

**Report of the**

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**PRE-SURVEY MEETING TO PLAN THE YEAR 2000 SURVEY  
WITH THE R/V DR. FRIDTJOF NANSEN IN THE WESTERN GULF  
OF GUINEA**

**(Benin, Togo, Ghana and Côte d'Ivoire)**

**Tema, Ghana, 26 August 2000**

**Rapport de la**

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**RÉUNION DE PRÉPARATION ET DE PLANIFICATION  
DE LA CAMPAGNE 2000 AVEC LE N/R DR. FRIDTJOF NANSEN  
DANS LA RÉGION OCCIDENTALE DU GOLFE DE GUINÉE**

**(Bénin, Togo, Ghana et Côte d'Ivoire)**

**Tema, Ghana, 26 août 2000**



**Food  
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## **PREPARATION OF THIS DOCUMENT**

The Pre-survey Meeting to Plan the Year 2000 Survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea (Benin, Togo, Ghana and Côte d'Ivoire) held in Tema, Ghana on 26 August 2000 was organized under Project GCP/INT/730/NOR "International Cooperation with the Nansen Programme: Fisheries Management and Marine Environment". The project is funded by the Norwegian Agency for Development Cooperation (NORAD) and operated in close cooperation with the Institute of Marine Research, Bergen, Norway (IMR).

FAO is grateful to the participants in the year 2000 survey with the R/V DR. FRIDTJOF NANSEN who were responsible for the preparation of this report. Jacques Konan and Doumini Boubéri (Centre de recherches océanologiques, Abidjan) were responsible for the overview of the fisheries and resource surveys in Côte d'Ivoire, Amélie Gbaguidi (Direction des pêches, Cotonou) and Roger Djiman (Centre national océanographique, Cotonou) were responsible for the chapter on Benin, Kossi Maxoe Sedzro and Vidzraku Abokousse (Direction de l'élevage et de la pêche, Lomé) were responsible for the chapter on Togo and Kwame Koranteng (Marine Fisheries Research Division, Tema) provided the overview from Ghana as well as the overview of the international surveys carried out in the sub-region. Else Torstensen and Oddgeir Alvheim (Institute of Marine Research, Bergen) wrote the chapter on the review of the results from the 1999 Nansen survey and Merete Tandstad (FAO Fisheries Department) was responsible for the remaining chapters, the format and overall editing of the report.

## **PRÉPARATION DE CE DOCUMENT**

La Réunion de préparation et de planification de la campagne 2000 avec le N/R DR. FRIDTJOF NANSEN dans la région occidentale du Golfe de Guinée (Bénin, Togo, Ghana et Côte d'Ivoire) qui s'est tenue à Tema, Ghana, le 26 août 2000 a été organisée sous l'égide du projet GCP/INT/730/NOR "Coopération internationale avec le Programme Nansen: aménagement des pêches et environnement marin". Le projet est financé par l'Agence norvégienne pour le développement (NORAD) et réalisé en étroite collaboration avec l'Institut de recherche marine (IMR), Bergen, Norvège.

La FAO est reconnaissante aux participants à la campagne 2000 avec le N/R DR. FRIDTJOF NANSEN responsables de la préparation de ce rapport. Jacques Konan et Doumini Boubéri (Centre de recherches océanologiques, Abidjan) étaient responsables d'une synthèse sur les campagnes des pêches et des ressources en Côte d'Ivoire; Amélie Gbaguidi (Direction des pêches, Cotonou) et Roger Djiman (Centre national océanographique, Cotonou) du chapitre sur le Bénin; Kossi Maxoe Sedzro et Vidzraku Abokousse (Direction de l'élevage et de la pêche, Lomé) du chapitre sur le Togo; et Kwame Koranteng (Division de la recherche marine, Tema) a fourni une synthèse du Ghana de même qu'une synthèse des campagnes internationales effectuées dans la sous-région. Else Torstensen et Oddgeir Alvheim (Institut de recherche marine, Bergen) ont écrit le chapitre sur l'examen des résultats de la campagne 1999 du Nansen et Merete Tandstad (Département des pêches de la FAO) était responsable des chapitres restants, de la mise en page et de la rédaction générale du rapport.

FAO.

Report of the Pre-survey Meeting to Plan the Year 2000 Survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea (Benin, Togo, Ghana and Côte d'Ivoire). Tema, Ghana, 26 August 2000.

Rapport de la Réunion de préparation et de planification de la campagne 2000 avec le N/R DR. FRIDTJOF NANSEN dans la région occidentale du Golfe de Guinée (Bénin, Togo, Ghana et Côte d'Ivoire). Tema, Ghana, 26 août 2000.

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### ABSTRACT

The Pre-survey Meeting to Plan the Year 2000 Survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea (Benin, Togo, Ghana and Côte d'Ivoire) was held in Tema, Ghana, on 26 August 2000. The purpose of the meeting was to bring together the regional and international scientists participating in the survey and other interested parties for discussions on the resources of the region, as well as to discuss the results from the 1999 survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea and the objectives of the 2000 survey taking place from 29 August to 17 September.

This report gives a summary of the fisheries in Côte d'Ivoire, Ghana, Togo and Benin as well as an overview of the surveys undertaken in the sub-region (both national and sub-regional). The report also provides a summary of the results from the 1999 combined acoustic and bottom-trawl survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea and a summary of the discussions from the pre-survey meeting concerning the results from the 1999 survey and the planning of the year 2000 survey.

### RÉSUMÉ

La Réunion de préparation et de planification de la campagne 2000 avec le N/R DR. FRIDTJOF NANSEN dans la région occidentale du Golfe de Guinée (Bénin, Togo, Ghana et Côte d'Ivoire) s'est tenue à Tema, Ghana, le 26 août 2000. L'objet de la réunion était de rassembler les scientifiques nationaux et internationaux participant à la campagne et d'autres partenaires afin de discuter les ressources de la région ainsi que les résultats de la campagne 1999 du N/R DR. FRIDTJOF NANSEN dans la zone ouest du Golfe de Guinée et les objectifs de la campagne 2000 qui s'est déroulée du 29 août au 17 septembre.

Le rapport présente un résumé des pêcheries en Côte d'Ivoire, au Ghana, au Togo et au Bénin ainsi qu'une revue des campagnes entreprises dans la sous-région (nationales et sous-régionales). Le rapport fournit également un résumé des résultats des campagnes acoustiques combinées à celles de chalutage réalisées en 1999 par le N/R DR. FRIDTJOF NANSEN dans la région occidentale du Golfe de Guinée ainsi qu'un résumé des points discutés au cours de la réunion de planification concernant les résultats de la campagne 1999 et la préparation de la campagne 2000.

### Distribution :

Participants in the Meeting /Participants à la Réunion

FAO Regional Fishery Officers/Fonctionnaires des pêches  
des Bureaux régionaux de la FAO

FAO Fisheries Department/Département des pêches de la FAO

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## 1. INTRODUCTION

The Pre-survey Meeting to Plan the Year 2000 Survey with the R/V DR. FRIDTJOF NANSEN in the Western Gulf of Guinea (Benin, Togo, Ghana and Côte d'Ivoire) was held in Tema, Ghana on the 26 August 2000. The purpose of the meeting was to bring together the regional and international scientists participating in the survey and other interested parties for discussions on the resources of the region as well as to discuss the results from the 1999 survey with the R/V Dr. Fridtjof Nansen in the region and the objectives of the year 2000 survey taking place from 29 August to 17 September.

The meeting and survey were organized under Project GCP/INT/730/NOR "International cooperation with the Nansen Programme: Fisheries Management and Marine Environment", following a request from the Government of Ghana to FAO<sup>1</sup> to repeat the 1999 R/V Dr. Fridtjof Nansen survey in the region and subsequent to the approval of the Norwegian Agency for Development Cooperation (NORAD) and the Institute of Marine Research (IMR), Bergen, Norway. The above mentioned project is in support of the Nansen Programme, which is a Norwegian bilateral programme to assist developing countries in fisheries research, management and institutional strengthening funded by NORAD and operated by IMR. Project GCP/INT/730/NOR, which is also funded by NORAD and implemented in close cooperation with IMR, is the follow-up of a series of FAO projects and agreements (e.g. Project FAO/UNDP/GLO/92/013) involving surveys by the research vessel R/V Dr. Fridtjof Nansen.

