Engine type	
HP	
Licensed fishing method	
Fishin method and target species by season	
Information on the fish thrown away	
Number of crews	
Wages	
Daily cost of bunkers	
Yearly cost of refit of ship	
Yearly cost of repair of fishing gears	
Duration of depreciation	
Selling comission	
Daily sales	
Official subsidy	

Table 3-2(2) Items of interview inquiry with industrial fishing companys

Target sepcies of fishery	Present condition of the stock				Recent tendency of the stock			
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)
•	•Good	•Average	•Bad	(No answer)	•Improving	•No change	•Deteriorating	(No answer)

Reason for the bad stock condition or the deterioration
 (e.g. illegal fishing, environmental degradation, excessive competition...)

Problems in the fishing operation

Problems in the fish distribution and adding more values to the fish

Practical measures by the authority and fishermen for the optimal stock use
 (e.g. fishing gear regulation, no-fishing area, no-fishing season, environmental considerations...)

4. Makeup of Survey Teams and Individual Team Members' Tasks and Assignment Periods

The makeup of the survey teams and the tasks and assignment periods of the individual team members are shown in Table 4.1 along with the work periods of the second and third field surveys.

Table4-1(1). Project team members and subject allocations

2nd field survey

Member	Job title	Counterpart	Position
Dr. T. Yonemori	Leader/ Fishery Resources Management	Mr. Johanson K. Atsu	Assistant Fisheries officer, Fisheries Department(FD)
Dr. H. Kimoto	Fishery Resources Survey/ Stock Assessment	Mr. Johanson K. Atsu	Assistant Fisheries officer, FD
Mr. H. Dosoden	Fishing Technology/ Fishing Gear and Methods	Mr. R. T. B. Ashong	Fisheries officer, FD
Dr. H. Ishihara	Biological survey	Ms. Comfort Yeboah	Assistant Fisheries officer, FD
		Mr. J. K. Teye	Principal Technical officer, Fisheries Department(FD)
Mr. K. Wada	Oceanographic survey	Mr. Emmanuel K. Dovlo	Assistant Fisheries officer, Fisheries Department(FD)
Mr. T. Hosho	Land Survey	Mr. A. N. A. Baddoo	Assistant Chief Technical officer, Fisheries Department(FD)

* Counterparts above are the participants of the field survey.

Ms. Anang, Dr. Koranteng, Mr. Bannerman and Ms. Hawa were also Ghanaian counterparts.

Mr. M. Uno replaced Dr. Kimoto in the course of the Sea survey

3rd field survey

Member	Job title	Counterpart	Position
Dr. T. Yonemori	Leader/ Fishery Resources Management	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
Dr. H. Kimoto	Fishery Resources Survey/ Stock Assessment	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. R. Pong	Technical officer, Fisheries Department(FD)
Mr. H. Dosoden	Fishing Technology/ Fishing Gear and Methods	Mr. R. T. B. Ashong	Principal Technical officer, Fisheries Department(FD)
Dr. H. Ishihara	Biological survey	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. F. Odai	Senior Technical officer, Fisheries Department(FD)
Mr. K. Wada	Oceanographic survey	Mr. Emmanuel K. Dovlo	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. E. Nii-Anme	Technical officer, Fisheries Department(FD)
Mr. T. Hosho	Land Survey	Mr. A. N. A. Baddoo	Assistant Chief Technical officer, Fisheries Department(FD)

4th field survey

Member	Job title	Counterpart	Position
Dr. T. Yonemori	Leader/ Fishery Resources Management	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
Dr. H. Kimoto	Fishery Resources Survey/ Stock Assessment	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. R. Pong	Technical officer, Fisheries Department(FD)
Mr. H. Dosoden	Fishing Technology/ Fishing Gear and Methods	Mr. R. T. B. Ashong	Principal Technical officer, Fisheries Department(FD)
Dr. H. Ishihara	Biological survey	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. S. Among	Senior Technical officer, Fisheries Department(FD)
Mr. K. Wada	Oceanographic survey	Mr. Emmanuel K. Dovlo	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. E. Nii-Anme	Technical officer, Fisheries Department(FD)
Mr. T. Hosho	Land Survey	Mr. A. N. A. Baddoo	Assistant Chief Technical officer, Fisheries Department(FD)

