JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

REPUBLIC OF NAMIBIA
MINISTRY OF FISHERIES AND MARINE RESOURCES

BASIC DESIGN STUDY REPORT ON PROJECT FOR BUILDING A FISHERIES RESEARCH VESSEL IN REPUBLIC OF NAMIBIA

NOVEMBER, 1992

OVERSEAS AGRO-FISHERIES CONSULTANTS CO., LTD.

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PREFACE

In response to a request from the Government of Namibia, the Government of Japan decided to conduct a basic design study on the Project of Building A Fisheries Research Vessel and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Namibia a study team headed by Akira Kuroiwa, Senior Fishing Boat Inspector, Fishing Boat Division, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries and constituted by members of Overseas Agro-Fisheries Consultants Co., Ltd., from August 23rd to September 10th, 1992.

The team held discussions with the officials concerned of the Government of Namibia, and conducted a field survey at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Namibia in order to discuss a draft report, and the present report was prepared.

I hope that this report will contribut to the promotion of the project 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 Namibia for their close cooperation extended to the teams.

November 1992

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

November 1992

Mr. Kensuke Yanagiya,
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project of Building A Fisheries Research Vessel in the Republic of Namibia.

This study has been made by Overseas Agro-Fisheries Consultants Co., Ltd., based on a contract with JICA from July 22th to November 30th 1992. Throughout the study, we have taken into consideration the present situation in Namibia and have planned the most appropriate project in the scheme of Japan's grant aid.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, the Fisheries Agency. We also wish to express our deep gratitude to the official concerned of the Ministry of Fisheries and Marine Resources for their close cooperation and assistance during our study.

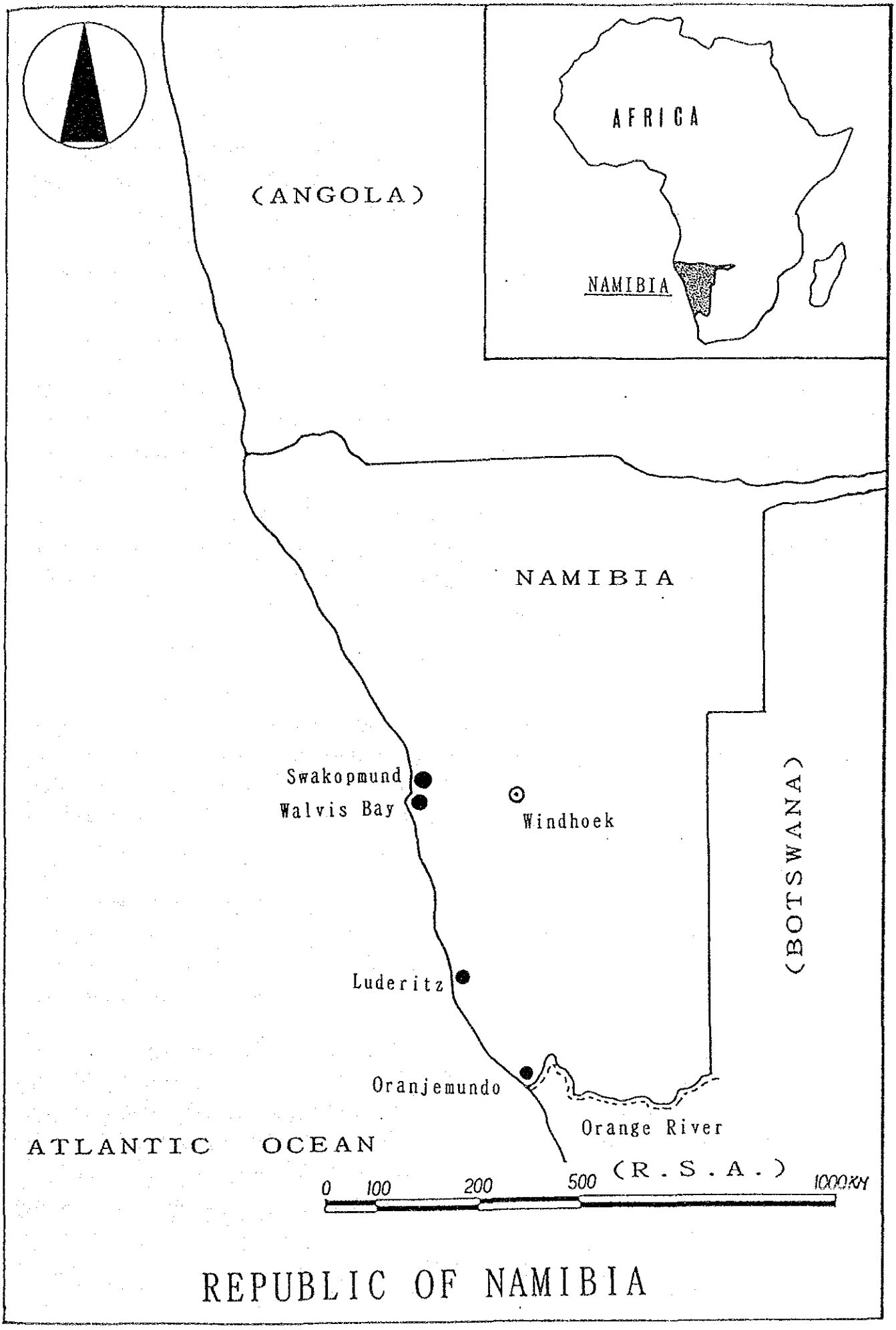
At last, we hope that this report will be effectively used for the promotion of the project.

Very truly yours,

Overseas Agro-Fisheries Consultants Co., Ltd.

T. Kanno

Team leader, Tsuyoshi Kanno
Basic design study team on the Project of
Building A Fisheries Research Vessel



REPUBLIC OF NAMIBIA

SUMMARY

The Republic of Namibia is located in southwestern Africa and borders the Atlantic Ocean to the west. It has a long coastline of some 1,570 km and a continental shelf area (up to 200 m deep) of approximately 110,000 km^2. The coastal and offshore sea of Namibia experiences strong upwelling due to the Benguela Current with a high level of primary production which is almost as productive as that of the upwelling area created by the Peruvian Current, the most representative upwelling fishing ground in the Pacific. Typical fish caught off the Namibian coast are pilchards, anchovy, horse mackerel and hake.

Fishery resources are one of the most important resources for Namibia and efficient utilization of these resources is essential for the future development of the Namibian economy. There is, however, concern regarding the depletion of fishery resources due to reckless over fishing by fleets from many countries over a long period of time prior to Namibia's independence. Introduction of appropriate measures to concerve fishery resources is long overdue. Immediately after independence, the Government of Namibia introduced a 200 nautical mile exclusive economic zone (EEZ) together with measures concerning fishing permits, fishing quotas, fishing periods and fishing grounds, all of which are designed to control fishery operations and aim to restore fishery resources in a sustainable manner.

As the Government of Namibia believes that it is equally important to conduct constant research surveys on fishery resources in order to achieve efficient, sustainable fishing, it has prepared a project plan for the construction of a new fisheries research vessel (the Project) to replace R/V "Benguela", the existing 24 year old research vessel which is not fully functional due to general deterioration. It thus asked the Government of Japan to provide a grant aid for the Project.

In response to this request, the Japan International Cooperation Agency (JICA) sent a preliminary study team to Namibia for the period between March 31st and April 20th, 1992 to confirm the necessity of the Project and also the suitability of the Project for grant aid cooperation provided by the Government of Japan.

Based on the positive findings of the Preliminary Study, the Government of Japan further decided to conduct a basic design study for the Project and, JICA sent a basic design study team to Namibia between August 23rd and September 10th, 1992 to discuss the project and contents of the Namibian request, to confirm the local set-up for project implementation, to study the current conditions of the Benguela (existing research vessel) and to hold technical consultations on the specifications of the requested research vessel.

Following the study and design work in Japan after the survey, JICA sent a team to Namibia for the period between November 14th and 20th, 1992 to explain the draft report and the basic design of the vessel.

The executing agent of the Project is the Directorate of Resources Management (DRM) under the Ministry of Fisheries and Marine Resources (MFMR). The DRM is responsible for the supplying of basic information and data on resources and the planning of fishery control measures in order to allow effective utilization of the commercial fish resources. The DRM has marine resources research centres at Swakipmund and Luderitz, and currently employs 48 people. It is trying to consolidate its research capability through the recruitment of new research staff and the improvement of its physical facilities.

As part of its overall research, the DRM has been operating the R/V Benguela since the end of 1990 with technical cooperation of several foreign governments, in particular the Icelandic government. The main thrust of the research is assessment of the biomass of small pelagic fish, including pilchards, using acoustic equipment. However, due to general deterioration of the R/V Benguela and its research equipment, it has been impossible to conduct R/V surveys on other important commercial species such as horse mackerel and hake.

The new research vessel planned under the Project will replace the age Benguela and will be designed to assess the biomass of pelagic fish (such as pilchards and horse mackerel), bottom fish (mainly hake) and crustaceans (mainly red crab) in Namibia's Exclusive Economic Zone (EEZ).

In Japan, the Study Team first, examined the original request, the findings of the Preliminary Survey and the proposed purposes and functions of the requested vessel and prepared a draft design for the requested vessel. This draft design of the vessel was then discussed by the Study Team and the DRM. The comments and requests made by the DRM during these discussions were further examined and the necessary modifications were made to the draft design to complete the basic design. The principal specifications of the planned vessel in the basic design are given below.

Vessel Type:	Long forecastle, single deck stern trawler
Length:	Approx. 47.2m
Moulded Breadth:	Approx. 8.3m
Moulded Depth:	Approx. 4.0m
Gross Tonnage:	Approx. 485 tons
Speed:	Approx. 11.5 knots
Main Engine Output:	Approx. 1,400HP

Fish Hold Capacity:	Approx. 51m^3 including a freezing room
Fuel Tank Capacity:	Approx. 150m^3
Fresh Water Tank Capacity:	Approx. 50m^3
Complement:	28 persons
Fishing Apparatus:	Bottom/midwater trawling gear
Survey Equipment:	Acoustic survey equipment, marine research equipment
Fishing Nets:	Bottom trawling net, midwater trawling net

The DRM has been responsible for the operation of the "Benguela" and, therefore, has not only experience of operating a research vessel but also the ability to smoothly implement the Project. The initial operation of the new vessel by the crew of the Benguela has been planned. The DRM has been training the crew members to operate a research vessel with the technical cooperation of the Icelandic government, but further efforts will be required for the successful outcome of the Project since special budgetary appropriation has been secured in order to cover the operation cost of the new vessel, this does not seem to be a problem.

The period required to build and deliver the planned vessel to the Namibian side is estimated to be some 13 months after the conclusion of the Exchange of Notes (E/N) between the two governments.

The implementation of the Project is expected to improve the efficiency of fishery resources surveys in Namibia and to contribute to the optimal protection and utilization of fishery resources, which in turn will lead to the promotion and development of fisheries in the newly born Namibia. The provision of grant aid cooperation for the Project by the Government of Japan is, therefore, deemed to be both highly appropriate and significant.

The following recommendations are put forward to make the new vessel effective and to ensure the above mentioned effects.

(1) Increase of crew's capacity

The crew members of the new vessel shall be well versed in seamanship and posses sound fishing skills. In addition to the transfer of the experienced crew now working on "R/V Benguela" to the new vessel, together with Icelandic experts, the MFMR should make efforts to strengthen the crew's capacity including i) recruitment of well

experienced and qualified seamen, ii) improvement of working conditions of the crew and iii) education of the crew.

(2) Maintenance

Besides the training and education of the crew, the maintenance system with on-shore facilities should be improved. The MFMR has to establish a reliable maintenance system with a well-experienced and qualified marine supervision and simplified procedures so as to provide prompt and adequate technical support to the vessels.

(3) Reinforcement of research vessels

The new vessel is mainly designed to conduct fishery resources survey by trawling and acoustic surveying. For the consolidation of the MFMR's research capability, it may be desirable in future to introduce other vessels which are suitable for the surveys in shallow waters and basic research in the fields of marine biology and environment.

(4) Consolidation of Research Facilities Linked with the Research Vessel

The present Project will introduce the planned research vessel with several laboratories in view of the recognized importance of basic research in marine biology and environment. The scope of the surveys and experiments suggested by the DRM, however, is beyond the capability of marine research vessel and improvement of research facilities and also should be taken into account improved linkage between the planned vessel and the onshore research facilities.