Ms Emelia Anang, Director of Research, Marine Fisheries Research Division, Ghana welcomed the local and international participants to the meeting. Opening addresses were also read by Mr Alfred Tetebo standing in for the Director of Fisheries and Mr A. Jallow from the FAO Regional Office for Africa, Accra, Ghana.

A total of 30 participants including fishery and environmental scientists from Benin, Togo, Côte d'Ivoire, Norway and Ghana participating in the year 2000 survey as well as representatives from the Ghanaian Directorate of Fisheries, the Water Research Institute (Accra), University of Ghana, the Fisheries Commission, the Ghana Tuna Association and FAO attended the meeting. The list of participants is given in Appendix I. The chairman of the meeting was Mr E.K. Abban, from the Water Research Institute (CSIR), Accra, Ghana. The agenda for the meeting is attached as Appendix II.

This report gives a summary of the fisheries in Côte d'Ivoire, Ghana, Togo and Benin as well as an overview of the surveys undertaken in the sub-region (both national and sub-regional). The report also provides a summary of the results from the 1999 combined acoustic and bottom-trawl survey with the R/V Dr. Fridtjof Nansen in the Western Gulf of Guinea and a summary of the discussions from the pre-survey meeting concerning the 1999 survey and the planning of the year 2000 survey.

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<sup>1</sup> Later supported by requests from the Governments of Côte d'Ivoire, Benin and Togo.



## 2. SUMMARY OF NATIONAL FISHERIES AND SURVEYS

### 2.1 Côte d'Ivoire

#### Fisheries

In Côte d'Ivoire four coastal fisheries exist: the pelagic fishery, the demersal fishery, the shrimp fishery and the artisanal fishery.

The pelagic fishery landings are dominated by sardinella and principally by *Sardinella aurita* which represents 75% to 80% of the total annual catch. This fishery is dependent upon the presence of sardinellas which depend upon environmental conditions (presence or non-presence of upwelling). During the upwelling season, the species moves to the coast where it is fished. It is during this period, which goes from July to the end of September, that 80% of the annual sardinella catch is caught. Fourteen 20m long purse seiners take part in this fishery. Table 1 shows the landings of the last three years (all species).

The trawl fishery, due to the narrowness of the continental shelf in Côte d'Ivoire, about 12 000 km<sup>2</sup>, does not constitute more than 6000 – 7000 tonnes annually to the national fishery production. There are twenty trawlers operating in depths greater than 50m and these are concentrated along the eastern coast of the shelf. The catch of the last three years (Table 1) consist mainly of eight species: *Dentex angolensis*, *Pseudotolithus senegalensis*, *Pseudotolithus typus*, *Galeoides decadactylus*, *Pagellus bellottii*, *Cynoglossus canariensis*, *Brachydeuterus auritus* and *Pomadasys jubelini*.

**Table 1:** Catch in tonnes of the pelagic and trawler fishery in Côte d'Ivoire from 1997 to 1999

Catch (tonnes)	1997	1998	1999
Pelagic fishery	26 000	20 000	22 000
Trawler fishery	7 400	6 200	6 800

The shrimp fishery, once around 1200 tonnes (600 tonnes from the sea and 600 tonnes from the coastal lagoons) (Garcia, 1976), has been going through a crisis for many years. It has stabilised at 200 tonnes from the sea, although during the first six months of 2000 landings had already exceeded 200 tonnes. This amphidromic resource is fished by artisanal fishers, which affects the catch levels at sea by the industrial shrimp boats.

The artisanal fishery, or canoe fishery, very active both in coastal lagoons and at sea, mainly targets the young fish of the same species as those fished by the industrial fleet. Landings are around 35 000 tonnes of which sardinella is the most important. One thousand canoes of all sizes operate in this sector.

#### Surveys

From 1978 to 1995, le Centre de recherches océanologiques d'Abidjan (CRO) carried out two series of trawl surveys to evaluate the demersal stocks. The first series was carried out from 1978 to 1986 and the second from 1993 to 1995.

The vessel used was the André Nizery, a research vessel belonging to ORSTOM (Institut français de recherches, now known as IRD). A small sized vessel of 25 metres, the surveys were carried out by the same crew, in almost identical conditions.

The objectives of the surveys were:

- to evaluate the biomasses of the different stocks of fish, crustaceans and molluscs.
- to locate the greatest concentrations of fish and the best fishing zones.
- to compare the biomass data from the two principal marine seasons: the cold season (July to October) and the warm season (March to June).

In the first period from 1978 to 1986, the method used was random stratified trawling of two large strata, 0 to 50 metres and 51 to 120 metres. These strata were further divided into sub-strata depending on the type of sediment.

In the second period from 1993 to 1995, the method used was non-random trawling, carried out on 20 radials perpendicular to the coast. The trawls were carried out parallel to the coast in half hour time periods. The sample taken was sorted, weighed and some of the species were measured. The Nan-Sis software was used to process the data. The densities thus obtained were converted to biomass (Table 2).

**Table 2:** Results of the second period (1993-1995)

Survey	Marine season	Biomass (tonnes)
1993	cold season	47 468
1994	warm season	42 227
1995	warm season	31 135
1995	cold season	35 885

*Dentex angolensis*, which was the predominant species in the catches, had a biomass of 9656 tonnes in 1993 and 4632 tonnes in 1994.

During all the surveys the predominance of two families was noted: the sparidae, notably *Dentex angolensis* and *Dentex congoensis*, in the deeper stratum from 51 to 120 metres, and the pomadasyidae (Haemulidae), notably *Brachydeuterus auritus*, in the coastal stratum from 0 to 50 metres.

## 2.2 Ghana

### Fisheries

The marine fishing industry provides over 87 percent of all fish produced in Ghana and constitutes one of the most important sectors of the nation's economy. The industry has three sectors, namely small-scale (or artisanal), semi-industrial (or inshore), and industrial.

The artisanal sector employs between 90 000 and 110 000 fishers and produces between 65 and 80 % of the total catch of marine fish in Ghana. The principal fishing craft is the dug-out canoe. The number of canoes operating actively in Ghanaian marine waters in the last two decades was estimated at various times as between 6000 and 9000 units. Artisanal fishing gears include gilling and entangling nets (set and drifting), seine nets and handlines.

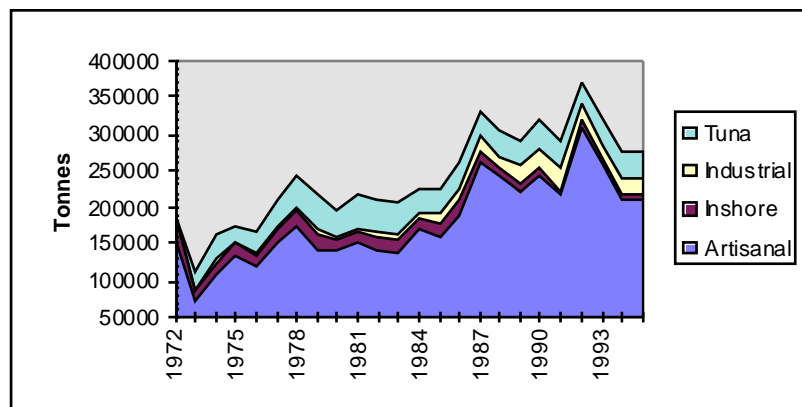
The inshore (or semi-industrial) sector comprises mainly locally-built, wooden-hulled vessels measuring between 8 and 37 m long and numbering about 250. There are also a few steel-hulled foreign-built vessels in this sector. The inshore vessels use purse seine gear during the upwelling season when sardinellas and chub mackerel are the target species and bottom trawl nets for the rest of the year.

In the industrial sector large, steel-hulled foreign-built trawlers, shrimpers, tuna baitboats and tuna purse seiners are used. In the last two decades, the number of industrial vessels operating in Ghanaian waters varied between 60 and 90.