5th field survey

Member	Job title	Counterpart	Position
Dr. T. Yonemori	Leader/ Fishery Resources Management	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
Dr. H. Kimoto	Fishery Resources Survey/ Stock Assessment	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. R. Pong	Technical officer, Fisheries Department(FD)
Mr. H. Dosoden	Fishing Technology/ Fishing Gear and Methods	Mr. R. T. B. Ashong	Principal Technical officer, Fisheries Department(FD)
Dr. H. Ishihara	Biological survey	Ms. Comfort Yeboah	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. D. Adekpui	Senior Technical officer, Fisheries Department(FD)
Mr. K. Wada	Oceanographic survey	Mr. Emmanuel K. Dovlo	Assistant Fisheries officer, Fisheries Department(FD)
		Mr. E. Nii-Anme	Technical officer, Fisheries Department(FD)
Mr. T. Hosho	Land Survey	Mr. A. N. A. Baddoo	Assistant Chief Technical officer, Fisheries Department(FD)

Table 4-1(2). Field work period of each member

2nd field survey

Member	Period
Dr. T. Yonemori	5 Oct. to 18 Oct., 1 Nov., 2000 (Land survey)
Dr. H. Kimoto	4 Oct. to 13 Oct., 2000 (Sea survey)
Mr. H. Dosoden	4 Oct. to 18 Oct., 2000 (Sea survey)
Dr. H. Ishihara	4 Oct. to 18 Oct., 2000 (Sea survey)
Mr. K. Wada	4 Oct. to 18 Oct., 2000 (Sea survey)
Mr. T. Hosho	5 Oct. to 1 Nov., 2000 (Land survey)
Mr. M. Uno	13 Oct. to 18 Oct., 2000 (Sea survey)

3rd field survey

Member	Period
Dr. T. Yonemori	30 July to 15 Aug., 2001 (Land survey)
Dr. H. Kimoto	25 July to 13 Aug., 2001 (Sea survey)
Mr. H. Dosoden	25 July to 13 Aug., 2001 (Sea survey)
Dr. H. Ishihara	25 July to 13 Aug., 2001 (Sea survey)
Mr. K. Wada	25 July to 13 Aug., 2001 (Sea survey)
Mr. T. Hosho	30 July to 15 Aug., 2001 (Land survey)

4th field survey

Member	Period
Dr. T. Yonemori	29 Oct. to 15 Nov., 2001 (Land survey)
Dr. H. Kimoto	29 Oct. to 16 Nov., 2001 (Sea survey)
Mr. H. Dosoden	29 Oct. to 16 Nov., 2001 (Sea survey)
Dr. H. Ishihara	29 Oct. to 16 Nov., 2001 (Sea survey)
Mr. K. Wada	29 Oct. to 16 Nov., 2001 (Sea survey)
Mr. T. Hosho	29 Oct. to 15 Nov., 2001 (Land survey)

5th field survey

Member	Period
Dr. T. Yonemori	20 July to 9 Aug., 2002 (Land survey)
Dr. H. Kimoto	20 July to 5 Aug., 2002 (Sea survey)
Mr. H. Dosoden	20 July to 5 Aug., 2002 (Sea survey)
Dr. H. Ishihara	20 July to 5 Aug., 2002 (Sea survey)
Mr. K. Wada	20 July to 5 Aug., 2002 (Sea survey)
Mr. T. Hosho	20 July to 9 Aug., 2002 (Land survey)

5. Results of Conducted Surveys

5-1. Results of General-Conditions Surveys

5-1-1. Nature-related General Conditions

(1) Territory

The Republic of Ghana has an above-ground land area of 238,540 square kilometers, extending from 4 to 11 degrees north latitude and from 1 degree east longitude to 3 degrees west longitude. The republic is bounded by Burkina Faso on the north, Côte d'Ivoire on the west, Togo on the east, and the Gulf of Guinea on the south. The country became independent from England on March 6, 1957 and its present population (in 2000) is estimated at approximately 19.2 million.

