Intergovernmental Oceanographic Commission

Workshop Report No. 36 - Supplement

IOC/FAO Workshop on Improved Uses of Research Vessels

organized with the support of NORAD

Lisbon, 28 May - 2 June 1984

Submitted Papers

Unesco

IOC Workshop Reports

The Scientific Workshops of the Intergovernmental Oceanographic Commission are usually jointly sponsored with other intergovernmental or non-governmental bodies. In each case, by mutual agreement, one of the sponsoring bodies assumes responsibility for publication of the final report. Copies may be requested from the publishing bodies as listed below.

No.	Title	Publishing Body	Languages
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia (Report of the IDOE Workshop on); Bangkok, Thailand 24-29 September 1973 UNDP (CCOP), 138 pp.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974 (Unesco Technical Paper in Marine Sciences, No. 20).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish (out of stock)
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock)
4	Report of the Workshop on the Phenomenon known as "El Niño", Guayaquil, Ecuador, 4-12 December 1974.	FAO Via delle Terme di Caracalla 00100 Rome, Italy	English (out of stock) Spanish (out of stock)
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
7	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/Unesco/EAC, Nairobi, Kenya, 25 March-2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock) Russian
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish (out of stock)
11 Suppl.	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
12	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, Fort-de-France, Martinique 28 November-2 December 1977.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, Port of Spain, Trinidad, 16-18 January 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific, Santiago de Chile, 6-10 November 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Russian
17	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
17 Suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
18	IOC/Unesco Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (Unesco reports in marine sciences, No. 4)	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
19	IOC Workshop on Marine Science Syllabus for Secondary Schools, Llantwit Major, Wales, U.K., 5-9 June 1978 (Unesco reports in marine sciences, No. 5).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian Arabic
20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
21	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
22	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Russian
24	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
25	Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (superseded by IOC Technical Series No. 22)
26	IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September-5 October 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
27	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Nouméa, New Caledonia, 9-15 October 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes Lima, 20 April-5 May 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
29	WESTPAC Workshop on Marine biological methodology Tokyo, 9-14 February 1981.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
30	International Workshop on Marine Pollution in the South-West Atlantic Montevideo, 10-14 November 1980.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English (out of stock) Spanish
31	Third International Workshop on Marine Geoscience Heidelberg, 19-24 July 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
32	UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime Paris, 27 September - 1 October 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish

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SC-85/WS-3

Unesco

INTRODUCTION

The International Workshop on Improved Uses of Research Vessels was held in Lisbon, Portugal, from 28 May to 2 June 1984, under the sponsorship of the Intergovernmental Oceanographic Commission and the Food and Agricultural Organization of the United Nations. Financial support was provided by the Norwegian Agency for International Development.

The main aim of this Workshop was to examine the problems confronting a number of developing countries with regard to the efficient use of research vessels, problems which are hindering the development of marine science research at the national and regional levels. The Workshop was attended by forty-three experts from twenty-three developing and industrialized nations.

To provide a common framework for discussion, participants were invited to prepare background documents on the operation and use of research vessels in their respective countries. These documents were presented during the Workshop, and selected papers are published in the present Supplement The Report of the Workshop (IOC Workshop Report No. 36) has been published separately in 1984.

All invited participants took part in the Workshop in their individual capacity as experts on the operation, management and use of research vessels.

In collecting these background papers in the Supplement, some editorial changes have been made to provide a greater degree of uniformity in style and presentation.

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INFORMATION PAPERS

SUBMITTED PAPERS

EXPERIENCES WITH THE TWO RESEARCH VESSELS OF THE UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM)

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RESEARCH VESSELS

Besides a considerable number of small craft, the Institute of Marine Sciences and Limnology (ICMyL) of the National Autonomous University of Mexico operates two medium-size research vessels specially designed and built for multiple research and training activities. These vessels are the R.V. EL PUMA and the R.V. JUSTO SIERRA.

The characteristics of these vessels are the following:

Overall length	50 m
Waterline length	46.3 m
Breadth moulded	10.3 m
Gross regular tonnage	683 tons (R.V. EL PUMA) 782 tons (R.V. JUSTO SIERRA)
Displacement	1,058 tons
Draught (maximum)	5 m
Draught (design)	4.3 m
Operational radius	9,000 miles
Cruise speed	13.5 knots
Crew	15 persons
Accommodation for scientists	20 (R.V. EL PUMA) 21 (R.V. JUSTO SIERRA)

ACQUISITION OF RESEARCH VESSELS

The decision to acquire a ship for UNAM was made after several years of careful consideration. It was clear that, before undertaking such a costly enterprise, several basic conditions had to be fulfilled. Obviously, the most important among these conditions was that there should be a real need for such research vessels. The second condition was the existence of an adequate academic infrastructure and manpower to take full advantage of such a costly tool.