Off Ghana and Côte d'Ivoire, two upwelling seasons, major and minor, occur annually with differing duration and intensities. Small pelagic fisheries in the area are sustained by this upwelling (FRU/ORSTOM, 1976; Pezennec and Koranteng, 1997). The most important fish species in the small pelagic fishery are round sardinella (*Sardinella aurita*, Clupeidae), flat sardinella (*Sardinella maderensis*, Clupeidae), chub mackerel (*Scomber japonicus*, Scombridae) and anchovy (*Engraulis encrasicolus*, Engraulidae). In the last decade, total landings of small pelagic fish from this ecosystem have been between 200 000 and 260 000 tonnes annually (Bard and Koranteng, 1995).

In the demersal fishery, several high-valued species are exploited. The most important of these belong to the families Sparidae, Lutjanidae, Haemulidae, Serranidae, Sciaenidae and Mullidae. Total annual landings were between 40 000 and 80 000 tonnes in the last decade.

Trends of the landings of the various fishing fleets between 1972 and 1995 are depicted in Figure 1.



**Figure 1:** Trend of fish landings of Ghanaian fishing fleets, 1972-1995. The catch is made up of both pelagic and demersal fishes caught in Ghanaian waters.

## Surveys

The first documented national survey was conducted in May-June 1956 by the West African Fishery Research Institute (WAFRI) (Salzen, 1957) using the research vessel R/V Cape St. Mary. Following the establishment of the Fishery Research Unit (now the Marine Fisheries Research Division of the Directorate of Fisheries) in Ghana in 1962, the FAO assisted the Unit to conduct trawl surveys. A survey programme was executed in 1969-70 using the Unit's research vessel R/V Research (Rijavec, 1980). After the 1969-70 survey, mechanical problems on the research vessel could not permit sustained surveys until a new

research vessel, R/V Kakadiamaa, was acquired in July 1979. In August 1979 a new survey programme was put in place.

The national surveys that have been conducted in Ghanaian waters are described in Table 3. Table 4 describes the characteristics of the vessels and gears used in the national fishery resource surveys.

**Table 3:** Description of the national trawl surveys, their design and methodology used

Survey/Vessel	Year	Description
WAFRI R/V Cape St. Mary	1956	The objective of the survey was to explore the Ghanaian (then Gold Coast) continental shelf for potential trawling grounds. The survey was limited to a distance of 20 miles (32.2 km) on either side of the port of Tema. No estimate of stock size was given.
MFRD 1 R/V Research	1969-70	A systematic sampling design was used. In this design, there were five inshore-offshore transects placed at uneven intervals from one another and covering the shelf area of Ghana between 18 and 100 m deep. There was a total of 21 stations on the 5 transects .
MFRD 1B R/V Research	1973-77	A number of survey cruises were undertaken with R/V Research during 1973 - 77. The survey design was basically that of the 1969-70 survey but with some modification in the station location and numbering.
MFRD 2 R/V Kakadiamaa	1979-80	These were the first cruises made with the then newly-acquired fisheries research vessel "R/V Kakadiamaa". The methodology and survey design followed those of the 1973-77 survey.
MFRD A R/V Kakadiamaa	1980	From August 1980, a new sampling design was introduced for the MFRD surveys. In this design, the survey area is bounded by the 1° 10' E and 3° W longitudes and the 15 and 75 m depth contours. The area is divided into 3 zones (E, C and W), 9 strata (I - IX), 10 sectors (Keta, Add, Tema, Accra, Winneba, Saltpond, Cape Coast, Takoradi, Axim and Half Assini) and 40 stations. The upper depth limit was 'moved' to 100 m in later surveys.
MFRD 3 R/V Kakadiamaa	1981-82	This survey was carried out between April 1981 and April 1982 and followed the design of the previous survey. Seven monthly sampling cruises were taken in the Saltpond sector in addition to the 4 cruises made in all 10 sectors.
MFRD B R/V Kakadiamaa	1983-84	In 1983-84, only occasional monthly surveys off Saltpond could be conducted. This is because the MFRD trawl survey programme was beset with technical and operational problems at the time. Planned surveys could not be conducted and only 4-6 hauls were made each month between August, 1983 and December, 1984.
MFRD 4 R/V Kakadiamaa	1987-88	From the same design, 4 quarterly surveys in all ten sectors were conducted between July, 1987 and November, 1988. These were interspersed with monthly surveys in the Saltpond sector.
MFRD 5 R/V Kakadiamaa	1989	A new survey programme that followed the design and methodology of the surveys conducted since 1981. 152 hauls were made between February and December 1989.
MFRD 6 R/V Kakadiamaa	1990	Three complete cruises and 3 monthly ones off Saltpond were undertaken in this programme which covered the period June-November, 1990.
MFRD 7	1991-92	As R/V Kakadiamaa was getting old and was beset with numerous technical problems the trawl survey programme was seriously affected. Between February 1991 and November 1992, 41 trawl hauls were made off Accra, which for operational reasons had been designated the reference sector instead of Saltpond.

**Table 4:** Characteristics of vessels and gears used in the national fishery resources surveys

Vessel	Name	R/V Research (1969-77)			R/V Kakadiamaa (1979-92)
	Total length (m)	22.4			29.3
	Main Engine (hp)	280			700
	GRT	50			173
Gear	Name/Type	Larsen	Engel 1 (with bobbins)	Engel 2 (without bobbins)	Engel (with bobbins)
	Codend mesh (mm)	40	40	40	40
	Wing spread (m)	14.4	16.3	14.2	16.4
	Trawling speed (km hr <sup>-1</sup> )	5.6	5.2	4.8	5.6
	Duration of tow	1 hour	1 hour	1 hour	30 minutes

The objectives of these surveys included the following:

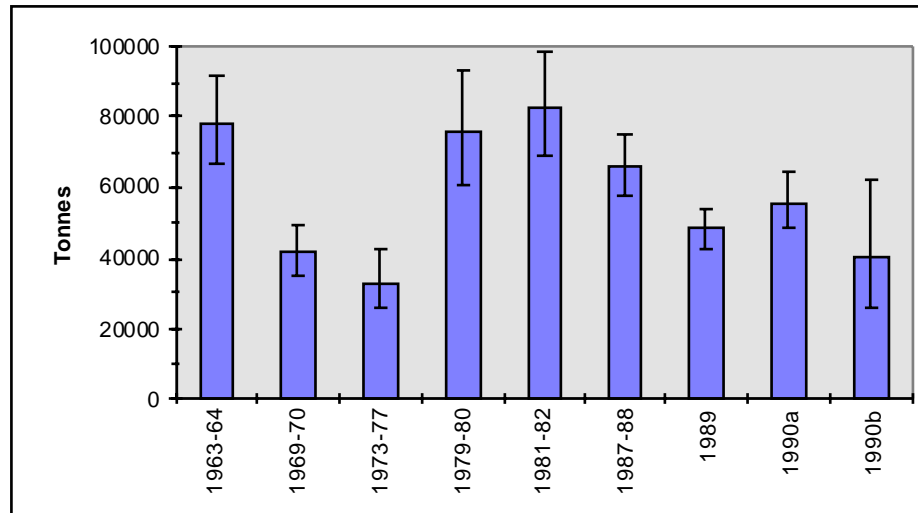
- i. exploration of the continental shelf for potential development of a trawl fishery (Salzen, 1957)
- ii. estimation of total biomass and catch rates (Rijavec, 1980; Koranteng, 1981; 1984)
- iii. monitoring the biomass of fish stocks (Koranteng, 1981; 1984)
- iv. collection of biological data on species of scientific and/or commercial importance (Rijavec, 1980), and collection of data on the marine environment (Rijavec, 1980; Koranteng, 1981; 1984).

In all cases after the survey net had been hauled in, the catch was sorted according to species, following identification keys provided by Blache *et al.* (1970), Fischer *et al.* (1981) and Schneider (1990). Each species was weighed separately and the number of individuals counted or estimated from sub-samples. During the trawl surveys water temperature was obtained from thermometers mounted on Nansen reversing bottles or from a constant sea surface temperature recorder mounted on the vessel. Salinity and dissolved oxygen were determined from the water samples collected with the Nansen bottles. All catch data from the surveys have been inputted into NAN-SIS.

Assessed density (in the indicated depth ranges) from the results of the surveys are summarised in Table 5 and the estimated biomass is depicted in Figure 2.