While one third of Ghana's territory is covered with rich tropical rain forests, grass-covered plateau and savannas are found in the northern part and steppes are found in some parts of the southern coastal region. On the whole, the degree of terrain roughness is relatively gentle. There is a plateau which trends to the east-west direction in the central-to-southern part while there exists a relatively high plateau region in the northwestern part (although its highest mountain stands at 880 meters above sea level). In the western part, Pra, Ankobra and Tano represent major rivers. In the eastern part, a plain extends all the way to the boarder with Togo. Within this plain, the Black Volta river flowing from the northwestern part and the White Volta river flowing through the northern-central part empty their water into and form the world's largest artificial lake, called the Volta Lake, measuring 5,000 km in overall circumference and 8,500 km² in total area.

Ghana's current arable land area is said to account for approximately 12 % of its total soil.

As for the climate, the southeastern costal region is generally warm and relatively dry while the southwestern part is hot and humid and the northern part is hot and dry. However, from January through March, Ghana enters the Harmattan season and dry sand-borne winds blow from deserts throughout the entire country. The rainy season lasts from April to September in the southern part. However, the rainy season in the northern part is rather short.

The coastal line extends for approximately 539 km and is rather monotonous except for relatively large lagoons that are located at its

east and west extremities. Continental shelf ranges relatively narrowly 24 to 80 km offshore, and its total area is 24,300 km². From a water depth of 100 meters, the sea deepens steeply toward abyssal seafloors in excess of 300 meters in depth. Seafloor is formed with soil materials from the Cretaceous Period and covered mainly with silt or masses of rock depending on the location.

In the waters along the coast of Ghana, the Guinea Current is flowing from west to east. Further in the offshore area, the South Equatorial Current is flowing from east to west. Furthermore, on the continental shelf, the period of upwelling and the period of thermocline formation alternately appear each year, and considerable fluctuations in temperature and salinity are observed. About these phenomena, M. A. Mensah and K. A. Koranteng (1988) described as follows:

"During the period of upwelling, there are generally the period of large-scale upwelling and the period of small-scale upwelling. The period of large-scale upwelling occurs during late June or early July to late September or early October for approximately three months. In some cases, the temperature of the surface water begins at 25°C or lower and drops to 17°C or lower. The period of small-scale upwelling takes place in January or February, or in December or March in some rare cases, and lasts for three weeks. During this small-scale upwelling period, the surface water temperature fluctuates between 27.5°C and 26°C, or lower in some cases.

During the period of upwelling, the salinity of surface water tends to increase and the amount of dissolved oxygen tends to decrease. Especially during the period of large-scale upwelling, high degrees of biological activity are observed, and both phytoplankton and zooplankton increase considerably. It is said that most fishes (both demersal and pelagic fishes) spawn during this period.

During the period other than the upwelling period, thermoclines form and temperature of the surface water generally soars close to 30 °C".

(2) Natural Resources

Since olden times, gold has been known as one of Ghana's representative mineral resources. Originally, placer gold had been

collected by indigenous people. In 1870s, gold mines were discovered by African people. Then, large-scale mining was started by Europeans. In 1900s, the country became one of the world's largest gold producers. It is for this reason that the region here used to be called the Gold Coast. Since then, the amount of excavated gold has gradually decreased and dwindled to 26 tons in 1991. After that, production picked up a little and it reached 72 tons in 1999. Following gold, manganese, diamond and bauxite were discovered, and their production amounts in 1999 were 540,000 tons, 650,000 carats and 350,000 tons, respectively. Together with gold, they combine to predominate the country's mining products.