(5) Strengthening of Resources and Fisheries Control System

The Project will contribute to the establishment of better control of fishing operations. In order to be effective, it is also indispensable for the MFRM to strengthen the fishing control system including surveillance in order to achieve effective implementation of the fishing policies and regulations.

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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The Government of Namibia believes that promotion and development of the fisheries sector through appropriate resource management is one of the most important policy objectives for the country and has been attempting to consolidate its fishery research capability. As part of these efforts, the Government of Namibia has prepared a project to construct a new research vessel (the Project) and has requested the Government of Japan to provide a grant aid for the Project.

In response to the above request, the Japan International Cooperation Agency (JICA) sent a preliminary study team to Namibia for the period between March 31st and April 20th, 1992 which confirmed the necessity of the Project and also the suitability of the Project as a grant aid project of the Government of Japan.

Based on the positive findings of the preliminary study team, the Government of Japan further decided to conduct a basic design study for the Project. Commissioned by the Government of Japan, JICA sent a basic design study team to Namibia for the period between August 23rd and September 10th, 1992 to discuss the background of the request, the contents of the Project and the specifications of the proposed research vessel with the Namibian side.

On its return to Japan, the basic design study team analyzed the collected data and contents of the discussions and prepared the optimal Basic Design for the research vessel to be constructed under the Project. And after the design work, JICA sent a team to Namibia for the period between November 14th and 20th, 1992 to explain the draft report an the basic design of the vessel.

The present report compiles the contents of the basic design, field survey results, project evaluation results and recommendations in relation to project implementation. A list of the study team members, list of Namibian Government officials and others interviewed, field survey schedule and the Minutes of Discussions are given in the Appendices at the end of this report.

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 Republic of Namibia

The Republic of Namibia (Namibia) was placed under a mandate of the League of Nations in 1920. After the subsequent period of UN trusteeship, it finally became independent in March, 1990 with the endorsement of the independence procedure for Namibia by the UN in 1978.

Namibia is located in the southwestern part of the African Continent between 17°S and 29°S and faces the Atlantic Ocean. It has a land area of 823,000km^2 which is approximately 2.2 times larger than Japan. Its entire coastal area consists of the 80-120km wide belt-like Namibia Desert while the central plateau of upto EL 2,000m occupies half of the national land. The lowland in the northeast and southeast form part of the Kalahari Desert. A desert to semi desert climate, therefore, generally prevails throughout the country.

The estimated population in 1990 was approximately 1.76 million with a population density of 2.1/km^2 and an annual population growth rate of 3.1%. One third of the population lives in urban areas.

It's main industry is mining mainly uranium and diamonds, followed by agriculture (extensive stock farming). Mining accounted for some 20% of the gross domestic product (GNP) in 1991 with 5.41 billion rands. The government of Namibia regards mining, agriculture and fisheries as the three main pillars of the country's future economic development. In the field of fisheries, a 200 nautical mile EEZ has been declared to control fisheries operations.

More than 80% of imports originate from South Africa and major enterprises in the mining and banking industries are subsidiaries of South African enterprises, underlining the strong economic ties with South Africa. Exports are heavily dependent on mining products such as diamonds and uranium ore (accounting for some 75% of the total export value) and livestock such as cattle and karakul sheep. Since independence, however, efforts have been in progress to diminish the dependence on mining products, of which prices tend to fluctuate, and to enlarge the GNP by promoting fisheries. The Government of Namibia is encouraging private investment. An investment act was adopted and a private investment conference convened. In addition, the development of oil and natural gas resources is being given serious attention.

The first national development plan since independence was approved by the Namibian cabinet in April, 1992. The basic premise of the plan is to obliterate poverty through continuous economic growth and the plan specifies 4 targets for its 1992-1994 period.

i) Annual economic growth rate of 3%.

ii) Creation of 13,700 new jobs.

iii) Reduction of income disparities.

iv) Improvement of the poverty situation among the population through employment and better social services.

The strategy to achieve these targets consists of the following components.

i) Development of the private sector, including the fishing industry.

ii) Development of agriculture and rural areas.

iii) Creation of employment opportunities.

iv) Consolidation of education and training.

v) Improved health care and social services.

2.2 Fisheries in Namibia

(1) History and Current Conditions of Namibian Fisheries

Prior to independence, fishing grounds off the Namibian coast were under the control of the South African Government for conservation and management of fishery resources. While South African fishing companies operated along the coastal zone to catch small pelagic fish as anchovy and pilchard, the fishing boats of member countries of the International Commission for Southeast Atlantic Fisheries (ICSEAF) were engaged in the trawling of hake and horse mackerel in offshore areas under the supervision of the ICSEAF.

* The ICSEAF was founded on October 23rd, 1968 with 17 member states, including Japan, and the Treaty for the Conservation of Biological Resources in Southeast Atlantic was concluded on October 24th, 1974. ICSEAF ceased the functioning in 1990 following the establishment of the Namibian Exclusive Economic Zone.

South Africa declared a 200 nautical mile EEZ in 1977, and in 1980 a zone was declared for Namibia by the Administration General for Namibia. Not being an independent country, the declaration of the zone was ignored by the international

community. Consequently, fishing grounds off the Namibian coast were fished by foreign fishing fleets while Namibia itself only benefited marginally from the rich fishery resources.

The Government of Namibia declared a 200 nautical mile EEZ on June 10th, 1990 following the country's formal independence. Prior to the independence, an official letter dated March 8th, 1990 was sent to the ICSEAF requesting all fishing boats belonging to member countries of the ICSEAF to cease fishing within 200 nautical miles of the Namibian coast by the end of March, 1990. In response to this request, the trawlers of most countries, with the notable exception of Spanish boats, left the specified area. Japanese crab fishing vessels were singled out by Namibia in their request and was allowed to proceed with catches.

The declaration of an EEZ gaves Namibia the right to control her marine resources in the zone and the responsibility of the proper management of such resources. The Government of Namibia is now obliged to implement a rational management policy and efficient use of the resources. It therefore follows that, in accordance with the spirit of the UN Convention on the Law of the Sea, national resources must be protected and wisely managed for the benefit of present and future Namibian generation. Surplus resources in future is to be made available to foreign fishing boats wishing to utilize such resources.

(2) Fishing Grounds Off the Namibian Coast

Namibia has a long coastline of some 1,570km and a continental shelf area (upto 200m deep) of some 110,000km^2. The width of the continental shelf varies from 30n.mile to 120n.mile with particularly wide areas off the Cape Cross-Walvis Bay area and the river mouth of the Orange River. The sea area off the Namibian coast is one of the best fishing grounds in the world, as a result of upwelling created by the mixed impact of the Benguela Current which runs north along the coast and the prevailing southwest wind. The primary productivity in the upwelling area is estimated to be 278×10^6 tons/C/year. It far exceeds the primary productivity of the upwelling area (155×10^6 tons/C/year D.H.Cushing, 1969 estimate) in the Peru Current, which is one of the main fishing grounds in the Pacific.

The combination of a large basic productive capacity and a low oxygen content in the deep sea has created a marine structure with excellent fishing grounds. Pelagic fish e.g. horse mackerel and pilchards for purse seine fishing abounds off the coast around Walvis Bay and around the northern Namibia upwelling area. To the north of the western upwelling area where the Benguela and Angola currents meet are good

midwater trawling grounds for horse mackerel. Bottom trawling grounds are situated outside the low oxygen area where hake (Merluccius capensis, Merluccius paradoxus) and other good quality white meat fish are caught. Lobster fishing grounds are located in the Luderitz area and deep sea red crab is found to the north of the Cape Cross in relatively deep water. Further out, migrating tuna are attracted by the abundant food.

(3) Outline of Namibian Fisheries

Because of the desert on the coast, the coastal population is concentrated in Walvis Bay, Swakopmund, Luderitz and several tiny villages. Unlike many other coastal states in Africa, Namibia does not have artisanal fisheries conducted by population in coastal areas.

The only two ports along the 1,570km coastline Walvis Bay* and Luderitz. All fishing operations in Namibia are based in one of these ports and the fishing boats are owned by companies or individuals. The main types of fishing are purse seine fishing for small pelagic fish such as horse mackerel and pilchard and bottom/midwater trawling for hake and horse mackerel, cage fishing for lobster / crab and bottom long line fishing for hake and kingclip, etc. Bottom / midwater trawling, longline, lobster and tuna fisheries operate out of Luderitz, whilst the purse seine fleet, the horse mackerel targeting midwater trawlers and the bulk of the hake trawlers operate out of Walvis Bay.

* Port Walvis Bay is located almost at the centre of the Namibian coastline (22°59'S and 14°30'E), some 400km by road from Windhoek (Namibia's capital), and plays an important role as the country's leading commercial and fishing port. At present, the enclave is jointly controlled by the Namibian and South African Governments.

The number of people working in the fisheries sector is approximately 3,000 and their distribution by type of fishing and the corresponding number of fishing boats is shown below.

(1992)

Type of Fishing	Size of Workforce	No. of Fishing Boats	Boat Length (m)	Gross Tonnage
Lobster Fishing	387	21	7-21	3-98
Purse Seining (Pelagic Fish)	380	38	21-48	98-560
Bottom Trawling	2,000	90	20-87	66-1,600
Angling	120	15	15-23	35-99
Bottom Long Lining	75	5	7-18	3-64
Crab Fishing	75	3	49-56	380-440
Tuna Pole and Line Fishing	120	12	20-37	90-250

Source: Directorate of Resources Management

(4) Catch

The main fishing grounds off the Namibian coast were firstly developed in the 1940's and many South African companies and cooperatives were engaged in the production of canned pilchards, fish meal and fish oil at Walvis Bay. South Africans developed lobster fishing at Luderitz in the 1970's. The annual catch of pilchards increased from the half million ton level in the early 1960's to nearly 1.4 million tons in 1968 due to the efforts of South Africans. The excessive fishing, however, depleted the pilchard resources and the catch drastically dropped to some 50,000 tons in the late 1970's. Meanwhile, the annual catch of bottom fish, mainly hake, increased from some 350,000 tons around 1965 to 820,000 tons in 1973 because of the involvement of foreign trawler fleets but then declined to the 300,000 ton level up until independence.

1) Small Pelagic Fish

The total catch of small pelagic fish was 475,000 tons in 1987, three times higher than the total catch in 1984 and recording an all time high in the 10 year period. In 1989, the catch of both anchovies and horse mackerel declined while the catch of pilchards hit its highest level since 1970. The total allowable catch (TAC) of pilchards in 1989 increased to 50,000 tons from the previous 40,000 tons but dropped back to 40,000 tons in 1990. It is presently slowly on the increase.

2) Demersal Fish

The offshore fishing of hake is the main component of bottom sea fishing off the Namibian coast. Most of the catch is landed by trawling. The hake caught off the Namibian coast is similar to the European Merluccius (Merluccius merlucious) and attracts much attention in view of its substitution potential for the depleted European Merluccius resources which used to be found off the British and French coasts. Catches of hake off Namibia immediately prior to independence approximately 300,000 - 400,000 tons annually, of which 10,000 - 30,000 tons was landed in Namibia.

3) Lobsters

Lobsters are caught along the 380km length of coastline in southern Namibia between 25°S and 28°50'S. Luderitz is used as the base and cage and ring nets are used. The legal fishing season is between November and April. Within this season certain areas are opened or closed for fishing for certain period on scientific recommendations.

At present, more than 97% of all lobsters caught is exported, in whole cooked form, to Japan. Small amount goes to France as live lobster. The TAC in 1987/88 was 2,000 tons. The catch has continuously declined, from a peak of 2,568 tons in 1983 to 1,360 tons in 1987 and further to 100 tons in 1991. The decline has hopefully now stopped and it is foresee that the TAC will steadily increase again in future.

4) Red Crabs

Red crabs are generally found throughout the Atlantic and 4 species (Geryon marinate and Geryon quinquedens) are caught commercially. The habitat of Geryon maritae spreads along the Atlantic coast of West Africa, i.e. from the western Sahara to Namibia. The area from Cape Cross to the Angola-Namibia border with a sea depth of 300-900m provide the most important red crab fishing grounds. A recent study estimates some 20 million red crabs of a commercially viable size to be present in these areas.

Red crab fishing along the Namibian coast was first introduced by Japanese fishing boats in 1973 and at present about three Japanese boats fish with crab cages in the area.