In considering what type of vessel should be designed and built, many aspects were taken into account, among which the versatility and the scientific work space was given a high priority along with low crew requirements, adequate accommodation for scientists and students, and reasonable costs of operation.

In previous years and during the selection process, several offers of "donations", particularly of old foreign navy vessels were studied. These were all rejected, since experience in other countries has shown that adapting an old vessel in a satisfactory way and running it under given circumstances is more expensive, in the long run, than to operate a new vessel designed to meet the particular needs of the national marine research and the conditions under which the vessel will be used.

When UNAM decided to acquire a ship in 1979, intensive studies and consultations were undertaken to work out the most adequate design and equipment, taking into account the operational needs, as well as the availability of spare parts and special maintenance services.

After several months of analysis and negotiations, it was decided to commission the building of the vessel to a Norwegian shipyard. Thus the vessel, R.V. EL PUMA was delivered in November 1980, dedicacted on 14 December 1980, and became operational in early 1981.

ORGANIZATIONAL ARRANGEMENTS

During the construction of the R.V. El PUMA in 1980, the authorities of UNAM had discussions with CONACyT and with PEMEX, with the idea of sharing such a sophisticated tool with other institutions. The purpose and possibilities of the vessel were analyzed, in particular the idea to use it for national purposes, concentrating efforts on the systematic exploration and knowledge of the Mexican Exclusive Economic Zone.

During the negotiations between the three National Institutions, a key question arose: if the R.V. EL PUMA will be based in the Pacific Ocean, when and how will it be possible to explore in due time, the Gulf of Mexico and the Mexican Caribbean. The original idea of UNAM to cross the Panama Canal once a year and to work alternatively on each side was considered inadequate, since it is essential for the country to work systematically and simultaneously on both sides in order to obtain timely information. Consequently, it was decided to establish an inter-institutional agreement between UNAM, CONACyT and PEMEX. The main reasons for this agreement are the following:

- the need to realize fundamental scientific research on the nature, characteristics, and natural resources of the Mexican seas (including the territorial sea and the EEZ) and to evaluate human impact on these resources.

- to increase the national marine scientific capability through the concerted efforts of the available human resources in the country;

- to strengthen the national marine research activities through the concentrated action of various Mexican institutions;

- to open up the possibility to improve the research work and the institutional programmes for the education of highly qualified researchers and technicians required by Mexico for the development of its marine resources;

- to have two modern, multipurpose and efficiently operated research vessels, making them available to the national scientific and technological community;

- to reduce substantially the cost of marine exploration activities of the country;(up to that moment the offshore prospecting was done only through very expensive leasing contracts of foreign vessels and technicians: the inconvenience of these types of contracts is quite clear).

The agreement constitutes a consortium that operates on the following basis:

- UNAM contributes with the R.V. EL PUMA, the shore facilities and piers, as well as the support of the three marine stations of the ICMyL;

- the cost of construction of the R.V. JUSTO SIERRA is shared between CONACyT and PEMEX. The ship was commissioned to the same shipyard in Norway: delivered on 16 July, 1982 and dedicated on 19 November 1982, it began operation in April 1983.

- both vessels are the property of UNAM. This institution assumes all the responsibility of administration, operation and maintenance;

- the annual operational expenses of the two vessels are shared equally by UNAM, CONACyT and PEMEX;

- for the programmatic aspects and general supervision of the agreement, an Inter-institutional Committee (CIPBO) was established, with participation of UNAM, CONACyT and PEMEX. Basically, each institution has the right to one third of the available ship time for its own use.

The agreement has important implications:

(i) it has projections at a national level and indeed represents the most significant negotiation in marine sciences made in Mexico;

(ii) it permits national institutions to attend properly to the areas and problems in marine scientific research in order of priorities.

(iii) as Mexican scientists are studying the National EEZ, it assures first-hand information and results that will remain in the country;

(iv) it enhances the image of Mexican marine science in the international community;

(v) it reduces dependency by stimulating the development of national technology;

(vi) it allows us to educate and train, within the country, the required marine scientists and technicians;

(vii) in the short existence of the agreement, more marine research has already been done by nationals than in the rest of Mexican history;

(viii) the purposes of UNAM, CONACyT and PEMEX are complementary and do not interfere with each other;through CONACyT, the vessels are available to the entire national scientific community;

The agreement was originally signed on 14 December, 1980 and ratified in March, 1982. It should be pointed out that both vessels have been totally paid with Mexican funds, which is evidence of the importance given to the ocean by the Mexican Government.