**Table 5:** Summary (by depth range in metres) of calculated density of the total demersal resource (excluding *B. capriscus*) (kg ha<sup>-1</sup>)

Survey	Year	10-30	31-50	51-100	10-100
MFRD 1	1969-70	10.3	23.3	32.3	20.4
MFRD 2	1973-77	9.8	17.9	22.3	16.0
MFRD 2	1979-80	36.2	41.9	31.9	36.6
MFRD 3	1981-82	37.9	42.9	39.6	40.1
MFRD 4	1987-88	20.1	32.7	48.2	31.9
MFRD 5	1989	19.8	21.2	31.6	23.4
MFRD 6	1990	20.7	28.0	34.3	27.2



**Figure 2:** Estimated total demersal biomass, 1963-1990

In the last 40 years or so, Ghana's fishery resources were subjected to increasing exploitation and suffered decline. Catches became erratic and landed sizes of prime fishes decreased (Mensah and Koranteng, 1988). The national surveys (as well as the international ones) and other studies have documented some changes in the biology and population dynamics of the important small pelagic species, especially *Sardinella aurita*. After the near-collapse of the stock following high landings in 1972, sardinella catches increased again reaching a record high in 1992. The other small pelagic species have been relatively stable in their abundance and distribution.

On coastal demersal fish and fisheries, changes that have been noted include the following:

- dramatic increase in the abundance and landings of triggerfish (*Balistes capriscus*) between 1973 and 1988 (Ansa-Emmim, 1979; Caverivière, 1991)
- increase in the biomass and catch of globefish (*Lagocephalus laevigatus*) and cuttlefish (*Sepia officinalis*); the importance of the globefish was short-lived but the cuttlefish is still prominent in the landings of trawlers (MFRD unpublished data).

## 2.3 Togo

### Fisheries

In Togo, there are two main fisheries, the industrial maritime fishery and the artisanal maritime fishery, both operating all year round. About 3000 fishers work in the fishery sector of whom 700 are master fishermen. Two thousand women also work in the sector, 900 of whom work in the fishing port of Lomé in the processing and marketing of fish products.

The artisanal maritime fishery employs on average 500 monoxyll canoes each year, of a length of between 6 and 18 metres, equipped with bottom gillnets, surface gillnets, shark gillnets, drift gillnets, sliding seine, beach seine and handlines. Of these vessels 47% are divided into the following groups based on the power of the outboard motorised engine: 40HP (84%), 25HP (15%) and 8HP (1%).

The species fished are generally *Engraulis encrasicolus*, *Sardinella maderensis*, *S. aurita*, *Ilisha africana*, *Pseudolithus* spp., Carangidae, Pomadasyidae, Sparidae, etc. Since 1997 only one trawler has been allowed to fish in Togolese waters. This vessel, 24 metres in length and with a 400HP engine, fishes only for part of the year. The species landed are *Brachydeuterus auritus*, *Dentex* spp., *Epinephelus* spp., Sciaenidae, Lutjanidae etc.

Table 6 below shows the national fishery catch for the years 1997-1999.

**Table 6:** National fishery catch (in tonnes)

	1997	1998	1999
Artisanal maritime fishery	9 080	13 806	17 927
Industrial maritime fishery	211	707	PM
Total	9 291	14 513	17 927

### Surveys

Several surveys have been carried out on the Togolese continental shelf since 1959.

The surveys of pelagic fish are shown in Table 7.

**Table 7:** Acoustic surveys in Togo

Vessel	Year	Month	Area covered
Colombia	1959-1960	November (59) - July (60)	Togo, Ghana
R/V Dr. Fridtjof Nansen	1981	August	From Togo to Cameroon
Cornide de Saavedra	1987	September - October (upwelling), July	Liberia, Côte d'Ivoire, Togo
R/V Dr. Fridtjof Nansen*	1999	April - May	Benin, Togo, Ghana and Côte d'Ivoire

\* combined acoustic and bottom trawl survey.

The Colombia survey on tuna fish that took place from 1959 to 1960 (Bane, 1960) revealed the existence of an important bait stock, composed principally of *Sardinella* sp. with some *Trachinotus* sp. and *Scomber japonicus*. The R/V Dr. Fridtjof Nansen survey in 1981 (Strømme *et al.*, 1983) surveying the area between the 10 and 200 m isobaths detected around 6000 tonnes of pelagic fish and 2000 tonnes of demersals. The R/V Cornide De Saavedra survey in 1987 evaluated the biomass of the pelagic stock at 25 000 tonnes and estimated the exploitable stock at 19 000 tonnes a year. This stock is mainly composed of small migratory pelagics.

The demersal surveys carried out are shown in Table 8.

The “Ombango” and “Thierry” surveys in 1963–1964 (Crosnier et Berrit, 1966) made it possible to determine different water masses, the different bottom-types of the continental shelf and about 200 species belonging to several families. The Lomé and Humburg survey of 1972 –1974 (Beck, 1974) was carried out on the continental shelf, which was divided into 38 quadrants spread out over several stations. Sampling was undertaken at irregular monthly intervals at 32 stations located at depths of between 10 and 60 m. The results obtained gave a

biomass of 6700 tonnes of which 4600 tonnes of triggerfish. The results of this survey using commercial fishing vessels are not very reliable due to the unscientific method used. The Fiolent survey in 1976 (Robertson, 1977), consisting of 16 trawls, evaluated the biomass between 25 and 30 metres depth at 3400 tonnes. But the inconsistencies encountered in the available data imply that the results are only marginally reliable.

**Table 8:** Demersal surveys in Togo

Vessel	Year	No. of surveys	Season
Ombango and Thierry	1963-64	5	warm and cold
Lomé and Humburg	1972-1974	1	warm and cold
Fiolent	1976	1	warm
Andre Nizery	1983-1984	7	warm and cold
Susainah	1999	1	warm
Dr. Fridtjof Nansen*	1999	1	warm

\* combined acoustic and bottom trawl survey.

The Andre Nizery survey of 1983 to 1984 (L'Homme, 1985) composed of 7 surveys was carried out using a random stratified sampling scheme. The continental shelf was divided into several strata which were themselves sub-divided into 75 small rectangles of equal size which constituted the sampling units. In each survey 30 of the 75 sampling units were chosen at random. A total of 182 trawls of a duration of 30 minutes each were carried out. Two hundred species were identified on the continental shelf of which 24 are marketable. The principal species found were: *Pseudotolithus senegalensis*, *Galeoides decadactylus*, *Lutjanus goreensis*, *Sepia officinalis*, *Balistes capriscus*, *Epinephelus aenus*, *Dentex angolensis*, *Dentex congensis* and *Smaris macrophthalmus*. The total biomass was 2600 tonnes.

The results of the R/V Dr. Fridtjof Nansen survey is discussed in Chapter 4.

## 2.4 Benin

### Fisheries

In Benin, there are two maritime fisheries, the industrial and the artisanal maritime fisheries.

In the industrial fishery, a dozen boats (trawlers and shrimpers) on average fish the Beninese waters each year. The shrimpers' engine power is between 390 and 503 HP and the trawlers between 190 and 375 HP. The total catch for all the vessels together has varied between 600 and 700 tonnes on average over the last three years. The nominal fishing effort varies between 751 and 1015 days at sea, that is an average of 920 days at sea. The species fished are mainly the demersal species, which account for over 80% of the total catch. The dominant demersal species in the catch are: *Pseudotolithus* spp., *Pentanemus quinquarius*, *Sparus* spp., *Cynoglossus* spp., *Dasyatis* spp., *Soleidae* and *Penaeidae*. The smaller amount of pelagic species caught comprise: Clupeidae, Carangidae, Pomadasidae and Scombridae, etc.



The artisanal maritime fishery is practiced by about 3 800 artisanal marine fishers (1999 survey) using anchored nets, floating nets, shark nets, beach seines, turning seines, sardinella nets and lines. The canoe fleet numbers more than 800 boats of which 375 are equipped with outboard engines of between 6 and 40 HP. The level of motorisation is 46% (381 engines). The number of engines is higher than the number of motorised boats, due to the existence of spare engines. Additionally, in some areas, the motorised boats do not own their own engines and two canoes can take it in turns to use the same engine. The total catch for the artisanal maritime fishery has been on average 9000 tonnes per year over the last three years. Fishing effort is around 75 000 days/canoes. The majority of the species fished are pelagic, 48% against 30% demersal, the remaining 22% which are not sorted, represent the “various”. The main pelagic species are: Clupeidae (sardinellas, razor fish, anchovies), Carangidae, Pomadasydae, Scombridae and Thonidae.