Red crab fishing is conducted throughout the year. The catch in 1983 was 10,000 tons but declined to 7,000-8,000 tons in 1986, showing signs of overfishing. A survey by the Fisheries Research Institute in Cape Town registered a decline in CPUE (catch per unit effort) of some 26% for the period between 1981 and 1986 in the Namibian resource.

Changes of Annual Catch

(Unit: 1,000 tons)

Year	Pilchards	Anchovies	Horse Mackerel	Hake	Others	Total
1975	561.4	186.4	8.9	5.6	19.6	781.9
1976	451.7	87.8	19.6	6.1	21.6	586.8
1977	200.0	132.9	82.5	3.3	9.5	428.2
1978	46.0	355.4	9.0	2.1	10.2	422.7
1979	33.8	277.5	27.7	1.3	16.7	357.0
1980	10.8	190.2	39.3	4.3	8.2	252.8
1981	52.4	199.1	4.2	8.3	14.6	278.9
1982	51.4	83.4	67.2	14.0	18.6	234.6
1983	44.0	183.7	106.8	10.5	15.6	360.6
1984	57.3	13.7	87.6	13.7	10.7	183.0
1985	55.9	50.7	26.4	31.6	10.7	175.3
1986	53.1	15.5	83.2	20.0	11.4	183.2
1987	66.6	376.1	33.8	19.6	9.1	505.2
1988	62.2	116.9	170.5	30.3	13.5	393.4
1989	76.0	78.7	32.0	13.9	13.7	214.3
1990	92.4	50.5	178.5	53.3	29.5	404.2
1991	68.8	17.1	435.7	53.2	15.0	589.8

Source: Directorate of Resources Management (DRM)

(5) Marketing of Processed Marine Products

Because of the small, thinly distributed population there is few domestic distribution of fresh fish. Almost all the catches landed in Namibia are sent directly to processing factories in either Walvis Bay or Luderitz as raw materials. There are 3 canning factories and 5 fish meal factories in Walvis Bay which process pelagic fish e.g. pilchards and enchovy to produce canned pilchards, fish meal and fish oil. Most of the factories were constructed in the 1970's when the catch was at its peak. Consequently, the canning factories are capable of processing a total of some 100 tons of raw materials/hour while the fish meal factories have a total capacity to process some 250 tons/hour. In recent years, however, the factories have not been operating at the relatively large production capacities due to the dwindling catch. The factories normally operate between early March and the end of August but stop operation as soon as the quota for pilchards has been filled. Luderitz has long been the base for lobster fishing and has factories which process lobsters. In addition, processing factories for hake have recently been established, producing frozen fillets and other products. The Namibian catch is in principle, caught and processed by companies registered in Namibia. The final products are marketed by sales companies also registered with the Government of Namibia. The marketing of products such as canned pilchard, fish meal and fish oil produced in Namibia is conducted by the following companies registered at Windhoek.

- Atlantic Canned Fish Sales
- Fish Meal Marketing
- Fish Oil Marketing

As much as 98% of the fish products are exported. Almost the whole canned pilchard and fish meal production is exported to South Africa while processed white fish, lobster and crab are exported to Europe and Japan. No fish products are imported to Namibia.

2.3 Fisheries Administration

2.3.1 Ministry Responsible for Fisheries Administration

(1) Ministry of Fisheries and Marine Resources

The Ministry of Fisheries and Marine Resources is responsible for fisheries administration in Namibia. The former Fisheries Department of the Ministry of

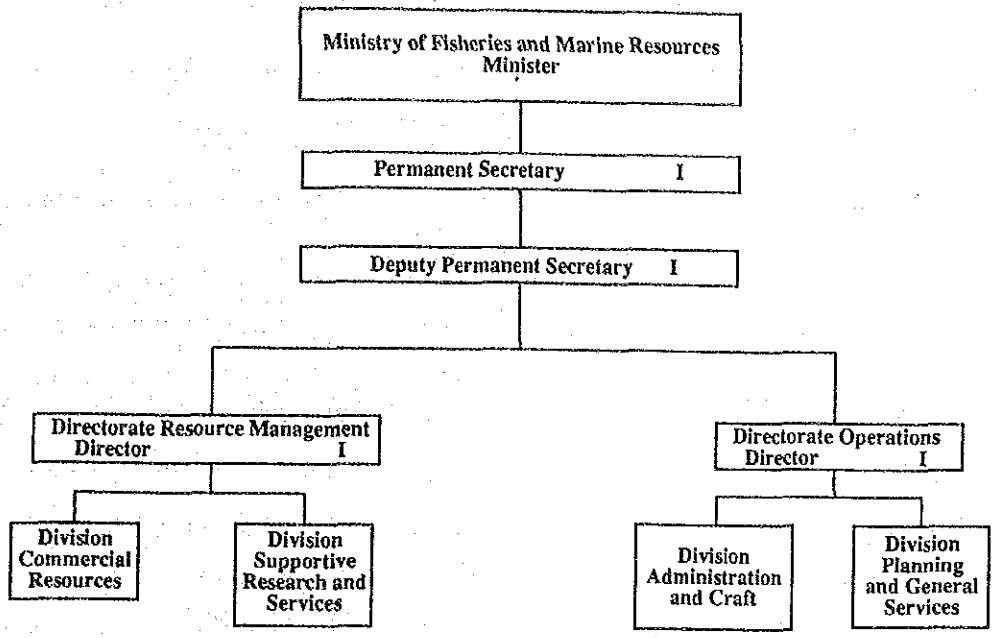
Agriculture, Fisheries, Water Resources and Rural Development was promoted to full ministerial status in February, 1991. The Government of Namibia recognized the importance of fisheries in the development of the economy of the newly independent Namibia.

The Ministry of Fisheries and Marine Resources is responsible for the proper management of marine resources and for the sustained, optimal utilization of such resources for the benefit of present and future Namibian generations. The following functions are carried out by the Ministry.

- Conservation of marine resources by enforcing the 200 nautical mile EEZ.
- Registration and control of fishing boats, issuing of fishing permits and decisions on the conditions for the issuing of such permits.
- Issuing of fishing permits to enable new fishing companies / fishermen to take the opportunity to become involved in the fisheries industry and planning of the mechanism for the distribution of the fishing quota.
- Implementation of scientific surveys for both the conservation and efficient utilization of marine resources, including the minimization of the possible adverse impacts of certain fishing methods.
- Study of the impacts of offshore diamond mining on lobster fishing and seal colonies.
- Preparation of regulations and acts to prevent sea pollution by oil leakage, waste dumping and rubbish disposal by navigating vessels and also by the trial boring of offshore oil fields, etc., including pollution caused by the cleaning of oil tankers.
- Preparation of revised clauses of present Fisheries Act.
- Promotion of a Namibian fishing industry to utilize domestic marine resources.
- Study of prospective markets both domestic and international for fish meal, fish oil, canned fish and fresh fish. The promotion of domestic fish consumption.
- Study of processing methods for Namibia's local marine products.
- Accelerated training of Namibian nationals to work in the fishing industry as well as other related industries.

The Ministry employs some 180 permanent staff and consists of 2 Directorates (Directorate of Resources Management and Directorate of Operations) and 4 Divisions. The ministerial head office is located in Windhoek.

Organization of Ministry of Fisheries and Marine Resources



(2) Directorate of Resources Management

The Directorate of Resources Management (DRM) of the Ministry of Fisheries and Marine Resources (MFMR) is the executing agency of the Project. Its main function is the management of Namibia's marine resources and the provision of advising on sustainable production levels and other aspects of fisheries management by studying the conditions of the marine resources for the implementation of controlled fisheries. It has some 48 senior and research staff members. The DRM's budget is appropriated from the MFMR (mainly to cover the personnel cost) and the Sea Fisheries Research Fund, the income source of which is a research levy on the catch.

The DRM has a total of 48 senior officials and scientists (September, 1992). Efforts are made to increase its manpower and the personnel plan has room for a total of 81 scientists, technicians and assistants. Only the Director and the deputy Director of the Commercial Fishery Resources Division have their offices in the DRM's head office in Windhoek and most other staff members work at the Research Centre at Swakopmund with a smaller number working at the laboratory in Luderitz.

The surveys and research on marine resources are conducted by the Research Centre of the DRM. The Centre was established in January, 1989 to conduct surveys and research on marine resources after independence. The laboratories are located in

Swakopmund and Luderitz. The main functions of the Centre, which also acts as a marine resources information centre, is outlined below.

- Biomass, biological and distributional surveys on marine resources such as pelagic fish, demersal fish and crustaceans.
- Studies the status of seal populations and their impact on marine resources.
- Oceanographic surveys on the marine environment, including sea water temperature, salinity, oxygen level, currents and primary production levels etc.
- Collection and analysis of various data, e.g. catch per unit effort, age, length and egg/larval surveys.

Although the independent fisheries administration and research operation have only a short history, at present over and above the task of institution, the recruitment of the necessary manpower and the construction/improvement of facilities, advice on TAC's is forthcoming for the major commercial species. While the present office at Swakopmund is located in a former hospital building, a new fully-fledged research facility is under construction on the coast at Swakopmund and the phase one is to be occupied in January 1993. The laboratory at Luderitz is also being move into new facilities and the construction is about to start.

2-3-2 Fisheries Development Policies

The Government of Namibia regards fishering as one of the three main pillars for the development of the national economy together with mining and agriculture and has adopted the principal objectives of (i) sustained utilization of national fishery resources and (ii) promoting the development of the fishing industry in order to ensure a sustained contribution to the Namibian economy and to meet all other development targets of the country. The following policies have been adopted to achieve the above principal objectives.

i) Sustained utilization of national fishery resources through effective fisheries management.

ii) Promotion of a Namibia-based fishing industry.

iii) Promotion of international cooperation, such as joint ventures, fishing permit system and mutual treaties, etc. in view of the introduction of foreign capital and technologies.

iv) Increase of the share of Namibians in the work force in the sector through training programmes.

v) Consolidation of government involvement in the conservation and management of fishery resources.

Fundamental to the policy of the MFMR is the establishment of a controlled fisheries on the basis of a maximum sustainable yield (MSY). Through scientific surveys, the Ministry aims to set total allowable catch figures (TAC's). It is the declared policy of Namibia to give the first priority to restoration of the fishery resources which have decreased to a dangerously low level despite the favorable marine environment. It will then give fishing quotas within TAC's to domestic fishing operators and make excess fish available to foreign fishing boats if any allowance.

By controlled fisheries is meant the adoption of adequate regulations on the catching effort of fishing fleets to ensure that the available resources is utilized in the most efficient, sustainable way. In this regard, stock biomass, MSY and TAC must be accurately identified together with relationship between the reproduction of resources and the level of fishing efforts.

The Government of Namibia endeavors to control fishing activities with the assistance of various international organizations and foreign governments. Examples of such efforts are listed below.

- Introduction of 200 nautical mile EEZ.

- Research on fisheries resources (currently in progress with assistance from FAO, Norway and Iceland).

- New Fisheries Act (draft completed with assistance of FAO and Norway with promulgation expected in December, 1992).

- Construction of phase 1 of the Marine Resources Research and Information Centre (work commenced in September, 1991 for completion in January, 1993).

In addition, the Government of Namibia has proceeded well with the development of a fishing monitoring / surveillance system within the EEZ with patrol boats and aircrafts, etc. with the assistance of Norway and France.

2.4 Current Situation in Fisheries

2.4.1 Fisheries Research Vessels

Namibia currently has three fisheries research vessels, which are operated on research schedules of the Directorate of Resource Management.

Name	Length	Gross Tonnage	Year of Construction	Material	Use
Nautilus II	19.8m	approx. 30 tons	1954	wood	Environment and rock lobster surveys
Kwiseb	20.7m	approx. 30 tons	1955	wood	Environment, pelagic fish surveys
Benguela	44.2m	494 tons	1968	steel	fishery resources surveys using acoustic equipment

Nautilus II is based at Luderitz and is mainly used for surveys on the lobster resource, plankton and marine environment near Luderitz. Kuiseb is used for surveys on line fishing, pelagic seining and bottom trawling near Walvis Bay.

R/V Benguela is Namibia's only steel fisheries research vessel. It was built in 1968 in Durban, South Africa and has a long service history of fishery surveys off both the South African and Namibian coasts for the South African Government before being handed back to the Government of Namibia in 1990. The Benguela regularly undergoes maintenance and repair in a dock at Walvis Bay and is engaged in surveys in the Namibian EEZ.