UTILIZATION OF RESEARCH VESSELS

USERS

Besides UNAM staff, several other institutions are using the vessels:

(i) UNAM:

- ICMyL
- Facultad de Ciencias (School of Sciences)

(ii) PEMEX:

- Gerencia de Protección Ambiental
- Instituto Mexicano del Petróleo (IMP)

(iii) CONACyT:

- Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)
- Centro Inerdisciplinario de Ciencias Marinas (CICMAR), IPN
- Centro de Investigaciones Biológicas de la Paz (CIB)
- Instituto Nacional de la Pesca (Secretaría de Pesca)
- Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (CINVESTAV) - Unidad Mérida
- Instituto Nacional de Investigaciones Eléctricas, Comisión Federal de Electricidad
- Several State Universities

The overall use and schedule of operations of the vessels is established, as mentioned above, by an "Inter-institutional Committee for the Oceanographic Programme of the Vessels" (CIPBO).

Normally, the vessels are requested by groups of scientists within a common programme. There is enough flexibility to accept the participation of individual scientists provided that they adjust their needs to the main plan of each cruise.

A Technical Advisory Committee (CAIBO) advises the Director of the Institute in judging whether the activities to be carried out on a particular cruise are technically feasible and whether any risk for the vessel and the scientists is involved.

As the whole operation is quite recent, up to now most of the cruises have been conducted separately by each partner of the consortium. Presently, however, efforts are being made to integrate an inter-institional programme relative to the different oceanic areas near the country.

A basic condition is that the cruise leader should be a participant in the control of the cruise poject, and he or she should have experience in leading research work at sea.

At the end of each cruise a confidential report is presented by the cruise leader. Later on, a Technical Report is required.

UTILIZATION OF VESSELS

Both vessels are used for multipurpose research concerning all major fields of oceanography.

- Physical oceanography
- Marine meteorology
- Chemical oceanography
- Marine pollution
- Marine biology
- Marine geology and geophysics
- Hydrography
- Fisheries
- Prospecting of mineral resources

To do this, the vessels are equipped with the following laboratories and general facilities:

- General-purpose laboratory
- Wet laboratory
- Biology laboratory
- Unit for reception and preparation of samples and instruments
- Registration and computing centre
- Cartography and copying room
- Library
- Conference room
- Photographic laboratory
- Mechanics and electronics workshops
- Scientific freezers
- Gravimetry room

Formal training of university students is given on board the vessels, and on-the-job training to scientists, technicians and crew is also provided.

RESEARCH VESSEL MANAGEMENT

As there did not exist previous successful experience in Mexico in managing research vessels, ICMyL needed to build its own mechanisms and infrastructure starting from zero. In this effort, great support has been received from the University administration. Very valuable guidance has also been provided by a UNDP-Unesco Project.

Efforts have been made to keep the administrative structure as amall as possible, trying to obtain the maximum efficiency and to make full use of the structure and capabilities of the University.

The body responsible for the overall operation of the vessels is the ICMyL of UNAM. Within the ICMyL the structure is as follows: the Director of the Institute carries the entire responsibility for the vessels. The administrative aspects are under the Administrative Secretary of the ICMyL and his staff which interacts with the general administration of UNAM and that of each ship. Local administration of each vessel is carried out by an administrative superintendent, with accounting and office facilities.

Until now, some administrative aspects have been carried out by a private shipping agent. However, recently, our two administrative superintendents were approved by the government as shipping agents. This will reduce drastically some of the costs of operation.

The funds for the administration and operation of the vessels are provided by the Mexican Government through three separate channels: UNAM; CONACyT; and PEMEX.

The UNAM, as the organization responsible for the operation, receives periodically funds provided by CONACyT and PEMEX. A very strict and detailed accounting and auditing system is established by UNAM and between the three institutions.

All administrative personnel, as well as the crew, are university employees. Crew members have sea allowances and a special compensatory salary and leave for extra working time; also, the crew has 30 days of vacations per year and a free day ashore for each Sunday and official holiday at sea.

At sea, a three-watch system is used; i.e., 4 hours watch and 8 hours rest twice a day for the three groups. Exceptions are the galley and service personnel, who work normal-day hours, and the electronic engineer, electrician and handy-man, who have a more flexible schedule and are on stand-by 24 hours a day.

In home port the crew works normal-day hours. During the night, the vessel is guarded by a bridge officer, an engineer and an extra watchman.