### Surveys

At a national level, two series of demersal surveys have been carried out in Benin: by the French vessel André Nizery in 1985 and 1986 and by the Beninese vessel Le Dauphin from 1991 to 1994 (Table 9).

**Table 9:** Demersal surveys in Benin

Vessel	Year	Number of surveys
André Nizery	1985	1
André Nizery	1986	1
Dauphin	1991	2
Dauphin	1992	2
Dauphin	1993	2
Dauphin	1994	2

The main aim of the national surveys is to evaluate the potential exploitable stock, in order to establish a fishery development and management plan for the Beninese continental shelf. The method used to set the trawl station was random, stratified sampling.

At a sub-regional level, several pelagic surveys and combined demersal/pelagic surveys have been carried out (Table 10). During these different surveys data was collected on the hydrography, sedimentology, topography and living resources of the Beninese continental shelf.

**Table 10:** Pelagic and combined demersal/pelagic surveys at a sub-regional level in Benin

Vessel	Year	Type
PROPAM I	1963 – 1964	Demersal/pelagic
Thierry	1963 – 1964	Demersal/pelagic
Ombango	1963 – 1964	Demersal/pelagic
John Elliot Pillbury	1964	Pelagic
Sera	1965	Pelagic
Soviet – Beninese	1977 – 1978	Demersal/pelagic
R/V Dr. Fridtjof Nansen	1981	Pelagic (acoustic)
Susainah (LME-GOG)	1999	Demersal/pelagic
R/V Dr. Fridtjof Nansen	1999	Demersal/pelagic (acoustic)

### **3. AN OVERVIEW OF REGIONAL RESOURCE SURVEYS IN THE GULF OF GUINEA**

Many international surveys as well as national surveys have been conducted in the region. Both research and commercial vessels were used for these surveys. In this section, we look at the international surveys that have been conducted in the Western Gulf of Guinea sub-region (i.e. Côte d'Ivoire, Ghana, Togo and Benin), especially those focusing on living marine resources.

#### **Surveys before 1900**

Fluctuation in fishery yields in the mid 1880s led national governments to commission studies to determine the causes of the fluctuation. Inter-agency and international expeditions were undertaken to study the problem (Smith, 1988). According to van der Knaap (1985), the earliest recorded scientific expedition in the CECAF region was in 1826-1829 by a vessel called *Astrolabe*. It is uncertain which areas in the region were covered and the purpose of the expedition. Similar expeditions (*Buccaneer* in 1886 and *Challenger* in 1873-1870) followed in the late 1890s and early 1900s but none of these is reported to have covered the waters of the Western Gulf of Guinea until the middle of the twentieth century.

#### **Surveys after 1900**

Assessment of fishery resources in West African waters started with institutions established under colonial administrations. As fisheries in the then colonies were being 'developed' it was found expedient to assess the state of resources in order to take good decisions on exploitation levels and types and size of investment. In English-speaking West Africa, these studies were pioneered by scientists of the West African Fisheries Research Institute (WAFRI), which was based in Freetown, Sierra Leone. L'Office de la recherche scientifique et technique des territoires outre-mer (ORSTOM) - now renamed Institut de recherche pour le développement (IRD) - carried out most of the assessments in the French-speaking area of West Africa. Thus international surveys that were conducted in the pre-independence era (mid-1950s and early 1960s) were regional in nature, but varied due to the Francophone - Anglophone division or some other basis depending on survey objectives and the financiers or nationality of the research vessel.

An important international survey in the region is the Guinean Trawling Survey which was conducted under the auspices of the Scientific Committee of the Organization of African Unity with assistance from US and European governments (Williams, 1968). The objective of the survey was to investigate the potential of demersal fish of the West African continental shelf in relation to the marine environment.

In the post-independence era the surveys tended to be localised and national in nature but also many trans-national and sub-regional surveys were conducted. For example in the Francophone area the vessel *N/O Andre Nizery* owned by ORSTOM worked off Congo, Gabon, Equatorial Guinea, Côte d'Ivoire and Togo at various times following similar survey objectives and scientific methodology.

With the coming into existence of CECAF came promotion of sub-regional and regional surveys. Under the auspices of the CECAF Project, FAO and other bilateral and multilateral initiatives, a number of surveys were conducted in the Western Gulf of Guinea in the early 1960s. Some of these are listed in Table 11.

**Table 11:** Some of the important international surveys conducted in the Western Gulf of Guinea

Year	Vessel	Area surveyed
1952, 1956	Cape St. Mary	Benin, Ghana
1959-60	Columbia	Côte d'Ivoire, Ghana, Togo, Benin
1961	Birkut	Côte d'Ivoire, Ghana
1963-64	Thierry, La Rafale	Côte d'Ivoire, Ghana, Togo, Benin
1963-64	Ombago	Togo, Benin
1969	Thue Jr	Côte d'Ivoire, Ghana, Togo, Benin
1971	President Kennedy	Côte d'Ivoire, Ghana
1973	Capricorne	Côte d'Ivoire, Ghana
1976	Fiolent	Côte d'Ivoire, Ghana, Togo
1981	Dr. Fridtjof Nansen	Côte d'Ivoire, Ghana
1981	Dr. Fridtjof Nansen	Togo, Benin
1986	Cornide De Saavedra	Côte d'Ivoire, Ghana, Togo
1989	Dr. Fridtjof Nansen	Côte d'Ivoire, Ghana
1990	Lagoa Pesca	Côte d'Ivoire, Ghana
1999	Dr. Fridtjof Nansen	Côte d'Ivoire, Ghana, Togo, Benin
1999	Susainah	Côte d'Ivoire, Ghana, Togo, Benin

**What was done**

The surveys have had various objectives. In the early expeditions, the primary objectives were mainly to discover and describe the marine fauna. In succeeding surveys, emphasis shifted towards establishing the ecology of the fish species as well as their distribution and abundance.

The objective of the R/V Cape St. Mary was to explore the continental shelf waters for potential trawling grounds (Salzen, 1957). No estimate of stock size was given. The Columbia surveys looked at assessment of potential for tuna fisheries in the Gulf of Guinea (Bane, 1960). Subsequent surveys looked specifically at resource assessment, re-assessment and monitoring of both environmental and fishery resources in the Western Gulf of Guinea. Whereas some of the surveys were directed towards pelagic species (acoustic surveys), others were for demersal species (bottom trawling) and a few others combined the two.

#### 4. HIGHLIGHTS OF RESULTS OF THE 1999 R/V DR. FRIDTJOF NANSEN SURVEY IN THE WESTERN GULF OF GUINEA

The survey of the Western Gulf of Guinea (Benin, Togo, Ghana and Côte d'Ivoire) was carried out with R/V Dr. Fridtjof Nansen from 19 April to 6 May 1999.