2.4.2 Current Condition and Problems experienced with R/V Benguela

(1) Current Condition

R/V Benguela, the existing fishery research vessel, has an exclusive jetty at the Port or Walvis Bay which is located some 35km south of Swakopmund. Using Port Walvis Bay as its base, surveys are carried out with the vessel by the DRM. The vessel has been operated with assistance from Iceland with an Icelandic captain, chief engineer, chief mate and second engineer. The rest of the crew is Namibian. The surveys are conducted by Namibian scientists and technicians specially assigned to each trip.

The main specifications of the R/V Benguela are given below.

Main Particulars of R/V Benguela

Year of Construction	1968
Port of Registration	Luderitz
Material	steel
Length over all	44.20m
Moulded Breadth	9.45m
Moulded Depth	3.96m
Gross Tonnage	494.0 tons
Main Engine	596 BHS x 2 sets
Fuel Tank Capacity	$137m^3$
Complement	28
Cruising Range	6,000 nautical miles
Fishing Equipment	bottom/midwater trawling equipment
Survey Equipment	3 marine survey winches (2 for general purposes and one for CTD), Scientific sounder and CTD, etc.

The general condition of the hull and equipment on board of the R/V Benguela is fairly good considering the vessel's age.

R/V Benguela has an acoustic laboratory, wet laboratory and dry laboratory. The acoustic laboratory is equipped with scientific sounders, data processors and other acoustic equipment, to carry out acoustic surveys. The main equipment and instruments in the acoustic laboratory are as follows.

- scientific sounder — SIMRAD EK400 (integral type) — 1 set
  SIMRAD EKS (integral type) — 1 set
  SIMRAD ES400 (split beam type) — 1 set
- personal computer for data processing — 2 sets
- CDT and Rosete multi-sampler command unit and data processing unit
- GPS display unit

The EK400 and EKS are coupled with the echo integraters and the data generated are displayed by the analogue printer. The ES400 has a color display unit (CTR) capable

of showing sounding responses in color. The fish size (or TS) is shown in histogram form. Data from these sounders can be fed into the personal computer to allow researchers to process the data. CTD data can also be processed by the personal computer. The CTD does not have a DO (dissolved oxygen) sensor. The laboratory has a table for preparation of survey charts and resource distribution maps, etc. based on the survey results. Neither the dry laboratory nor wet laboratory have fixed equipment worth mentioning.

The nautical instruments are adequate for the vessel's purposes. The gyrocompass, radar and scientific sounders in particular are fairly new.

There are 2 oceanographic winches and a special winch for the CTD on board.

(2) Problems

While the condition of the hull and equipment is fairly good, considering that the vessel operated over a period of 24 years, wear and tear has taken its toll. This inhibits survey activities, particularly sampling. The reduced capacity of the trawling winch due to the deterioration of the hydraulic unit makes it almost impossible to conduct bottom and midwater trawling. The only sampling possible with the R/V Benguela is surface trawling with a small midwater trawling net aiming at pelagic fish such as pilchards. The sampling of horse mackerel, hake and other bottom fish which requires a larger net and/or trawling at a greater depth (approximately 50-500m below sea level) cannot be carried out satisfactorily.

The addition of a net drum after the original construction of the vessel has reduced the already limited fishing deck space at the stern even more and it is extremely difficult to work on this deck.

Because of the age of the vessel, repair and maintenance cost are escalating and amounted to 830,000 rands in 1991 (including the procurement cost of new equipment and materials). This amounted to more than the fuel expense. The DRM is greatly concerned about the continuous escalation in maintenance costs.

The stability of the vessel is however a much more serious problem than those mentioned above. The trim and stability calculation sheets for the vessel clearly illustrates the vessel's poor stability. When the fuel tanks are less than half full, the stability of the vessel falls outside the minimum IMO stability requirement. It is furthermore likely that the weight of the vessel above the center of gravity has increased during its long service history due to the installation of additional equipment and other reasons. It is essential that the vessel undergo tests to check the

centre of gravity and its stability. As the stability problem leads serious safety issues, they should be viewed as a serious matter throughout the remaining years of service of the vessel.

2.4.3 Past Research Activities of Benguela

Following its handing back by the South African Government, R/V Benguela has so far conducted the following research activities.

Month	Activities
1990 September	test trip, pelagic trawling
October	midwater trawling, hydrographic survey
November	test operation of trawl net made in Iceland
December	hydrographic survey assisted by Iceland
1991 March	crab sampling
April	hydrographic survey
May	pelagic trawling, crab sampling and tagging, horse mackerel sampling
June	pelagic trawling, calibration of equipment
July	hydrographic survey, horse mackerel sampling
August	pelagic trawling
September	supply of fuel and water to patrol vessels
November	hydrographic survey, pelagic trawling
December	pelagic trawling, acoustic survey
1992 March	testing of acoustic equipment, demersal survey
April	testing of acoustic equipment
May	bottom fish, pelagic fish and crab sampling
June	crab and pelagic fish sampling
July	bottom fish sampling
August	crab and pelagic fish sampling

The actual contents of the main survey activities are outlined below.

1) Pelagic Fish Surveys

Surveys on small pelagic fish such as pilchard and anchovy are conducted using both acoustic equipment and sampling by surface trawling. The objectives are to

make biomass estimates, determine fish age, size and the distribution of resources.

Main fish species: pilchards (Sardinops ocellatus)

anchovies (Engraulis capensis)

round herring (Etrumeus whiteheada)

Biomass of horse mackerel has been estimated using acoustic equipment. However, the insufficient capacity of the fishing gear has made it impossible to conduct full-scale surveys by means of midwater trawling and to discriminate between horse mackerel and other fish species (including jellyfish and plankton).

Main fish species: horse mackerel (Trachurus trachurus)

2) Demersal Surveys

Surveys of demersal species are mainly carried out by researchers on commercial fishing boats. Catch data collected. The main aim is to determine hake by-catch on fishing boats targeting for horse mackerel. The R/V Benguela is unsuitable for midwater and bottom fish surveys because of its inefficiency in midwater and bottom trawling due to the inadequate capacity of the fishing apparatus and gear.

Main fish species: hake (Merluccius capensis)

(Merluccius paradoxus)

3) Crab Surveys

Crab surveys are conducted by researchers on board crab fishing boats. As in the case of bottom fish surveys, the catch data is collected and samples are taken. Data on the catch rate, size, weight and gender ratio is collected. The crabs are then tagged and released to the sea. Biomass estimate is base don their catch returns.

Subject Species: red crab (Chaceon maritae)

4) Pelagic Survey Results

Acoustic and sampling surveys by trawling (on the composition of fish species and fish size, etc.) were conducted between January and August, 1991. The age composition of pilchards stocks was more favorable than the findings of similar

surveys in the past. The biomass of pilchards was estimated to be 300,000-700,000 tons and the necessity of follow-up surveys was stressed.

(Note: R/V Dr. Fridtjof Nansen, the research vessel registered in Norway, has done surveys on fisheries resources in the Namibian area under the auspices of the FAO and the Norwegian Government (NORAD) in close cooperation with the R/V Benguela.)

The results from the joint survey done in May and June, 1992 are as follows. The area surveyed is the Namibian coastal zone from southern Namibia (26°10'S) to southern Angola (15°50'S) and the total mileage was 4,434 miles. In addition to the acoustic survey, trawl sampling was conducted at 62 points. The estimated resources size in the survey area of each fish species is shown in the following table.

(Unit: tons)

	Pilchards	Anchovies	Round Herring	Total
Estimated biomass	580,000	120,000	55,000	755,000

The acoustic survey on horse mackerel came up with an estimated biomass of 2.1 million tons. This figure, however, is unreliable as sampling at a depth of 100-500m was not conducted due to the inadequacy of the fishing gear.

The biomass of pelagic fish estimated by the relevant surveys in the period between 1990 and 1992 is listed in the following table. The most recent survey results set the biomass at a minimum of 600,000 tons.

(Unit: tons)

Vessel	Date	Pilchards	Other Small Pelagics	Horse Mackerel
Nansen	March, 1990	180,000	170,000	1,200,000
Nansen	June, 1990	580,000	140,000	1,700,000
Nansen	March, 1991	630,000	180,000	1,300,000
Benguela	August, 1991	620,000	345,000	-
Benguela	November, 1991	750,000	255,000	-
Nansen	November, 1991	720,000	325,000	1,400,000
Benguela	June, 1992	580,000	175,000	2,100,000

2.4.4 Future Survey Themes

The main objectives of the surveys done on the resources are to determine the biomass of commercial species and to record trends in the biomass. The DRM emphasizes the following themes for future surveys.

- Clarification and evaluation of trends in biomass and size, distribution, biological factors of commercial species.
- Clarification on natural and other factors influencing the biomass of commercial important species.
- Planning of effective resources management measures.

While acoustic and sampling surveys have so far cast some light on the status of the stock of small pelagic fish such as pilchards, the inadequate research capability of the existing research vessel resulted in limited understanding of the status of horse mackerel, bottom fish such as hake and deep sea crab (red crab). Surveys on midwater and bottom fish in future must be carried out with an enhanced survey capability. Items that will be essential to guarantee future successful survey results are:

(1) Pelagic Fish

- Continuous surveying of the biomass of pelagic fish such as pilchards.
- Surveys in shallow areas.
- Proper understanding of ecology and migratory pattern of the different fish species for the accurate assessment of resources.
- Collection of catch data from fishing boats operating in the relevant areas.
- Resources surveys on horse mackerel by means of acoustic surveys and sampling.

(2) Bottom Fish

- Acoustic and sampling surveys to estimate the biomass of hake.

(3) Biological and Oceanographic Surveys

- Integrated oceanographic and biological surveys to establish a causal relationship between the marine environment and fish resources.

2.5 International Assistance for Namibian Fisheries

(1) Norway and FAO

The Norwegian Government, through NORAD, has made the fisheries research vessel "Dr. Fridtjof Nansen" available for survey under FAO program. Several joint-surveys were carried out with R/V Benguela. Namibian researchers worked together with Norwegian scientists on the R/V Dr. Fridtjof Nausen. The data collected by the Dr. Fridtjof Nansen are made available to the Directorate of Resource Management, Namibia.

In addition, 2 or 3 Namibian scientists receive stipend from NORAD to do courses at Bergen University every year.

(2) Iceland

The Icelandic Government has been implementing a technical cooperation project (1991-1994) with the dispatch of experts to Namibia to assist with fisheries research. The objectives of this program are (i) to assist and cooperate with Namibian researchers engaged in fisheries research and (ii) to provide guidance and training for crews to operate the research vessel. At present, the following 8 experts are working at the Directorate of Resources Management's Marine Research and Information Centre in Swakopmund and on board R/V Benguela.

Project manager: 1

Fisheries scientists: 2

Instructors for research vessel operation: 5

The above 5 instructors are on board R/V Benguela as the captain, mates, chief engineer and engineer. They train the Namibian crew members while conducting official survey and other work.

2.6 Contents of the Request

2.6.1 Project Components

(1) Project Objectives

The Government of Namibia, in view of the policy of sustainable utilization of resources believes that it is absolutely necessary to base TAC's on accurate estimates

of stock biomass. The existing research vessel, Benguela, however, is incapable of conducting a full range of marine surveys because of its age and general status. In response to this situation, the Project aims to replace the inefficient, out dated present vessel with a modern efficient vessel to enable the Namibian scientists to do proper stock assessments and oceanographic surveys.

(2) Research Plan

1) Relevant Research Area

The relevant area to be surveyed by the requested research vessel is the Namibian EEZ, in particular from the coast to the slope of the continental shelf.

2) Operation Schedule of the Research Vessel

The operation schedule for the research vessel was unavailable at the time of the Preliminary Study (April, 1992). The schedule for the research vessel is, however, a part of the annual work schedule drawn up by the DRM annually.

3) Home Port

The port of registration will be Luderitz while the port of Walvis Bay will be the operational base.

4) Research Methods

Surveys will be conducted with a scientific echo-sounder and by sampling catches using both the trawling and long lining.

5) Crew and On Board Researchers

The maximum complement of the requested research vessel will be 28 consisting of 20 seamen and 8 researchers.

2.6.2 Contents of the Request

The original request made by the Government of Namibia was for the construction of one fisheries research vessel to conduct surveys on fishing resources in Namibia's EEZ. Details of the request are given below.