Since much of the country belongs to the tropical rain forest climate, various kinds of high trees including mahogany grow. In recent years, the timber section accounts for approximately 6 % of Ghana's GDP and some 8 % of the country's total exports in value terms.

The Volta Lake is extremely unique to the country and it can be said that it represents immeasurably great and rich resources. This is because the Lake stores rain water during the rainy season and thereby controls the amount of water in the river that runs through its catchment area. Its water is being used not only for the production of hydroelectric power (which accounts for more than 70 % of the country's total power generation), the irrigation of agricultural land, the supply of water for household use but also for the production of freshwater fish, the promotion of exchanges with backwater communities by water-borne transportation, and the provision of considerable benefits to a variety of sectors and industries including recreational and tourism branches.

5-1-2 Overview of Political and Economic Aspects

(1) Politics and Administrative Machinery

In what was today's Ghanaian territory, small kingdoms rose and fell since the 13th century. During the 15th century, a party of Portuguese landed on its shore and began gold trade. Later on, Holland, England, Denmark and others made inroads and conducted gold trade. In 1874, the territory became a British protectorate under the designation "the Gold Coast." After the end of the World War II, an independence movement for autonomy gained momentum. In 1951, an autonomous government was inaugurated under the leadership of Nkrumah and the country became the first-ever independent state in Sub-Saharan Africa on March 6, 1957. Although the country became a republic in 1960 under the presidency of Nkrumah, his Administration was toppled in a military coup d'etat in 1966. Since then, the returning of control to civilians and the seizure of power by a coup d'etat alternately occurred a number of times under various administrations. Since the forth republic was inaugurated in 1992, a form of politics, in which there is a single-chamber system composed of fixed members of 200 (with a 4-year tenure) and each president (with a 4-year term) is elected through a direct presidential election, has taken hold (Kodansha, 1997). In the 1992 election, the National Democratic Congress (NDC) party won power and Jerry J. Rawlings took office as President-cum-Prime Minister up until December, 2000, for two consecutive terms.

However, Mr. John A. Kufuor of the New Patriotic Party (NPP), the hitherto largest opposition party, took Presidential office in a decisive presidential vote by beating John Atta Mills of the NDC by a vote ratio of 57%:43%. NPP members also won 100 seats of a total of 200 available seats, and the party became the ruling party until its term expires in December, 2004. (The NDC, the largest opposition party, took 92 seats while the remaining 8 seats were shared by four minor parties and independent members). Because the Administration has changed hands, how Ghana's politics will change is an interesting matter to keep an eye on. However, since the difference in power between the ruling party and the major opposition party is so small, there are views that no major change will take place both politically and economically.

The national government consists of following administrative units

under the president and vice-president:

Attorney-general & Justice, Chairman of Economic Management Team, and ministries of Communications & technology, Defense, Economic Planning & Regional Integration, Education, Energy, Environment & Science & Technology, Finance, Food & Agriculture, Foreign Affairs, Health, Information & Presidential Affairs, Interior, Land & forestry, Local government, Manpower Development & Employment, Mines, Parliamentary Affairs, Private Sector Development, Road & Transport, Tourism, Trade & Industries, Works & Housing, Youth & Sports.

Heads of each units (ministers) are appointed by the president.

The central seat of the Administration is Accra, the capital city. The country of Ghana is divided into ten administrative regions, and all administrative regions are under the control of the central Government. However, the central Government has been forging ahead with a policy to decentralize power. With this being the situation, for the purpose of taking care of such matters as the education of residents, sanitation, residential/housing environments, regional industries etc., councils and committees responsible for their respective matters have been created, in a move reflecting a policy to respect the initiative/self-reliance of residents.