It should be kept in mind that the vessels of UNAM are provided with a high degree of automation, with a partially unmanned engine room, automatic pilot, radars, echosounders with alarm, satellite navigation and remote controls, "A" frames and the crane whereby the vessels can be handled by a crew of only 15 persons.

The annual operating cost for each vessel (equivalent in US$) is as follows:

Crew salaries	199,560
Food, water, provisions	52,618
Maintenance	142,424
Harbour dues, pilotage	47,681
Fuel and lub. oil	88,052
Overhead management	85,538

Approximately, net annual salaries of crew for vessel mid 1983, including sea allowances (equivalent in US$) are:

Captain	12,700
First Officer	10,180
Chief Engineer	11,878
Deckhand	6,280

As a comparison, the average net salary of the academic and technical staff (mid-1983) for UNAM only is:

Academic staff (monthly)

Full-time senior professor or researcher	696
Full-time junior professor or researcher	575
Full-time associate professor or researcher	484

Technical staff (monthly)

Full-time senior academic technician	484
Full-time associate academic technician	424

The scientific and technical staff of UNAM have sea allowances when participating in a cruise.

It is pertinent to mention that salaries were seriously deteriorated by the devaluation of the Mexican peso.

The R;V. JUSTO SIERRA has its home port in Tuxpan, Veracruz, and operates in the Gulf of Mexico and the Caribbean Sea. The R.V. EL PUMA is based at Mazatlán, Sinaloa, and operates in the temperate and tropical Eastern Pacific Ocean.

Normally the vessels operate within the Mexican Exclusive Economic Zone. Occasionally, however, cruises include neighbouring areas, particularly the Eastern Tropical Pacific and the Caribbean.

MAINTENANCE AND REPAIR

The technical aspects related to the operation of a vessel are under the responsibility of the Technical Secretary of the Institute, assisted by a Technical Superintendent who looks after both vessels.

Preventive and corrective procedures are being established by the Technical Superintendent, including the timetable of dry docking, and other maintenance services.

There are national dry-dock facilities in the Gulf of Mexico and on the Pacific coast, although they can be used only for normal and preventive maintenance. Shipboard facilities are also available for normal engine and general repair.

For very specialized repairs and maintenance work, it is necessary to resort to foreign facilities, as well as technicians from neighbouring coutries, in particular the USA. Fortunately, this happens only sporadically.

Matter related to the maintenance, repair and replacement of scientific equipment are co-ordinated by the Technical Secretary, with a responsible unit, both general and for each vessel. The situation is still unsatisfactory, and training of personnel to remedy this situation is being carried out with the assistance of other departments of UNAM, such as the Instrumentation Centre and the Institute of Applied Mathematics and Systems.

GENERAL PERFORMANCE

General information on the institutes that operate research vessels may be found in Table I and Figures 1-3. The use and operation of the vessels is illustrated in Tables II, III and IV and Figure 4-9.

NATIONAL AND INTERNATIONAL CO-OPERATION

The institute is widely connected with several institutions, at national and at international levels (See Table II).

CO-OPERATION AT THE NATIONAL LEVEL

The ICMyL is not the only Mexican academic institution helping to create the national infrastructure in Marine Sciences. Others have been strengthened and/or created since 1973. This is the case of the Instituto Politécnico Nacional (IPN) with the Centro Interdisciplinario de Ciencias Marinas (CICIMAR), located at La Paz, B.C.; the Centro de Investigación y Estudios Avanzados (CINVESTAV), IPN, Unidad Mérida, and the Centro de

Investigación Cientifica y Educación Superior de Ensenada (CICESE). Several state or private universities have also established training in marine sciences.

In the governmental sector, Mexico is beginning to assign high priority to the ocean, as typified by the fisheries bureau being raised to State Secretariat level, and the significant increase in offshore oil developments, as well as the political decision to sign and ratify the United Nations Convention on the Law of the Sea.

The technical groups of the State Secretariats of the Navy and Fisheries have also been strengthened during recent years.

PEMEX (the Mexican Oil Company) and the Comisión Federal de Electricidad (CFE) have also improved their research capabilities.

Academic institutions continue, nevertheless, to function on this basis for the development of marine sciences in Mexico, as exemplified by the current intensive use of the research vessels previously referred to. This situation is the result of institutional policies as well as governmental decisions.

INTERNATIONAL CO-OPERATION

Collaboration takes place at bilateral or multilateral levels and with several foreign universities. Significant co-operation exists with Unesco, both with the Division of Marine Sciences since 1963, and with the IOC.