Fishery Research Vessel

Principal Dimensions : length overall - approx. 44.5m

		breadth - approx. 10m
		depth - approx. 4.5m
Complement	:	crew - approx. 20
		researchers - approx. 8
Fishing Gear	:	bottom/midwater trawling equipment
		long lining equipment
Nautical Instruments	:	GPS (Global Positioning System) with plotter and printer gyrocompass
		radar
		Doppler log
Communication Equipment	:	HF radio telephone
		VHF radio telephone

Scientific Research Equipment

For acoustic survey	:	scientific sounder (fish finder)
		sonar
		others
For oceanographic survey	:	winch for oceanographic surveying
		reversing thermometer
		CTD with rosette sampler
For biological Research	:	BONGO plankton net
		fluorometer for continuous recording
		flow meter
		digital salinometer
		others
Others	:	net recorder
		warp tension meter
Fishing Equipment:	:	equipment for bottom trawling
		equipment for mid-water trawling
		long lining gear gill net to catch swordfish
		acoustic laboratory

Laboratories	:	wet laboratory
		dry laboratory
		fish laboratory

The original request contains the following descriptions of the research vessel.

1) The resell must be of a size that Namibia can afford to operate and staff but must also be large enough to conduct research on one of the world's major fish resources. A size somewhat larger than the R.V.Benguela (43m, 486 tons) and approaching the R.V.Dr.Fridtjof Nansen (46m) would appear to be ideal.

2) The vessel must be capable of staying at sea for periods of 16-19 days. Owing to the central position of Walvis Bay on the Namibian coast, longer trips are not envisaged.

   The boat should be able to carry a total complement of scientific staff of at least 8.

3) The laboratories required are as follows.

   acoustics/electronic, including space for mapping and planning, etc.

   wet fish

   environmental/chemical

   dry/microscope

   The acoustics laboratory should be close to the bridge, either on the same deck or immediately below.

4) The wet fish and environmental laboratories must have direct access to the after-deck. A blast freezer is required for the immediate freezing of samples before transfer to the standard cold-room.

5) The vessel should be capable of standard bottom and midwater trawling. It should have 2 net drums carrying both bottom and midwater nets in order that both types can be interchangeably used depending on the type of fish to be sampled.

7) A low noise engine system is absolutely essential. Electrical drive motors with diesel powered generators are preferred. The diesel motors must be well insulated from the hull, possibly by being "floated" in an oil bath.

8) Apart from the trawl winches, a CTD winch fitted with electrical cable and a vertical haul winch fitted with standard cable are required. The vertical haul winch must be suitable for flights of Nansen bottles and, if possible, for plankton samplers. These should be positioned so that the sampling equipment can be easily transferred from the laboratory to the sea. A hatch mid-ships may be suitable.

   A third winch suitable for vertical-haul photo-plankton sampling and possibly for towed zoo-plankton sampling is also required.

9) Facilities for electronic repairs are needed, either a fixed electronics workshop or a containerized unit.

10) A desalination plant for the production of water for general use (as part of the engine cooling system) is required. In addition, a distiller is needed to produce pure water for analytical work.

11) Cabins should be single or, at most, double. Perhaps 4 double cabins.

CHAPTER 3 CONTENTS OF THE PROJECT

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3.1 Objectives of the Project

The direct objective of the Project is the construction and commissioning of a new fisheries research vessel to expand and consolidate marine research activities in Namibia. A proper understanding of fishery resources in Namibia's EEZ should assist the sustainable utilization of these resources through the implementation of appropriate conservation and control measures.

3.2 Examination of Requested Contents

3.2.1 Necessity of the Project

The sea off the Namibian coast provides good fishing grounds due to the favorable effects of the Benguela Current. Fish stocks are one of Namibia's most important resources and the efficient utilization of these resources is essential for the future development of the Namibian economy. There is, however, concern about the depletion of the fish resources due to the unchecked fishing by distant water fleets of many countries over a long period of time prior to Namibia's independence. The introduction of appropriate measures to control fishing is long overdue. Immediately after independence, the Government of Namibia introduced a 200 nautical mile exclusive economic zone (EEZ) together with measures concerning fishing permits, fishing quotas, fishing seasons and fishing grounds. All these measures are designed to control fishing operations and aim at restoring fish resources to restore stocks to optimal levels where sustained utilization on MSY levels can be realized.

To effectively control fishing, it is essential that the Government of Namibia obtain accurate data on the status of the stocks through continuous scientific surveys together with the ongoing monitoring of trends in the stocks. This information input is essential for the decisions taken on utilization and fisheries policy.

No proper resource assessments in possible without a well equipped research ship. Due to the R/V Benguela's 24 years of service and the unavoidable wear and tear on the vessel and its equipment, the quality of the research done with the vessel is influenced negatively. This is especially true for bottom trawl surveys as the winches are worn so badly that no proper trawling is possible. As a result the research is severely hampered. It is, therefore, essential that a new vessel be constructed and

commissioned, equipped with the necessary modern instruments and apparatus. It is only in their way that the research effort on the Namibian marine resources can be brought on par with internationally accepted levels.

3.2.2 Project Implementation and Management Plan

(1) Research Vessel Management and Operation System

The MFMR currently has 3 fisheries research vessels, i.e. the Benguela (494 tons and made of steel) and the smaller, wooden vessels, Nautilus II and Kuiseb. These vessels belong to the Directorate of Resources Management. At present, the DRM also takes the responsibility of maintaining and operating the vessels.

The annual operation schedules of these vessels are based on research plans submitted by the research sections at the end of each year. These plans are examined and approved by the managerial staff of the Directorate of Resources Management as the schedule for the following year. Prior to each trip, the research objectives and sailing orders are prepared and presented to both the captain and senior engineer by the scientists in charge of the trip upon receipt of approval from the Director of Resources Management. Upon completion of the trip, reports are submitted by the captain and the researchers.

The proposed research vessel will be registered in the port of Luderitz, as in the case of the existing research vessels. The port of Walvis Bay will be its operational base and the vessel will be operated by the Directorate of Resources Management.

(2) Crew Members

The research vessel Benguela, transferred back to Namibia by South Africa in 1990, is currently operated with the technical cooperation of Iceland. 5 experts dispatched by the Government of Iceland assume the duties of captain, mates, chief engineer and engineer and train the Namibian crew members (deckhands, engineers and cook). These Namibians are directly employed by the Directorate of Resources Management and receive technical training on navigational skills and engine maintenance, etc. from the Icelandic experts.

It is planned to transfer the crew of the Benguela, including the Icelandic experts, to the new vessel as the project executing agency is committed to secure a capable and properly qualified crew prior to the delivery of the new vessel to the Namibian authorities.

Crew Plan	
Captain	1
Chief Mate	1
Second Officer	1
Chief Engineer	1
Second Engineer	1
Third Engineer	1
Ratings	12
Total	18

(3) Budget for Operation and Maintenance

The budget of the Directorate of Resources Management for fiscal 1992/93 is 4,071,000 rands, of which 1,785,000 rands have been appropriated for the operation and maintenance of the research vessels (of the amount, 855,000 rands is for repairs and procurement purposes and 930,000 rands for fuel). The size of the appropriation for vessel operation and management is believed to be adequate. The actual expenditure on the Benguela for operation and maintenance purposes in 1991 (April-November) is as follows.

Repair and Procurement	:	832,982 rands
Fuel	:	485,036 rands
Food	:	58,878 rands
Total	:	1,373,896 rands

The budget of the Directorate of Resources Management is supplemented by the Sea Fisheries Research Fund (SEFREF) established under the Sea Fisheries Act (1973) to cover the cost of fisheries research. The income of the fund is from levies on the catch of both domestic and foreign fishing boats and is exclusively used by the Directorate of Resources Management which is responsible for fisheries research. The revenue income of SEFREF for fiscal 1991/92 was 8.2 million rands. For fiscal 1992/93, an increase to some 9 million rands is projected with the prospect of further increases in future as catches soar.

Mainly because of the existence of SEFREF, the Directorate of Resources Management is confident of securing the necessary funds for the operation and maintenance of the new research vessel.

(4) System for Maintenance and Repair

Theoretically the Administration and Crafts Division should be responsible for the maintenance and repair of research vessels. As it has no qualified ships engineer among its staff, the DRM has employed a private marine engineer as a consultant to advise on maintenance and repairs. The MFMR is however in the process of advertising to appoint a marine superintendent in the Administration and Crafts Division to supervise maintenance, repair, supply and procurement, etc. for the vessels of the Ministry. As soon as the post is filled, the ACD will take responsibility for the maintenance and repairs on all the vessels.

The private consultant, employed as engineering supervisor conducts, inspections of the hull and engine, inspection to verify repair requests made by the vessel captain for repairs. He estimates the repair/procurement cost vis-a-vis manufacturers or repair shops and supervision of repair work. The actual procurement of spare parts, is done by companies in Walvis Bay under instructions of the engineering consultant. Although the current system is functioning, it has a problem that, it involves a lengthy, time-consuming process whereby quotes have got to be collected from various private companies before a job can be allocated to company. In order to simplify the procedures, MFMR is now working on a maintenance and repair contract with private companies for engine and electronic equipment repair and maintenance.

The port of Walvis Bay is equipped with a synchro-lift capable of lifting boats with a displacement of upto 2,300 tons. There are also several engine repair shops, ironworks and electrical appliances repair shops in the city, all of which are involved in repairing of fishing boats based in Walvis Bay. These facilities is capable of taking care of any repairs that may become necessary for the new research vessel.

3.2.3 Examination of the Specifications of the Requested Research Vessel

In a preparation work of the study in Japan, the study team prepared a draft design (model vessel) for the Project, based on the purposes/functions of the vessel as it was set out in the original request made by the Government of Namibia. In the field survey, the Team discussed the specifications of the requested research vessel as set out in the draft design with representatives of the project executing agency. During these discussions, the project executing agency requested the following alterations to the draft design.

(1) Increase of freeboard of the trawl deck.

(2) Installation of 2 net drums to cater for the bottom trawl net and midwater trawl net.

(3) Extension of the acoustic laboratory.

(4) Additional single cabins to accommodate senior crew members and scientists.

(5) Provision of cabin(s), a shower and WC for the exclusive use by female scientist(s) when the same is on board.

(6) Additional showers and WCs for communal use.

(7) Provision of a change room to cater for oilskins, boots etc.

(8) Provision of fish sample processing space.

(9) Provision of line hauler to handle crab pots for crab biomass surveys.

In response to the above requests, the following points were investigated.

(1) Increase of Freeboard of trawl Deck

This request was made on the basis of the need for the vessel to have a trawl deck with sufficient freeboard to prevent water flowing in up the slipway. It was suggested that a double deck be considered to increase below deck space.

The introduction of double decks was found to be impossible without changing the principal dimensions (especially breadth) of the draft design without seriously affecting the ship's stability. It was eventually decided to increase the freeboard height for the stern by raising the sheer line for the trawl deck while maintaining the original single deck design. The resulting freeboard at the stern perpendicular is approximately 1,700mm. This is an increase of some 500mm compared to the draft design and is almost double the freeboard height of the Benguela. This is regarded as a substantial improvement.

(2) Installation of 2 Net Drums

This request was prompted by the need to use 2 different nets, one for bottom trawling and one for midwater trawling. Some 90% of the pilchard catch, the main subject fish of the surveys, is made in a shallow waters, in which the midwater trawl net cannot be used. The bottom trawl is sometimes not effective when bottom fish moves in to midwater. In cases were shoals registered off the bottom by the scientific sounder, sampling is needed to identify the species. In such cases, the bottom trawl is

ineffective and the midwater trawl must be used to sample the bottom fish in midwater.

The above motivation as put forward in the original request was viewed in the following way.

1) The main purpose of the research vessel for the project is to estimate biomass of different fish resources and the reasons why the vessel must be equipped with trawling facilities are as follows.

   ① To collect data (catch composition, species, length distribution and other biological data on fish) by sampling to determine and evaluate the biomass of the commercially important resources.

   ② To determine the biomass of the various fish resources, particularly that of pelagic fish, by scientific sounding, the accuracy of which is improved through the direct sampling of shoals that was surveyed and by determining species, composition, size of fish and density of shoals, etc. using the midwater trawl.

   ③ To keep track of trends in the resources and to buildupan historical data base of the catch in the different area.

2) Research trips should focus on a single main objective. For example, trips focusing on bottom fish should be conducted separately from trips focusing on pelagic fish. This principle is accepted and implemented by the project executing agency.