The main objectives of the survey were:

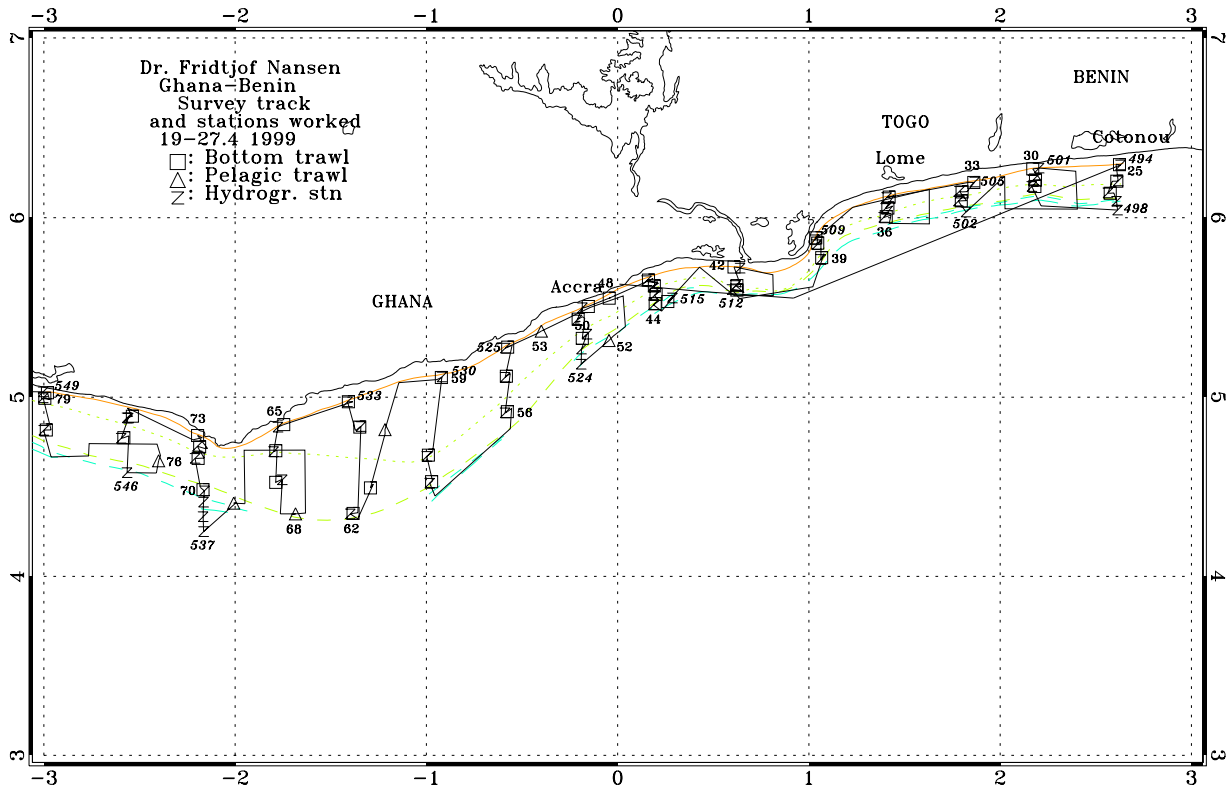
- to map the distribution and estimate the abundance of the main pelagic species
- to describe the distribution, composition and abundance of the demersal fish stocks by a swept-area trawl programme
- to map the general hydrographic regime by using a CTD-sonde to monitor the temperature, salinity and oxygen at bottom trawl stations and some transects
- to sample zooplankton at some bottom trawl stations
- to do on-the-job training on the main survey routines.

Swept-area hauls were carried out on the shelf during day-time within the depth zones 0-30 m, 31-50 m and 51-100 m. In Ghanaian waters a few additional bottom trawl hauls were made in waters deeper than 100 m at night time. Continuous acoustic registration using a SIMRAD EK 500 echo sounder was done throughout the survey. During dark hours an acoustic survey was carried out between the daytime-course tracks and pelagic trawling was carried out for identification of echo traces. Hydrographic stations were taken at locations of bottom trawls. In addition, five hydrographic profiles were made from the surface down to depths of 500m. In Ghanaian and Ivorian waters a few plankton hauls were made at depths from 30 to 50m.

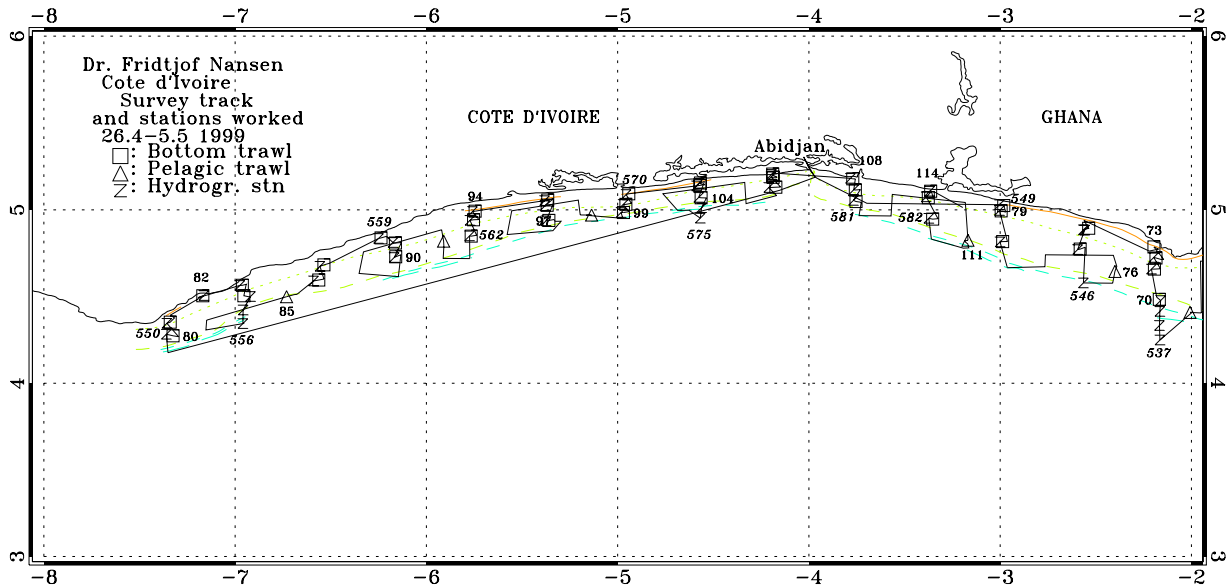
Figure 3 shows the cruise tracks with fishing, hydrographic and plankton stations. Table 12 summarises the survey effort in each sector.

**Table 12:** Number of hydrographic (CTD), plankton (P), pelagic trawl (PT) and bottom trawl (BT) stations, swept-area hauls (interrupted hauls not included) and distance surveyed (nm) by area

Region					Swept-area hauls			Distance surveyed (nm)
	CTD	P	PT	BT	0-30 m	31-50 m	51-100 m	
Benin – Togo	15	-	-	12	4	4	4	300
Ghana	41	4	6	37	10	12	10	955
Côte D'Ivoire	35	4	4	31	9	11	11	810
Total	91	8	10	80	23	27	25	2065



a) Ghana - Benin

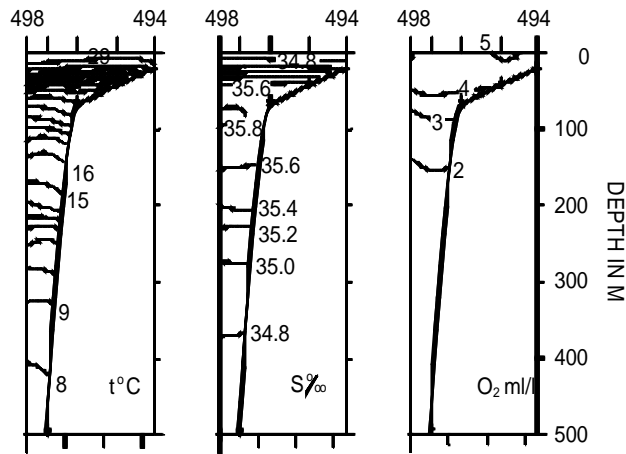


b) Côte d'Ivoire - Ghana

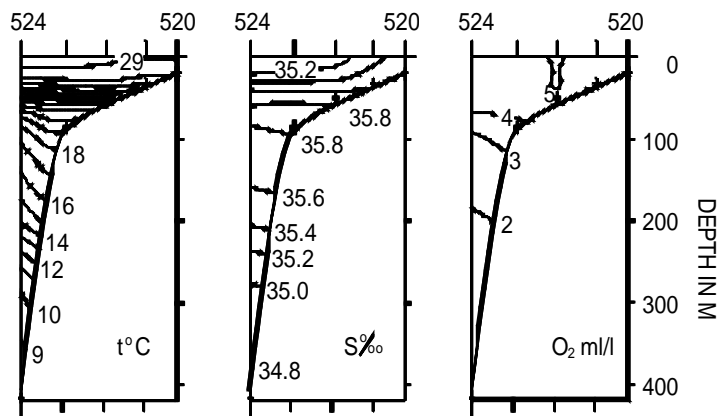
**Figure 3:** Course track with fishing and hydrographic stations for a) Ghana - Benin and b) Côte d'Ivoire - Ghana. Depth contours at 20 m, 50 m, 100 m, 200 m and 500 m are indicated.