The R.V. EL PUMA has been used in several bilateral co-operation projects, by UNAM, CICESE and others; in particular, in the study of the Costa Rica Dome in the Pacific Ocean, with participation of scientists from Norway, Costa Rica, Nicaragua, Chile, USA and Mexico. The R.V. JUSTO SIERRA is being used for several cruises in the IOCARIBE region. The first one, YUCA-1, is now in progress with scientists from Cuba, Costa Rica, Colombia, Barbados, USA and Mexico.

MAJOR PROBLEMS

As this is the first time that UNAM takes on the task of managing and operating oceanographic vessels of such size, a whole new administrative apparatus is presently in the making and obviously many problems have risen. Several of these have already received a definite solution, whereas others have been solved provisionally and some are still awaiting solution. Here are some examples:

- The problems related to licences and customs duties on the vessels and their equipment have been solved.

- Problems related to the sea-going personnel have received an ad hoc solution through a specific agreement with the labour union, in order to avoid conflicts that are bound to arise between the labour rules of the University, and those that apply to maritime personnel on commercial fishing and cargo vessels. As a solution to such problems, the University has taken the line to offer best prevailing conditions to its sea-going personnel. It is expected that, in the future, more clear-cut arrangements will be reached.

- The shore facilities for the vessels are still unsatisfactory. This applies in particular to the operational base at Tuxpan. In Mazatlán, storage capacity for equipment is already at hand and a proper pier for the vessel is being finished, while at Tuxpan no storage for equipment is yet available, so that practically all equipment and instruments are being stored on board the research vessel JUSTO SIERRA. The project for the operational base and a proper pier for the vessel is in the planning stage.

- Maintenance of scientific equipment and instruments presents a problem that has only been partially solved. Measures have been taken to use the total technical capability of the University to overcome this difficulty and it is expected that further efforts along this line will satisfy the most urgent needs in this respect.

- Some difficulties regarding spare parts have already appeared, in spite of a very substantial stock brought by the vessels upon arrival in Mexico. This situation has been aggravated by the country's economic crisis and the shortage of foreign currency.

STRATEGY FOR FUTURE DEVELOPMENT

It is expected to consolidate the institute with the smallest possible growth through:

(i) Improved support to individual researchers that are already actively engaged in marine research; namely:

(a) finishing doctorates;
(b) post-doctoral activities;
(c) proper use of sabbatical years;
(d) intensive interaction with appropriate external groups;
(e) residence in other institutions; and
(f) visiting scientists

Within this policy, the graduate programme of UNAM in marine science is very important. Advice from scientists from other institutions is being used for the dissertations of some of our students. Opportunities to finish their academic requirements in foreign institutions are given to our staff when needed.

(ii) Preparation and incorporation of the necessary new staff members to the institutes in different areas of marine scientific research, as well as the local stations

- recruitment of the best products of our graduate programme

- recruitment of scientists trained abroad (at this moment over 15 persons are working for their doctorates in different foreign institutions).

(iii) Improvement of the capability of the academic technical personnel.

NATIONAL AND INTERNATIONAL RELATIONSHIPS

Table I

Higher Education Institutions

Universidad Autónoma de Sinaloa
Universidad Autónoma de Baja California
Universidad de Sonora
Instituto Politécnico Nacional (Centro Interdis ciplinario de Ciencias Marinas)
Centro de Investigación y Estudios Avanzados (Unidad Mérida)
Centro de Investigaciones Biológicas de Baja California Sur

Descentralized Agencies

Comisión Federal de Electricidad
Fondo Nacional de Turismo
Petróleos Mexicanos
Consejo Nacional de Ciencia y Tecnología
Instituto Mexicano del Petróleo
SOMEX

Convenio UNAM-CONACyT-PEMEX (Buques)

Secretariats

Secretaría de Pesca
Secretaría de Desarrollo Urbano y Ecología
Secretaría de Programación y Presupuesto
Secretaría de Marina

Governmets of States

Guerrero
Michoacán

Local Universities

Bilateral

Australia, Costa Rica, Cuba, USA
United Kingdom, France, USSR, etc.

Multilateral

UNESCO, Intergovernmental Oceanographic Commission (IOCARIBE, MARPOLMON, GIPME, CCCO).

Foreign Universities

Scripps Institution of Oceanography. University of California, San Diego
Texas A&M University
University of Miami
University of Costa Rica
University of Bordeaux
University of Kiel
University Lomonosov
etc.