3) It is imperative to calibrate results obtained by acoustic methods by sampling shoals through trawling. Not all targets are however necessarily sampled.

   In areas where many fish species inhabit, sampling is necessary to identify species present and their relative abundance etc. In such areas, trawl surveys are usually more useful than acoustic surveys. By comparison, however, in areas where a single species dominante, acoustic surveys are generally more efficient and the frequency of sampling by trawling to check species can be reduced.

   As there are several dominant species off the Namibian coast e.g. pilchard, anchovy, horse mackerel and hake, sampling appears to be important. Based on the empirical knowledge that some 90% of pilchard are fished close to the coast and also based on past survey results, it should be possible to estimate the distribution of resources. It is, therefore, not deemed necessary to sample pelagic

fish using a bottom trawl in shallow water. It seems more practical to rely on the following procedures.

① To obtain catch data (fish species and size) from fishing boats operating in the survey area.

② To sample fish by handling fishing.

③ To monitor data on fish catch of fishing boats (statistic data on fishing grounds, seasons, species, fish size and catch, etc.)

Estimates of the biomass of demersal fish is mainly based on bottom trawl surveys. The scientific sounder can be used effectively only in cases where schools of fish rise above the bottom by 1~2 meters or more. The problem here is to know what species is dealing with as well as size and composition of the school found by the sounder. Given the small number of species, it be determined by examining the catch of the bottom trawl and, comparing that with the image displayed by the sounder. It is theoretically possible to determine whether the fish shown by the sounder is hake, other bottom species, plankton or jellyfish.

It is impractical to use all the data gathered to estimate biomass. On designing an acoustic survey, it is essential to preselect criteria on which the data that is gathered should be used. In this context, during a demersal survey, it appears reasonable to discard midwater data which cannot be verified by bottom trawling.

4) The deck space in the original design does not allow the installation of two net drums. Should two net drums be installed, it will limit the work space on deck. The equipment that goes with the two net drums will be complicated. Consequently, trawling will be more complicated and will demand more experience and skill of the crew.

Even if a school of fish that lifts from the bottom is found by the scientific sounder, it is deemed extremely difficult and impractical to change to the midwater trawl to sample fish of that school. Moreover, the use of the midwater trawl to catch bottom fish slightly off the bottom carries the risk of damaging the trawl on the bottom.

5) The DRM claimed that a bottom trawl was required to sample small pelagic fish e.g. pilchards in shallow areas because the midwater trawl would be grounded.

However, a research vessel of the planned size should not enter such shallow areas for safety reasons.

Based on the above considerations, it was decided by the Basic Design Study Team that one drum would be provided for the proposed research vessel on the premise that survey trips for bottom fish will be separately conducted from survey trips on pelagic fish. The nets are changed when the vessel is moored at the wharf in the port of Walvis Bay.

The DRM however strongly requested an additional net drum on the grounds that sampling surveys by the vessel in the anticipated areas will in any case require bottom trawling and midwater trawling nets for pelagic fish and bottom fish surveys respectively. Having further examined the rational of providing 2 net drums in the face of such a strong claim, it was finally decided to equip the vessel with 2 net drums. The rational for this decision is given below.

In the case of sampling surveys on bottom fish, the main species is hake which, unlike some other bottom fish e.g. monkfish and kingklip, has a wide habitat and often ascends 200-300m from the seabed area to swim in midwater. Hake is caught in the Namibian area not only by bottom trawls but also by midwater trawls. This fact suggests that the use of a bottom trawl with a low net height is not sufficient for surveying hake and that a midwater trawl is also required.

While surveys on hake are mainly conducted by means of acoustic surveys using a scientific and sampling, the data on a free swimming school of fish must be supported by sampling to determine the actual species, size and density, etc. This calibration process to correct sounding data is essential to enhance the reliability of the survey results (biomass) made by the vessel.

For the above mentioned reasons, the proposed research vessel is required to use both a bottom trawling net and midwater trawl to collect reliable data. Changing of the nets on a limited deck space, however, is difficult and both time and labor consuming. It is inefficient and impractical to keep changing the nets during a survey. A solution to this problem is to have an independent net drum for each net type in order to avoid changing nets on deck before the appropriate net can be used.

(3) Extension of Acoustic Laboratory

An acoustic laboratory, housing various survey equipment including the scientific sounder is essential. The design of this laboratory reflects the demands expressed by

the scientists of the project executing agency as far as possible. The Directorate of Resources Management plans to transfer some of the equipment presently installed on the Benguela to the new research vessel and to purchase new equipment in future. Extra space is, therefore, necessary to install those equipment in the laboratory. All equipment will be installed on racks, as is the case of the Benguela, with a working space allocated at the back of these racks for equipment adjustment and maintenance purposes. A work table will be provided for data processing and mapping. Having taken these requests into consideration, an acoustic laboratory of approximately $12m^2$ is planned.

(4) Accommodation

In principle, cabins will be single berth cabins. The maximum cabin size is a double berth cabin, the number of which should be kept to a minimum. The provision of a cabin, shower room and WC for exclusive use by female scientists was also requested. After consultation, the accommodation will be planed as follows;.

Crew (18)

Senior Crew Members (Captain, Chief Engineer, Chief Mate, Second Officer, Second Engineer and Third Engineer)	single berth cabin x 6
Ratings	double berth cabin x 6
Scientists and Technicians (8)	
Chief Scientist	single berth cabin x 1
Senior Scientists (Male or Female)	single berth cabin x 1
Scientists (Male or Female)	double berth cabin x 1
Technicians	double berth cabin x 2

An extra fold-away bunk will be provided in the chief scientist's cabin and in the senior scientist's cabin. A WC/shower room will also be provided for exclusive use by female scientists when on board. At least 4 WC/showers will be provided for crew and male scientists/technicians.

(5) Fish Sample Processing Space

Sorting and weighing of fish sampled by trawling is normally done on the work deck. However, because of lighting request, an enclosed space will be provided where fish can be identified, length frequencies can be measured and biological analysis of

sample can be carried out. This space will be located on the work deck next to the wet laboratory and will be fitted with a folding work table and water faucets.

(6) Provision of Raincoat Changing Room

A raincoat changing room will be provided in the passage between the accommodation quarters and the work deck to keep the accommodation quarters clean and dry.

(7) Provision of Crab Fishing Apparatus

Crab fishing gear was requested to survey deep sea crab resources, e.g. red crab, which is one of the main target species for surveys. Red crab sampling is done by long-lining with crab pots. A line hauler and line guide roller will be provided to conduct the fishing. As a crab pot can be as large as 1.8m in diameter, only the work deck at the stern can provide the necessary space required for the handling of such pots. Although hauling long-lines at the stern is more difficult than at the bow, there is no alternative working space for this operation. The requested gear will be installed at the starboard side, as the post side will be used for oceanographic surveys. Given the limited space available on the work deck, trawling will not be possible during crab survey trips.

3.2.4 Relationship with Other Aid Projects

At present, a project of technical cooperation from the Government of Iceland (planned project period: 1990-1994) in the fisheries sector is in progress. This project provides several experts to Namibia to assist Namibian counterparts with fishery surveys. The objectives of this technical cooperation are (i) to assist and guide Namibian researchers engaged in fishery research and (ii) to instruct and train with crew members to operate research vessels. At present, the following 8 experts are working with the Directorate of Resources Management in the Marine Research and Information Centre and on board R/V Benguela.

Project manager:	1
Fisheries scientists:	2
Instructors for vessel operation:	5

The Namibian crew members employed by the Ministry of Fisheries and Marine Resources have only limited experience and are receiving on the job training. They

will furthermore receive formal training to obtain official qualifications (licenses) as ship officers. The five Icelandic experts are currently engaged in operating the R/V Benguela as the captain, chief engineer, mates and engineer and are training the Namibian crew. The project executing agency plans to transfer these Icelandic experts as well as the Namibian crew from the Benguela to the new research vessel. As long as this plan is implemented, no immediate problems are seen with regard to the operation and maintenance of the new vessel. The project executing agency is, however, required to strengthen and speed up the education and training for the Namibian crew.

As the training of local crew members, which is one objective of Iceland's technical cooperation project, requires a long period of time, the project is expected to and should continue beyond 1994.

3.3 Outline of the Project

3.3.1 Operation and Maintenance Plan

(1) Operation and Maintenance System

The planned research vessel will be placed under the Administration and Crafts Division of the MFMR, as in the case of the existing research vessels, and will be operated by the DRM in accordance with its research schedule and under the plan described in 3.2.2. The operational base of the vessel will be the port of Walvis Bay, as in the case of the Benguela.

(2) Personnel Plan

1) Crew

The crew of the planned research vessel will acquire the relevant experience on board the Benguela and the necessary arrangements to transfer the crew to the new vessel will be made prior to the handing over of the vessel to Namibia.

i) Coordination with the technical assistance project from Island and its extention.

ii) Educations for Namibian crew for acquiring the qualifications.

iii) Recruitment of well experienced and qualified Namibian officers.

iv) Official procedures for the crew's transfer to the new vessel.

v) Determination of R/V Benguela's management and its disposal.

Crew Plan

Position	Number	Qualifications
Captain	1	Deck Officer Class 3
Chief Mate	1	Deck Officer Class 4
Second Officer	1	Deck Officer Class 4
Chief Engineer	1	Marine Engineering Officer Class 3
Second Engineer	1	Marine Engineering Officer Class 4
Third Engineer	1	-
Ratings	12	-
Total	18	

(3) Operation Plan

The followings are models of the vessel's survey cruise

1) Cruise for pelagic fish survey

a) Survey components

Acoustic survey, sailing on survey grid lines

Survey time (h) = Approx. 19 hours/days

Sailing speed (v) = 8 knot

Fishing survey by midwater trawl (sampling)

Survey time = Approx. 60 minutes from shooting the net to hauling up the coded, including tawling time 20 minutes.

Numbers of the survey = 2 times/day

Oceanographic survey with CTD and samplers

Survey time = Approx. 30 minutes/time

Numbers of the survey = 6 times/day

b) Survey area

The coastal area within approximately 40 miles from the shore. Distance of the survey area from the north end to the south end is approximately 580 miles.

c) Survey grid lines:

The surveys are conducted along the following survey grid lines;

Parallel grid

Length of grid line (L) = 30 miles

Interval (s) = 10 miles

d) Numbers of days of the cruise

Total mirage for surveys (D) = (L + S) x M/S = 2,720 miles

Number of days for surveys (a) = D/rh = 18 days

Number of days for silting (b) =

from the port to the survey starting point and from the survey ending point o the port = 3 days (at sailing speed 115 k't)

Total number of days for the cruise = a + b = 21 days

2) Cruise for demersal survey

a) Survey components:

Fishing survey by trawling:

The survey is conducted on survey grid lines at points with depth of 50m, 70m, 100m, 150m, 200m, 300m, 400m and 500.

Survey time = Approx. 60 minutes from shooting the net to hauling up the coded, including towing time of 20 minutes.

Number of the surveys = 6 times/day in average.

Oceanographic survey with CTD and samplers:

Survey time = Approx. 3 minutes/time

Numbers of the survey = 6 times/ day

Acoustic survey:

The survey is conducted, sailing along the survey grid lines.

b) Survey area

The area is from the coast to the slope of the continental shelf is divided into two parts, the north and south of Walvis Bay. One survey cruise covers one of them.

c) Survey grid lines

Survey liens are set in parallel to latitude lines with intervals of 20 miles. The survey area includes 36 survey grid lines.

d) Numbers of days of the cruise

One cruise covers 18 survey grid lines. The surveys are carried out on an average of one grid line per day.

Number of days for sailing between the port and the survey area is 1.3 days (at sailing speed 11.5 k't)

Total number of days at sea is 20 days.

On average, one survey cruise is 20 days and 10 cruises are conducted annually.

Sailing	2 days	Total number of days for sailing	20 day/year
Survey	18 days	Total number of days for surveys	180 day/year
Total	20 days/trip	Total operation days	200 day/year

(4) Operator and Maintenance Cost

1) Operation Cost

The operation cost of the new research vessel is estimated, based on the past expenditures.