### Hydrographic conditions

Small differences were found between the vertical distribution of temperature, salinity and oxygen in the five hydrographical profiles (Figure 4). A thermocline was found between 20 and 60 m depth. The water layers seemed stable with no clear signs of vertical water displacement and upwelling as expected at this time of the year. Dissolved oxygen values ranged between 2 and 5 ml/l.

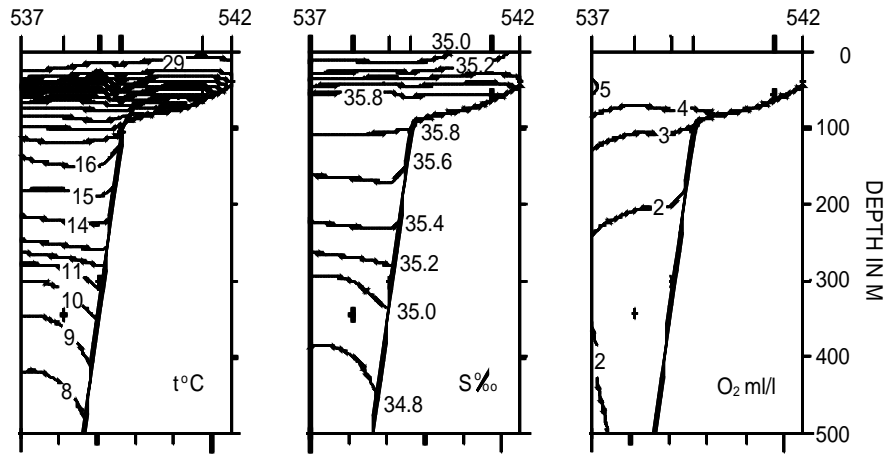


a) Cotonou - 20.4.1999

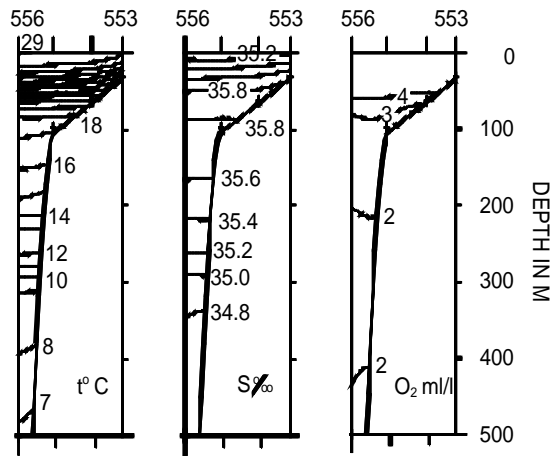


b) Accra - 23.4.1999

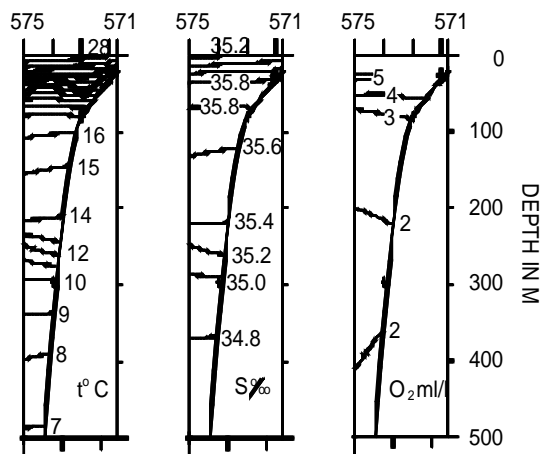
**Figure 4:** Vertical sections of temperature, salinity and oxygen at a) Cotonou, b) Accra, c) Cape Three Points, d) Grand-Bérébi and e) Grand Jacques.



c) Cape Three Points - 26.4.1999



d) Grand-Bérébi - 30.4.1999



e) Grand Jacques - 03.5.1999

**Figure 4 (cont.)** : Vertical sections of temperature, salinity and oxygen at a) Cotonou, b) Accra, c) Cape Three Points, d) Grand-Bérébi and e) Grand Jacques

### Acoustic survey

Estimated biomass of PEL 1 species (sardinellas and anchovies) and PEL 2 species (carangids, scombrids, barracudas and hairtails) are presented in Table 13. Results from previous surveys with R/V Dr. Fridtjof Nansen in the area are given for comparison. Benin - Togo was not covered in 1989.

Pelagic fish were present over large parts of the area, especially the central and western parts. In addition to schools recorded with the acoustic system, pelagic fish also occurred in dispersed distributions. Sardinellas and anchovy dominated on the inner shelf, while carangids, scombrids and barracudas were more widely distributed over the entire shelf. Triggerfish (*Balistes capricus*) was found only at a few stations in each area. In Ghana the biomasses estimated in this survey are similar to those estimated in 1989 and about twice the 1981 estimates. In Côte d'Ivoire the total biomass of sardinellas and anchovy was much higher in the present survey than in 1989 but at the same level as in 1981, while the PEL 2 biomass was slightly lower than in 1989 and much higher than in 1981. The total biomass of pelagic fish in the Ghana-Côte d'Ivoire area has increased by almost 80 % since 1981, mainly due to an increase in the biomass of carangids. This increase may be related to the decrease in the stock of triggerfish, from 500 000 tonnes in 1981 to 140 000 tonnes in 1986 and almost nothing in 1989 and 1999. Carangids were found distributed over the whole shelf area, which corresponds to the distribution area of the triggerfish.

**Table 13:** Acoustic biomass estimates of main pelagic groups (tonnes) a) Sardinellas and anchovies (PEL 1) and b) carangids, scombrids, barracudas and hairtail (PEL 2) from surveys with R/V Dr. Fridtjof Nansen off Côte d'Ivoire, Ghana, and Benin-Togo in June 1981, October 1989 and April/May 1999. Note that Benin-Togo was not covered in 1989.

#### a) Sardinellas and anchovies (PEL 1)

Survey year	Survey period	Côte d'Ivoire	Ghana	Benin - Togo	Total
1981	June	39 000	40 000	*	79 000
1989	12 - 20.10	6 000	41 000	not covered	47 000
1999	19.4 - 8.5	42 000	40 000	5 000	82 000

#### b) Carangids, scombrids, barracudas and hairtail (PEL 2)

Survey year	Survey period	Côte d'Ivoire	Ghana	Benin - Togo	Total
1981	June	2 000	10 000	*	12 000
1989	12 - 20.10	33 000	57 000	not covered	90 000
1999	19.4 - 8.5	30 000	50 000	4 000	80 000

\* The estimated biomass for pelagic species (PEL 1 + PEL 2) was 14 000 tonnes.



### Bottom-trawl survey

As the composition of the fish fauna on the continental shelf and slope of the Western Gulf of Guinea changes with depth, the catch-distribution analyses were performed for the inner (0-50 m) and outer shelf (51-100 m). In the analyses the “Demersal” group comprises commercially important families as Sciaenidae, Haemulidae (=Pomadasydae), Serranidae, Sparidae and Lutjanidae, while the “Pelagic” group includes Engraulidae, Clupeidae, Carangidae, Scombridae, Sphyraenidae and Trichiuridae (the latter family is actually mainly benthopelagic). For the different analyses the “other” group includes all species not accounted for in the groups listed. The content of “other” will therefore change from table to table.

In the swept-area biomass estimates, only the shelf area down to depths of 100 m was included, divided into 0 - 30 m, 31 - 50 m and 51 - 100 m. The catch rates of valuable demersal groups and a few other common groups in the three regions covered during the present survey, are summarized in Table 14.