(2) Fisheries Administrative System (Directorate of Fisheries)

Fisheries in Ghana are currently governed by the "Provisional National Defense Council Law (PNDCL) 256" of 1991 and the Fisheries Commission Act of 1993. Under these Law and Act, some regulations such as a ban on fishing in some areas and season, control on mesh sizes of net, protection of juvenile fish or gravid crustaceans and fishery licensing have been introduced. However, the Law and Act have not been found to be effective, because these did not provide a detailed management system which is required to effectively manage the fishery resources for long term sustainability or to promote the economic efficiency of exploitation of the resources (FMOC, 2000.)

As the results, major problems in the fisheries sector in Ghana manifest themselves as biological over-exploitation and economic over-capitalization. In order to cope with these problems, the World Bank urged the Government to promote the "Fisheries Sub-sector

Capacity Building Project". This project launched in 1996 with total cost of US\$10.5m (US\$9.0m financed by the International Development Association of the World Bank and US\$1.5m by the Government of Ghana). The project is expected to strengthen the capacity of the fisheries sub-sector especially the Directorate of Fisheries and facilitate the formulation and implementation of a sound fisheries management plan.

Under the Fisheries Sub-sector Capacity Building Project, a "Fisheries Management Operations Committee(FMOC)" was formed to help abovementioned tasks of the Directorate of Fisheries.

However, the development of a fisheries management plan has suffered from the lack of scientific data. Though the Government had sought to charter a vessel to conduct stock assessment of demersal fishes during 1999 and put in place a management process by 2000, this plan failed. Then the Government requested technical and monetary cooperation from Japanese Government.

Various problems and issues concerned with fisheries are addressed by the Directorate of Fisheries belonging to the Ministry of Food & Agriculture of the Government of Ghana (Fig. 5-1-2-1). The head quarters of the Directorate of Fisheries is located in the capital city Accra and its Marine Fisheries Research Division is placed in Tema. Local fisheries matters in Regions are not placed under the direct control of the Directorate of Fisheries, but belongs to a section of agriculture, livestock and fisheries of Regional Office of the Ministry of Food & Agriculture. A total of ten fisheries branch offices are stationed in four Regions (Volta, Greater Accra, Central and Western regions) which face to the sea.

As to the organizational structure of the Directorate of Fisheries, there are five sections under the supervision of the head of the Department. A deputy director is appointed to each section along with some staffers, and they are responsible for performing day-to-day business operations which include the devising of fishery policies, the issuance of fishing permits, the collection of fishery statistics and the supervision of fisheries (Fig. 5-1-2-2). The section which is most closely related to the Project is the Marine Fisheries Research Division located

in Tema. Under the director (section chief), there are a vice deputy director, several fisheries officers, research-related technicians, clerical staffers, etc. These personnel are charged with oceanographic surveys, resources surveys, fishing gear surveys, the collection of catch statistics, and the like (Fig. 5-1-2-3). Most of our counterparts under the Project belong to this Section. However, this Section has been in possession of no operable vessel since the beginning of 1990s when the survey vessel "Kakadiamaa" provided by Japan went out of order and became unserviceable. This Section is also virtually devoid of the personnel, facilities and equipment which are required for the implementation of research and study. For this reason, some of its researchers occasionally take part in joint research projects regionally conducted by such organizations as the FAO and ICCAT. This Section has been, therefore, extremely inactive where its own national research study activities are concerned.

(3) Overview of General Social Economy

A broad view of developments that have taken place up until today in the social economy since the independence of Ghana is given for reference purposes below (excerpted from Chapter 5 "Ghana," written by Tsutomu Takane, of "African Economies" edited by Tatsuro Suehara and published by Sekai Shisoshu):