Table II

OPERATION OF THE OCEANOGRAPHIC RESEARCH VESSELS

Number of Cruises and Days at Sea

	1981		1982		1983	
	Cruises	Days	Cruises	Day	Cruises	Days
R/V "El Puma"	9	105	14	197	13	207
R/V "Justo Sierra"					10	143
T o t a l	9	105	14	197	23	350
Available days not used		35		38		78

Total Nr. of Cruises 81-83: 46
Total Nr. of Cruises days 81-83: 652

Monthly average of cruises and days at sea

	YEAR	Working Months	Average number of Cruises per Month	Average number of days per cruise
R/V "El Puma"	1981	12	0.7	11.6
	1982	12	1.1	14.0
	1983	12	1.1	16.2
R/V "Justo Sierra"	1983	9	1.1	16.7
Average		45	1.0	14.8

Table III

OPERATION OF THE OCEANOGRAPHIC RESEARCH VESSELS

Cruises per Institution

	R/V "EL PUMA"			Total	R/V "JUSTO SIERRA"*
	1981	1982	1983		1983
UNAM	9	8	5	22	4
CONACyT		4	5	9	4
PEMEX		2	3	5	2
Total	9	14	13	36	10

Days per Institution

	R/V "EL PUMA"			Total	R/V "JUSTO SIERRA"*
	1981	1982	1983		1983
UNAM	105	124	71	300	53
CONACyT		51	82	133	56
PEMEX		22	54	76	37
Total	105	197	207	509	146

* Began operations in April 1983.

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Table IV

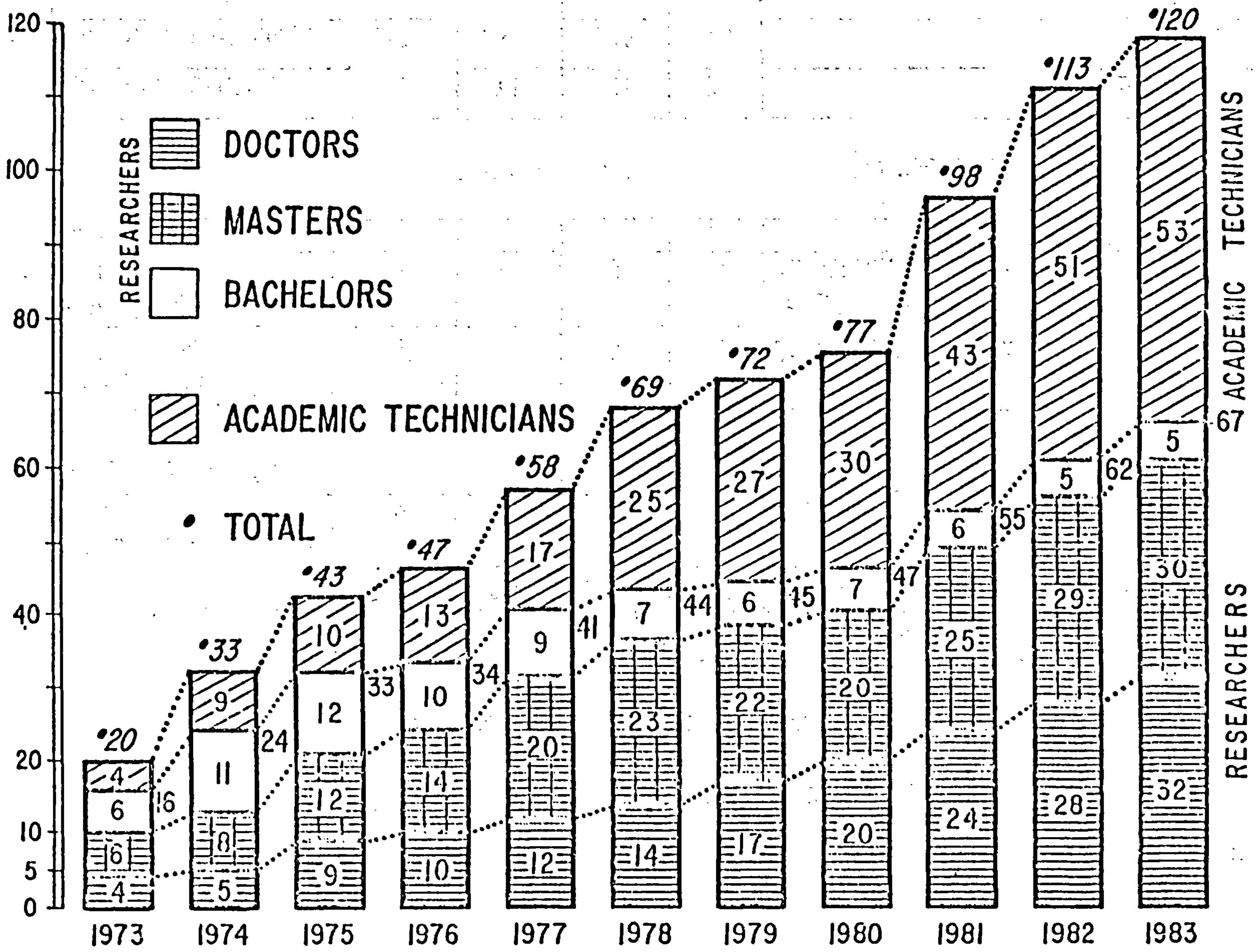
OPERATION OF THE OCEANOGRAPHIC RESEARCH VESSELS