**Table 14:** Catch rates (kg/h) of valuable demersal and some other groups in swept-area bottom-trawl hauls on the shelf (0 - 100 m) off Benin - Togo, Ghana and Côte d'Ivoire

Group/species	Benin – Togo	Ghana	Côte d'Ivoire
Sea breams	19.1	24.1	25.3
Grunts	0.9	7.1	6.0
Croakers	4.6	0.7	9.5
Groupers	10.3	2.5	2.5
Snappers	0.3	0.7	2.3
<b>Sum dem. val.</b>	<b>35.1</b>	<b>35.1</b>	<b>45.6</b>
Bigeye grunt	5.5	213.4	91.9
Carangids	37.0	33.3	62.2
Barracudas	6.3	5.9	13.2

The highest overall catch rate of valuable demersal fish was in Ivorian waters of 45.6 kg/h, and consisted mainly of sea breams and croakers. The corresponding rate in the Ghana and Benin-Togo sectors was around 35 kg/h in each sector, with sea breams and grunts as major groups in the Ghana catches and sea breams and groupers in the Benin-Togo catches.

Of the separate species groups, the highest catch rate of sea breams was in Côte d'Ivoire (25.3 kg/h), followed by Ghana (24.1 kg/h) and then Benin-Togo (19.1 kg/h). The catch rate of snappers showed the same trend between the sectors. The Benin-Togo sector had the highest catch rate of groupers, being over four times higher than the rate in Ghana and Côte d'Ivoire. For grunts and the bigeye grunt (*B. auritus*) catch rates were highest in Ghanaian waters, 7.1 kg/h and 213.4 kg/h respectively. The corresponding rates were 6.0 kg/h and 91.9 kg/h for Côte d'Ivoire, and 0.9 kg/h and 5.5 kg/h for Benin-Togo. Carangids and barracudas were most abundant in the Ivorian sector followed by the Benin-Togo sector and least abundant in Ghanaian waters.

Generally, in all three sectors the bottom conditions beyond 100 m depth were not suitable for trawling. However, two hauls were made east of Tema (Ghana) and appreciable catch rates were obtained for deep-water sharks (e.g. *Centrophorus squamosus*), sea breams (*Dentex congouensis* and *D. angolensis*) and deep-water shrimps (e.g. *Parapenaeus*

*longirostris*). Considering the limited area available for trawling beyond the 100 m depth, it appears unlikely that a viable deep-water fishery can exist in the Western Gulf of Guinea. However, a better coverage is needed in order to reach a solid conclusion on this matter.

The biomass estimates (tonnes) of valuable demersal and some other groups, are given in Table 15 for each of the three sectors covered in this survey. The shelf area in each sector is also given.

**Table 15:** Biomass estimates (tonnes) of valuable demersal species and some other groups

<b>Group/species</b>	<b>Benin – Togo</b>	<b>Ghana</b>	<b>Côte d'Ivoire</b>	<b>Total</b>
Sea breams	823	8 478	4 338	13 639
Grunts	59	1 431	417	1 907
Croakers	280	125	941	1 346
Groupers	312	557	305	1 174
Snappers	22	151	145	318
<b>Sum dem. val.</b>	<b>1 495</b>	<b>10 743</b>	<b>6 147</b>	<b>18 385</b>
Bigeye grunt	171	70 314	9 913	80 398
Carangids	1 143	6 860	5 477	13 480
Barracudas	246	1 084	811	2 141
Area (nm <sup>2</sup> ) 0-100m	1 092	6 227	2 883	10 202

## **5. COMMENTS ON THE SURVEY DESIGN AND PLANNING OF THE YEAR 2000 R/V DR. FRIDTJOF NANSEN SURVEY**

The year 2000 R/V Dr. Fridtjof Nansen combined acoustic and bottom-trawl survey in the Western Gulf of Guinea took place from 29 August to 17 September. A total of 12 scientists from the region participated in the survey, two each from Côte d'Ivoire, Benin and Togo and four from Ghana<sup>2</sup>. Four Norwegian scientists (including the cruise-leader) and one staff-member from FAO Fisheries Department also participated. The list of survey participants is attached as Appendix III.

During the pre-survey meeting in Tema, the 1999 survey design and survey report were discussed as well as the objectives and general strategy for the upcoming survey. A summary of the discussions is provided below.

### **Comments on the 1999 survey report**

As a general comment on the 1999 survey report, it was noted that the report at present is only available in English. The representatives from Togo, Benin and Côte d'Ivoire pointed out that this is a constraint for their countries. It was explained that due to lack of personnel at IMR, Bergen, there has been a backlog in the finalisation of survey reports and for this reason the preliminary English version is still not finally edited and therefore not yet translated. However the report is soon to be finalised, published and translated into French. A revised version of the survey report was distributed to the participants and the final version will be sent to them as soon as it is finalised. It was noted that it is desirable that a French version of the 2000 survey report should be made available as early as possible.

<sup>2</sup> Due to illness, one of the scientists from Côte d'Ivoire was later replaced by a Ghanaian scientist

The scientists from Benin and Togo requested that the results from the 2000 survey should be treated and analysed separately for the two countries and not together as was done in the 1999 report. In this way the survey results would be more useful to the two countries. It was explained that the reason why the information was treated together in 1999 was that with the decided 24 nm distance between transects, three transects were sampled in Benin and only one in Togo (due to the short coastline) hence making too few trawl hauls in each depth interval to make separate estimates. It was therefore suggested to attempt to decrease the inter transect distance in this area, allowing for 3 transects in Benin and 2 in Togo to accommodate the request of the two countries.

One of the meeting participants noted that the sea surface temperature during the 1999 survey at, for example, Grand-Bérébi was 29°C. The 2000 survey will be undertaken during the upwelling season and hence differences can be expected in the catches as well as hydrographic conditions as compared to 1999. In the upcoming survey, temperatures of around 20-21°C can be expected and a shallower thermocline. The temperature will probably not be as low as 18-19°C as there is evidence of a weak upwelling. Côte d'Ivoire and Ghana highlighted the importance of the survey with regards to the abundance and distribution of the small pelagic species, particularly anchovy and sardinella which is greatly influenced by the upwelling. In Ghana the catch of anchovy is also an important factor for the tuna fishery. The status of the triggerfish is another question that is of great concern to the countries in the region.

### **Objectives**

During the discussions on survey objectives, one representative from the industry expressed a wish to extend the coverage of the surveys to include depths of more than 100 m. This was supported by the representatives of the Directorate of Fisheries in Ghana and the Marine Fisheries Research Division. At present there is a high demand for information concerning deep-water resources off Ghana, but little information exists on these resources. The scientists from Benin, Togo and Côte d'Ivoire stressed that for them it was more important that the present survey should cover the same area and same resources as last year.

It was also noted that fishing in waters deeper than 100 m is very expensive and not likely to be commercially viable. The cruise leader also noted that, for comparison, it would be good to keep the same survey objectives as in 1999 and to cover the same resources. However, time permitting, deep hauls could be added to the survey to obtain some of the information needed.

The meeting agreed to maintain the same objectives as in 1999 with the possible inclusion of some deep-water stations.

## **6. CONCLUSIONS AND RECOMMENDATIONS**

### **General**

As almost all the countries in the sub-region do not have any suitable fishery research vessels of their own, surveys like that by R/V Dr. Fridtjof Nansen are a welcome contribution to the knowledge and assessment of marine fishery resources. The international surveys allow to facilitate comparability of stocks under various national jurisdictions and to facilitate the assessment of stocks that are shared by one or more countries. In addition to contributing to the knowledge of the fisheries, these surveys also serve as a forum for cooperation and

exchange of information in marine research for the scientists in the sub-region. It was noted however, that the frequency of such surveys do not allow effective monitoring of the resources in view of the increasing rates of exploitation of the resources of the sub-region.

### **The year 2000 survey**

The two previous international surveys carried out in the Gulf of Guinea in 1999 by R/V Dr. Fridtjof Nansen and the Susainah were both carried out during the non-upwelling period. It was therefore appreciated that the 2000 Nansen survey is to be carried out in the upwelling season.

The meeting agreed to maintain the same survey objectives as in 1999. However, given that there is a high demand for information concerning deep-water resources off Ghana, but little information exists, it was agreed to attempt to include some deep-water stations.

Benin and Togo expressed the view that the survey results would be more useful to the two countries if the results were to be treated and analysed separately and not together as was done in the 1999 report. It was therefore recommended to attempt to decrease the inter transect distance in this area, allowing for 3 transects in Benin and 2 in Togo to accommodate the countries' request.