"As Ghana became independent from British territory in March of 1957, Mr. Nkrumah, who took office as the first president, expanded public works spending in a variety of areas aimed at the modernization and industrialization of the economy by adopting state-centered economic management based on his socialistic ideology. During this period, large-scale projects such as the construction of airports in major domestic cities, the construction of the Akosombo Dam holding back the water of the Lake Volta, along with hydropower stations, and the construction of sea ports were carried out one after another. The funds for these public works were covered by loans from various foreign countries and international institutions as well as by increases in government spending. In the industrial sector, a large number of state-run corporations and joint-venture operations were created under the initiative of the Government aimed at domesticating the

manufacture of products. These government-run corporations were protected by various kinds of protective policies -- as diverse as the monopolization of domestic markets, the protection of domestically manufactured goods through import restrictions, governmental subsidy policies, and the like. However, these protected corporations were saddled with the problems of production inefficiency and lack of a competitive edge in the marketplace and were, at the same time, constantly putting a squeeze on the finances of the state. Also in the agriculture sector, a modernization policy calling for the state's direct intervention into production was adopted, and more than 100 state-run farms were established in a bid to forge ahead with the modernization and mechanization of agriculture. However, because of the inefficiencies of management and other factors, no growth was observed in production. On the other hand, policies adopted for the purpose of distributing economic profits equally included the improvement/upgrading of infrastructures such as electric power and running water and the provision of medical care and education at no cost. While these policies contributed to the betterment of people's lives, they forced increases in Government expenditure.

Although the Government expenditure sharply increased on account of the Nkrumah Administration's socialistic economic policies, what has mainly covered this spending was revenues from the cocoa sector. In order to increase revenues from the cocoa sector, the Government has monopolized the purchasing of domestically grown cocoa by means of a government agency called Marketing Board (Cocoa Board). At the same time, the Government lowered the price at which it purchased cocoa from farmers in an attempt to increase tax revenues. However, during this time, the number of cocoa producer countries increased and international prices suffered a slump. What's worse, due to the organizational bloating of the Cocoa Board and delays in breed improvement and disease-fighting efforts, cocoa-derived profits decreased considerably and the finances of the Government remained in the red.

In 1966, the Nkrumah Administration fell from power in a coup d'etat. As a result, Nkrumah's economic strategies which aimed at rapidly achieving modernization and industrialization along the lines of

socialism ended in failure without attaining their objectives. In those days, the Ghanaian economy left a large number of problems such as a deficit-running financial structure plagued by red ink caused by the industrial structure, inefficient state-run corporations and national farms, shortages of imported goods attendant to a controlled economy, and the expansion of black markets.

After that, between 1966 and 1981, the administration changed hands 7 times in all, including four coups d'etat in Ghana. The Ghanaian economy, which had become sluggish once, went from bad to worse due to such adverse factors as political turmoil, Ghana's economic structure, and decreased revenues from cocoa which represents the mainstay of the country's revenues.

On December 31 of 1981, J. J. Rawlings succeeded in his second coup d'etat (first one took place in 1979). He organized the Provisional National Defense Council (PNDC) and became its chairman by himself. At that time, Ghana was in a crisis situation at a time when shortages of necessities of life, the proliferation of black markets and the decline of the cocoa sector came to the surface. In addition, in 1983, agricultural production suffered a blow dealt by a drought. What's worse, at the beginning of the same year, an estimated one million Ghanaian workers returned home from Nigeria and the country's food shortages rapidly deteriorated.

In a bid to implement an economic reform which represented the greatest challenge in the early days of his Administration, Rawlings sought monetary support from Libya and East European countries but failed. In September of 1982, the Administration resumed negotiations with the IMF and made increasingly manifest its approaches toward the West. Such being the case, in April of 1983, the Administration announced an economic revival plan (1984 through 1986) and began implementing structural adjustment policies recommended by the IMF and the World Bank. The objectives of this revival plan are (1) Enhancement of production incentives, (2) Increases in the supply of consumer goods, (3) Increases in the amount of foreign currencies on hand and improvement of the mechanism to distribute them, (4) Suppression of inflation, (5) Restoration of infrastructures, (6) Reform of various economic systems/institutions.

Subsequently, for the years 1987 through 1989, the Government announced the second economic revival plan which spelled out (1) Economic growth at annual rates of 5 to 5.5%, (2) Increases in public investment, (3) Increases in domestic savings, (4) Reform of the public sector, (5) Improvement of the living standard of the poor, and so forth. Concrete policies included the liberalization of trade and foreign exchange, the streamlining of the public sector, the reform of customs duties, the reform of the financial sector such as banks, and investments into socioeconomic infrastructures."