¿ Fuel Cost

(a) Fuel Oil

Item	No. of Days	Consumption		Unit Cost (rands/Kl)	Total Cost (rands)
		per day (Kl)	Total (Kl)		
Cruising	20	5.4	108	1,200	129,600
Researching	180	3.1	558	1,200	669,600
Mooring (incl. days in dock)	165	-	-	-	-
Total	365	-	666	-	799,200

(b) Lubricating Oil

Fuel Oil Cost x 8% = 63,936 rands

Total Fuel Cost : 863,136 rands

② Ship's Supply

(i) Ship's stores

An annual cost of 42,000 rands is assumed from the second year of operation, excluding cost of engine parts which is included in the maintenance cost.

(ii) Fishing gear

An annual cost of 30,000 rands is assumed from the second year of operation.

③ Maintenance Cost

The vessel will go to dock once a year for maintenance and repair. The maintenance cost is estimated on the basis of the above annual repair, minor inspection every 2 years and major inspection every 4 years.

④ Personnel Cost

The annual total wages, pension fund and medical aid allowances, of the 18 crew members is calculated to be some 520,000 rands. The personnel cost relating to scientists and technicians is excluded from the cost. In addition, the food cost is calculated based on 25 rands / person / day.

At Sea : 25 rands/person/day x 18 persons x 200 days/year = 140,000 rands

In Port : 25 rands/person/day x 10 persons x 165 days/year = 21,000 rands/year

The total personnel cost, inclusive of the food cost, is 681,000 rands.

⑤ Miscellaneous Costs

It is estimated at 24,000 rands / year for miscellaneous costs, including expenses for using port facilities and electricity supply in the port and general administration cost.

Based on the above estimation, the operation cost of the vessel for the first 5 years is shown below. No insurance costs are included.

(Unit: rands)

Item	1st Year	2nd Year	3rd Year	4th Year	5th Year
Materials					
Fuel	865,000	865,000	865,000	865,000	865,000
Ship Fittings & Fishing Gear	0	72,000	72,000	72,000	72,000
Personnel (incl. of Food Cost)	681,000	681,000	681,000	681,000	681,000
Maintenance	80,000	200,000	100,000	400,000	100,000
Miscellaneous	240,000	240,000	240,000	240,000	240,000
Total	1,866,000	2,058,000	1,958,000	2,258,000	1,958,000

(5) Budgetary Arrangements

The operation and maintenance cost of the planned research vessel will be covered by the budget of the DRM, as in the case of the Benguela. There should be sufficient appropriation for the operation and maintenance of the new vessel.

3.3.2 Resources Survey Plan

(1) Survey Objectives

The objectives of the resources surveys to be conducted by the planned vessel are to assess the current status and biomass of commercial fishery resources in the Namibian EEZ and to determine the TAC for each species. The data obtained by the surveys will form the basis for the formulation of Namibia's fisheries policies and regulations for the effective control of marine resources and fisheries activities. This includes the introduction of a fishing permit, a quota system, fishing seasons and grounds and restrictions on fishing gear. These efforts aim to restore the resources back to the original state and to utilize them on a MSY basis.

(2) Survey Area and Species

The study area will be the Namibian EEZ and the main target species will be as follows.

small pelagic fish: pilchard, anchovy, and horse mackerel

bottom fish: hake, kingklip and monkfish

crustaceans: red crab

(3) Survey Method

While the survey method will vary depending on the species targeted, it will mainly consist of sampling, using the most appropriate fishing method and gears together with hydroacoustic surveys to assess the status of each specific species. As the data obtained by these surveys should be assessed and analyzed in the light of their relationship to marine environment and biological aspects of the fish. Environmental and biological surveys will be conducted hand in hand with stock assessment surveys and the data obtained will be integrated for a better understanding of the environment.

1) Fishery resources surveys using fishing gear and acoustic equipment

① Pelagic Fish

A midwater trawl net and scientific sounder will be used in the case of surface or midwater fish such as pilchard, horse mackerel and anchovy.

② Demersal Fish

A bottom trawl net and scientific sounder will be used for demersal fish such as hake and kingklip, etc.

③ Others

Crab pots with long-lines will be used to sample red crab.

④ Data Collection

In the case of actual sampling, observation on the following items will be made and recorded for each sampling point. The catch will be sorted by species and data such as quantity of the catch and species composition will be recorded to estimate biomass.

i) sampling date and study area

ii) points of commencing and ending surveys.

iii) starting and ending times of surveys.

iv) sampling depth

v) sampling direction, distance and speed

vi) net opening height and distance between wing nets

vii) water temperature and bottom conditions

viii) weather and sea conditions

2) Related Surveys

Over and above the main resource estimates, the following biological and environmental surveys will be conducted.

① Environmental Surveys

i) salinity water temperature and dissolved oxygen

ii) direction and velocity of currents

iii) water color (i.e. — light differential and transparency)

iv) bottom conditions

② Biological Surveys

i) length frequencies, age compositions, weight, sex and maturity of gonad

ii) analysis of stomach contents

iii) egg and larvae surveys

3) Analysis of Survey Data

The data obtained during surveys will be recorded in raw form for statistical processing and analysis at the Marine Research and Information Centre.

(4) Survey Plan

① Pelagic Fish Surveys

i) Objectives

- continuous surveying of biomass, spawning and habitat of pelagic fish in relation of marine conditions
- estimation of resources biomass and status and distribution of species e.g. pilchard, horse mackerel and anchovy
- estimation of density, distribution and abundance of eggs and larvae
- identification of optimal marine conditions

ii) Sea Area - upto 200 nautical miles from the coast

iii) Survey Period - one trip consisting of approximately 20 days and 4 long trips/year (spring, summer, autumn and winter)

② Demersal Fish Surveys

i) Objectives

- continuous surveying of degree of abundance and status of hake stocks.
- estimate of biomass and distribution of hake
- identification of the optimal marine conditions for the species.

ii) Sea Area — areas with depth of approx. 50m to 600m

iii) Survey Period

③ Red Crab Surveys

i) Objectives

- estimate of biomass and distribution and analysis of body size, sex ratio

ii) Sea Area - areas with depth of approx. 300m to 750m

iii) Survey Period - days from 10 to 14 days.

④ Potential Fishery Resources Surveys

Additional potential fishery resources surveys will be conducted from time to time with the purpose of developing new fishing grounds and identifying potential resources. These special surveys will be scheduled every year for specified species.

i) Objectives

Trial fishing and surveys on potential new fish resources in various areas (both existing and undeveloped fishing grounds) to determine the development potential of new fishery resources

ii) Sea Area - entire EEZ

iii) Survey Period - as required

2) Survey Priorities

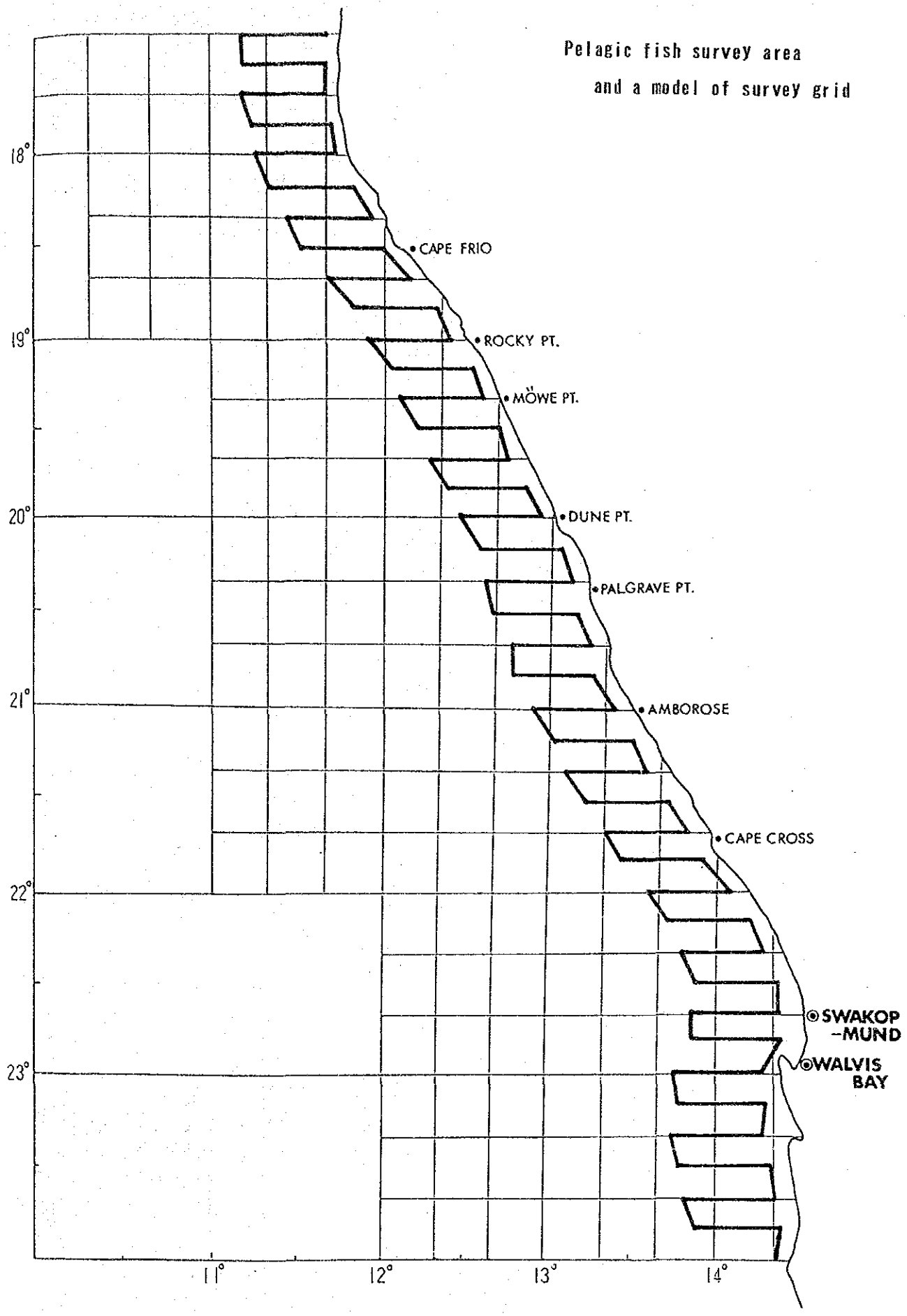
Stage 1: Estimation of biomass and state of stock of pelagic fish such as pilchards, horse mackerel and anchovy.

Stage 2: Estimate of biomass and state of stock of bottom fish such as hake, kingklip and monkfish.

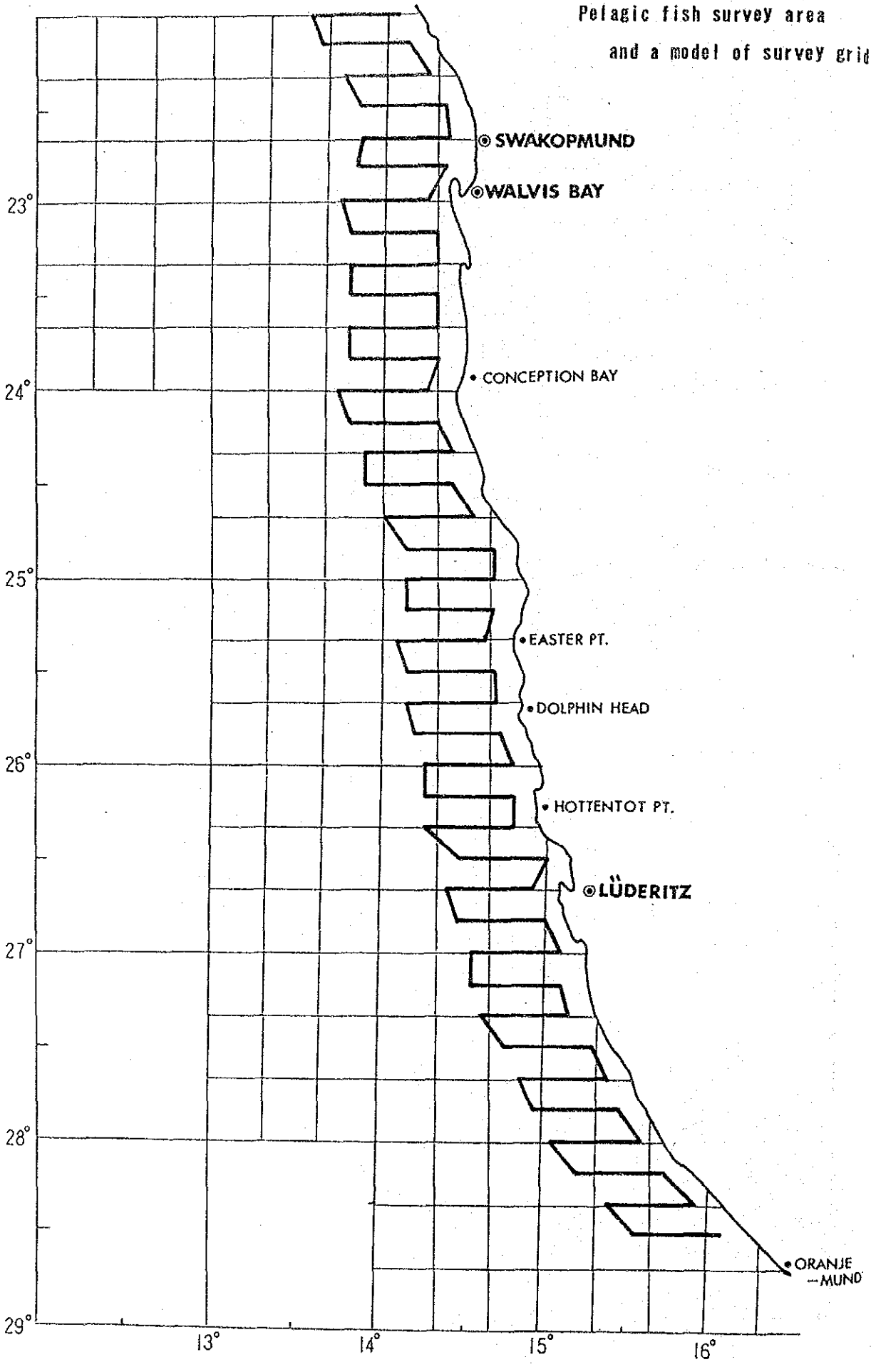
Stage 3: Thorough surveys on the development prospect of the near coastal zone and estimate of biomass of other commercial fish (species not covered by Stage 1 and Stage 2).