Beyond the year 1992 in which J. J. Rawlings was formally appointed to president by election as well as beyond the year 1996 in which he was elected as president for a second time, the structural adjustment policies had been continually implemented. Toward the new century, the Government announced "GHANA-VISION 2020" in January of 1995, which shows a national-development policy objective designed to effect a transition from poverty to prosperity during a 25-year time frame from 1996 through 2020. Its objective to be reached by 2020 is to develop the country of Ghana to such an extent that its economy will be on a par with the current level of today's average or higher-order developing countries. The plan shows a development path leading up to 2020 by making comparisons between the various economic indicators and their counterparts which the country hopes to attain along the way. As the first phase of the plan, a "mid-term development plan for 1997 through 2000" was already announced in July of 1997. Worthy of special note is that the plan speaks of the invigoration of grass roots movement-like activities through the sharing of power of the central Government and the participation of local governments, councils, people of experience or academic standing, NGOs, the private sector and the like. At the presidential election held in December of 2000, the Rawlings Administration suffered a defeat and the then opposition New Patriotic Party (NPP) won power instead. From this time on, it is a matter of great interest how past policy lines and development plans will be continued or modified.

Even though Ghana is located in a tropical rain forest region and is blessed with a favorable climate and natural resources, the country is still heavily dependent on international aid on the financial and

technological fronts. Gold, timber and cocoa represent major sources of foreign-currency earnings. With this being the situation, the domestic economy largely centers around agriculture for domestic consumption. According to 1999 data, agricultural production accounted for 36% of the country's GDP (whereas manufacturing/industries and service industries constituted 25% and 39%, respectively). The growth rate of the country's overall GDP was estimated at 3% (2000) and the per-capita GDP was put at US\$1,900. The number of workers stood at 9 million. The breakdown is as follows: Agriculture accounted for 60%, manufacturing industries for 15%, and service industries for 25%. The unemployment rate was approximately 20% (as of 1997), and the proportion of those below the poverty line was put at 31.4% (1992) of the population.

For information, estimated demographic figures for the year 2000 are as follows: a population of 19.2million, a population growth rate of 1.7%, a birthrate of 2.8%, an infant mortality rate of 5.7% (in relation to live births), and a life expectancy of 57.2 years.

Major industries include mining, timber, light manufacturing, aluminum refining, food processing and the growth rate of industrial production was estimated at 4.2% (as of 1996).

Major items of agricultural produce include cocoa, rice, coffee, cassavas, peanuts, shea nuts, bananas, tomato and other vegetables, and timber. As discussed earlier, agriculture constitutes the mainstay of Ghana's economy and the agricultural sector accounts for 30 to 35% of the total exports, thanks largely to cocoa, in terms of value. Although Ghana's population is relatively few, it has fertile land (13.60 million hectares) and a high rainfall. Under the circumstances, in addition to conventional traditional agricultural produce, the development of stable diversified agriculture capable of producing cash crops suitable for export to neighboring countries may be expected if and when progress will be made with the construction/upgrading of infrastructures such as irrigation projects using water from the Volta Lake as stated above.

Total export value reached US\$1.6 billion (in a 2000 estimate). Major items included gold, cocoa, timber, tunas, bauxite, aluminum, manganese ores, and diamond, most of which were destined for Europe, the United States and Togo.

Import value amounted to US\$2.2 billion (in a 2000 estimate). Major articles included daily necessities, petroleum, foodstuffs, and machinery. They hailed from Europe, the United States and Nigeria.

The estimated inflation rate stood at 22.8% in 2000. The exchange rate of Ghana's currency, Cedis to US\$1 were 1200 in 1995, 2050 in 1997, 2669 in 1999, 5455 in 2000 and 8000 in August 2002, showing a continuous decline in the value of Cedi.