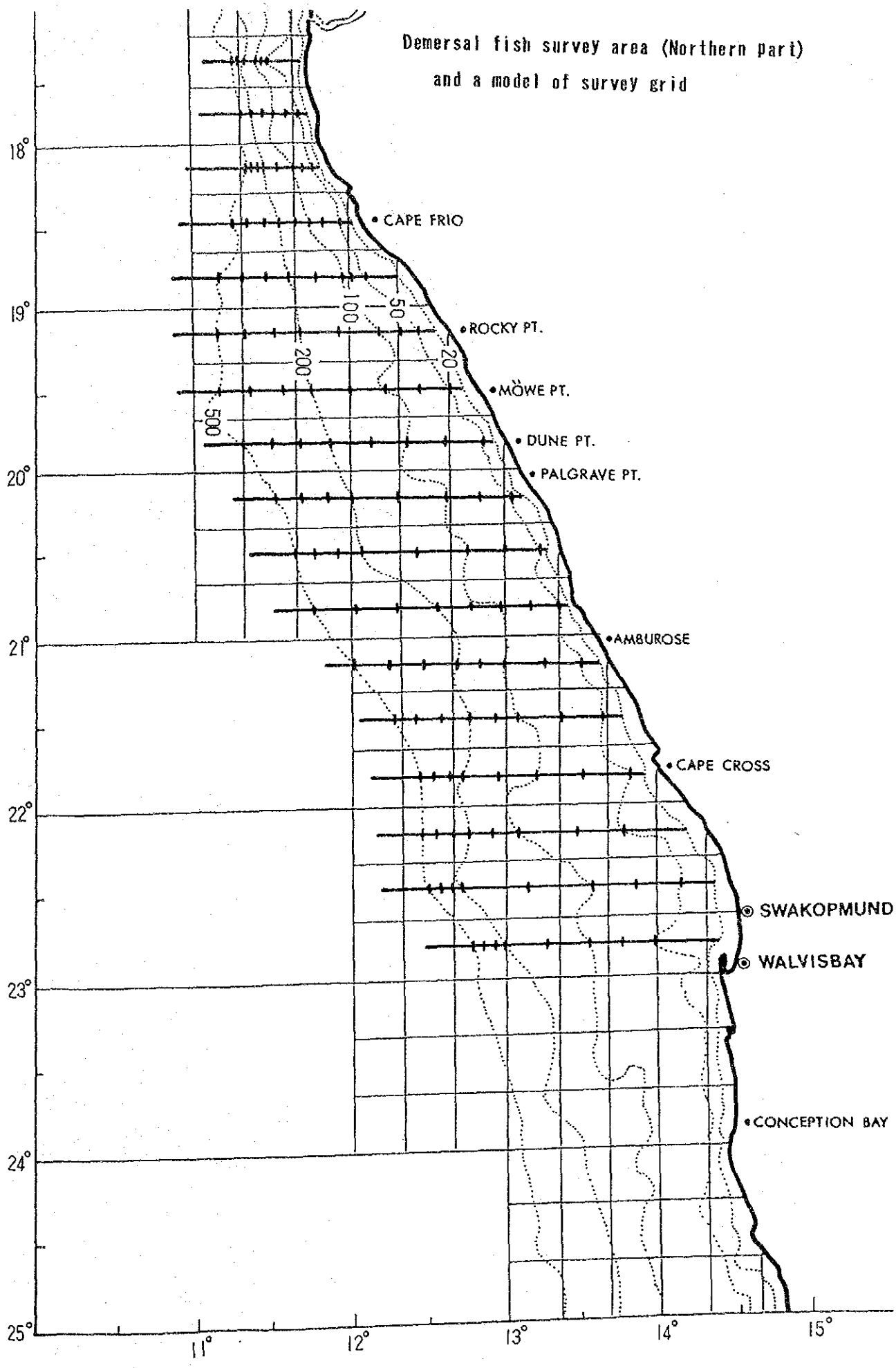
Stage 4: Surveys on potential of fish resources throughout the EEZ (species not covered by Stages 1, 2 and 3).

If required, samples will be frozen and taken back for further examination. Catches, landed during scientific surveys will not be processed commercially.


Pelagic fish survey area
and a model of survey grid
18°
19°
20°
21°
22°
23°
CAPE FRIO
ROCKY PT.
MÖWE PT.
DUNE PT.
PALGRAVE PT.
AMBOROSE
CAPE CROSS
SWAKOP-MUND
WALVIS BAY
11°
12°
13°
14°

Pelagic fish survey area
and a model of survey grid




Demersal fish survey area (Northern part)
and a model of survey grid
18°
19°
20°
21°
22°
23°
24°
25°
11°
12°
13°
14°
15°
• CAPE FRIO
• ROCKY PT.
• MÖWE PT.
• DUNE PT.
• PALGRAVE PT.
• AMBUROSE
• CAPE CROSS
SWAKOPMUND
WALVISBAY
• CONCEPTION BAY
100
50
20
200
500

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Basic Design Principles

The following basic design principles have been adopted of the basic design of the fishery research vessel to be constructed under the Project.

(1) The new research vessel should be capable of conducting fishery resources research/surveys within Namibia's EEZ.

(2) The new research vessel will replace R/V Benguela, currently operated by the Government of Namibia.

(3) The design of the new research vessel should meet the MFMR scientific and technical requirements and take into consideration, the contents of the original Namibian request, the findings of the field survey as well as data on similar research vessels available in Japan and other countries.

(4) The design of the new research vessel should incorporate excellent safety and sea worthiness features. In addition, the vessel should have superior anti-vibration, soundproof and bubble free under waterline.

(5) The design of the new research vessel should be such as to minimize the energy, manpower requirements and maintenance cost so as to reduce the operation expense to be borne by the DRM.

(6) The survey equipment and fishing apparatus should meet the purposes of the vessel's fisheries research/surveys requirement and also the technical level of the crew. They should be easy to maintain.

(7) Special consideration should be given to the good maneuverability of the vessel in terms of navigation along predetermined survey paths or positioning at fixed oceanographic observation points.

4.2 Examination of Design Conditions

(1) Vessel Type

The first priority of the planned surveys to be carried out by the vessel is given to fishery resources surveys using acoustic equipment and trawl fishing gear. The trawl

fishing requires a large deck space for proper operation while such facilities as laboratories must be provided on the deck. In view of these requirements, a long forecastle stern trawler type shall be adopted to obtain the maximum deck space and laboratory accommodation.

(2) Applicable Regulations and Conventions

The following regulations and conventions are applied to the basic design of the vessel.

① Application of standards set by Nippon Kaiji Kyokai (NK) to such basic aspects of vessel design as hull strength, hull structure, number of fittings, on board facilities and types of fittings, etc.

② Obtaining of NS and MNS marks to certify approval of hull and engine standards through inspection by NK.

③ Application of standards set by Japanese Government in respect to safety, lifesaving and fire-fighting facilities.

④ International Convention for Prevention of Collisions at Sea, 1972

⑤ International Load Line Convention (1966)

⑥ International Convention for the Prevention of Pollution from Ships (MARPOL, 1973, 1978 (Annexes 1, 4 and 5)

⑦ International Convention for Tonnage Measurement of Ships, 1969

⑧ IMO Resolutions for Stability: A-168 and A-562

⑨ International Telecommunication Radio Regulations (GMDSS)

In view of ensuring the proper scope and quality of technical examination and inspection during the construction stage, the vessel will obtain official classification certified by the Nippon Kaiji Kyokai (NK: Japan Marine Association). As a full-time inspector of the NK is stationed in Capetown in South Africa, the ship classification management of the vessel after the commencement of service will not be a problem.

(3) Design Temperatures

Based on sea temperature data for the proposed operation area of the vessel, the design temperatures have been set as shown in the table below. With regard to the high

temperature ranges, the fact that the vessel will sail in a tropical area during its delivery from Japan to Namibia has been taken into consideration.

Design Temperatures

	High Temperature Range	Low Temperature Range
Air Temperature	40°C	5°C
Sea Temperature	32°C	10°C
Relative Humidity	85%	80%

(4) Operational Conditions

The following operational conditions shall be applied.

① Main Fishing Method : bottom and midwater trawling

② Survey Area : EEZ of Namibia

③ Fish Hold capacity : approximately $40m^3$

④ Fuel Tank capacity : approximately $150m^3$

⑤ Fresh water tank capacity : approximately $50m^3$

⑥ Complement : 28

⑦ Trip duration : maximum 30 days/trip

(5) Maneuverability Conditions

The following maneuverability conditions shall apply based on the weather conditions of the operation area.

- turning radius : within double length of the vessel at cruising speed

- bow thruster : wind velocity of 24 knots

(6) Soundproofing and Anti-Vibration Measures

Anti-vibration measures should be introduced for the main and auxiliary engines, propellers and bow thruster to ensure soundproofing and vibration-proofing for the laboratories and cabins. These measures should also be designed to minimize the noise released to the sea.

- soundproofing : target noise level to be below 65db for cabins, laboratories and wheel house

- vibration-proofing : to meet relevant ISO standards

To minimize the radiating noise and vibration caused by the main and auxiliary engines, these engines will be rubber mounted. The engine room wall next to the accommodation quarters will be sound insulated and both anti-vibration and soundproofing measures will be employed for hydraulic pipes where possible. The use of a highly skewed propeller with a large propeller aperture will also be designed to minimize vibration. The bow thruster will use a high skewed propeller with a sufficiently thick nozzle to minimize vibration.

(7) Fishing Apparatus

The original request for fishing equipment consisted of bottom, surface and midwater trawling gear and crab pots long-line. As each type of these gears requires special functional arrangement, it will be difficult to ideally place all of them without the mutual disruption of their functions. Consequently, the following conditions shall be introduced for the design of the fishing apparatus for the vessel.

1) In planning the fishing gear, first priority shall be given to midwater trawling, followed by bottom trawling and then crab pots long-line.

2) The midwater trawling net shall be designed in such a way as to adequate sampling of horse mackerel.

3) The bottom trawling net should be suitably designed to catch such demersal fish as hake and kingklip, etc.

4) With regard to crab fishing, the number of crab pots to be used would be approximately 50 pieces in view of the working space on board. A line hauler and roller, should be provided for crab fishing accordingly.

(8) Oceanographic Surveying Equipment

One (1) oceanographic winch for general-purpose oceanographic survey and one (1) CTD winch should be mounted.

(9) Laboratories

The following laboratories and work spaces should be provided to enable scientists and technicians to conduct research work, analyze samples and process data, etc.