Areas covered by the Research Vessels

	R/V "El Puma"				R/V "Justo Sierra"	
	1981	1982	1983	Total		1983
Gulf of California and Adjacent Areas	0	6	8	14	South-East Gulf off Mexico	3
Eastern Pacific of Central Mexico	7	3	2	12		
Eastern Pacific off South Mexico	1	4	3	8	South Gulf of Mexico	4
Eastern Pacific off Central America	1	1	0	2	Yucatan Shelf and the Caribbean of Mexico	3
Total				36		10

	R/V "El Puma"				R/V "Justo Sierra"	Total
Number of Cruises	9	14	13	36	10	46
Number of Participants	189	268	219	676	190	866
Average per Cruise	21	19	18	19	19	19

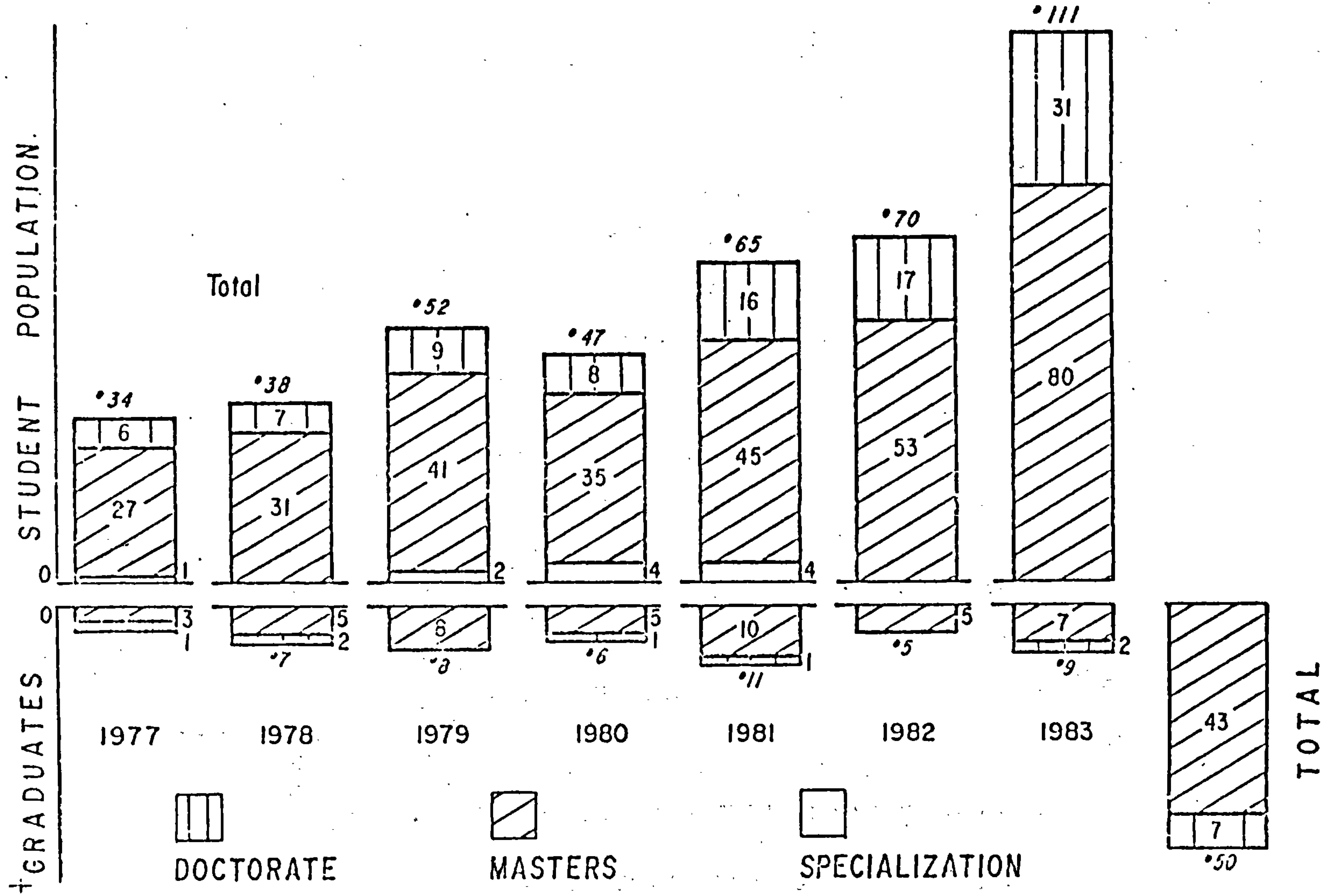
ICMyL ACADEMIC STAFF FIGURE 1



CCH-ICMyL FIGURE 2

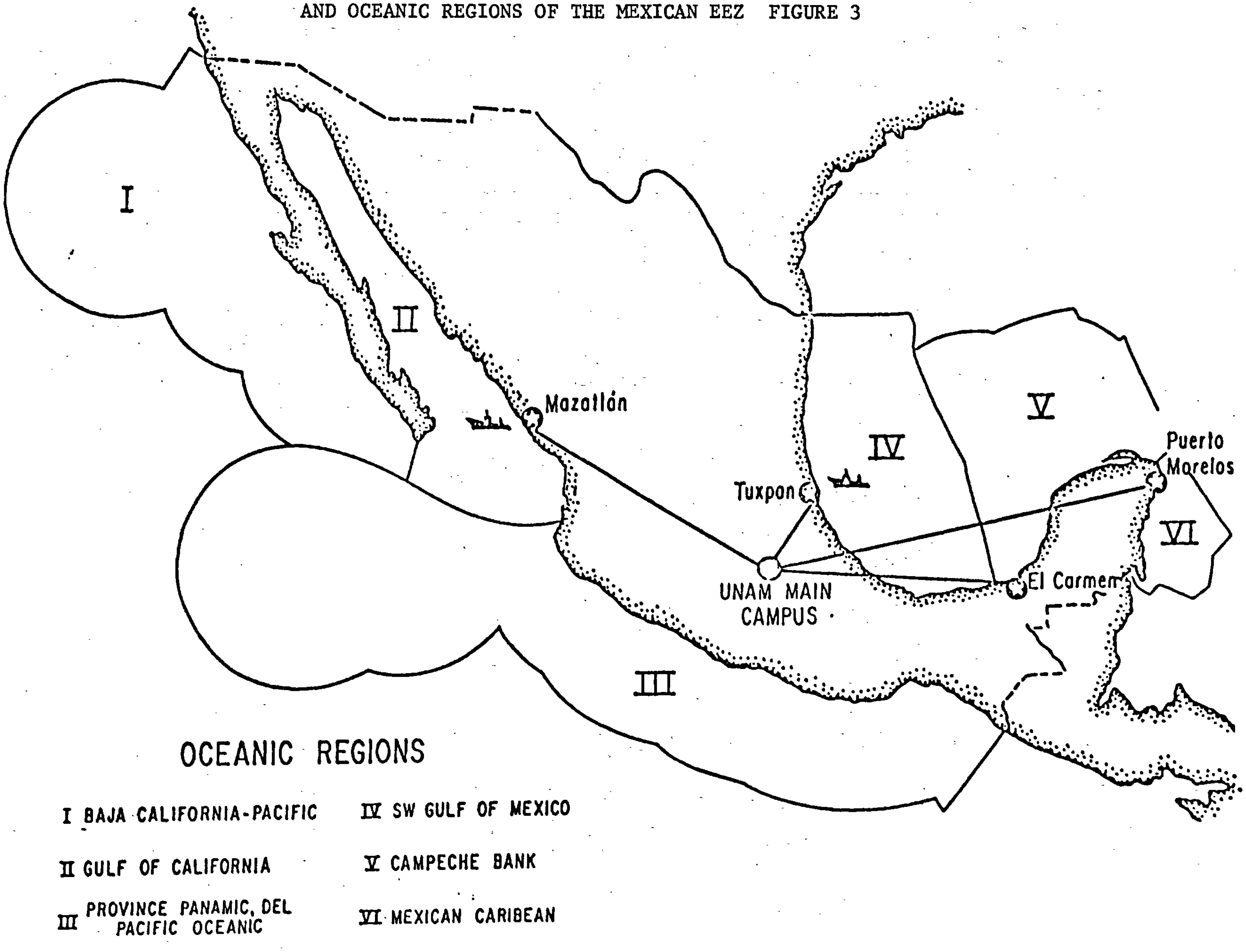
GRADUATE PROGRAMME IN MARINE SCIENCES

(Physical, chemical, geological, and biological and fisheries oceanography)



LOCATION OF THE FACILITIES OF THE ICMyL-UNAM

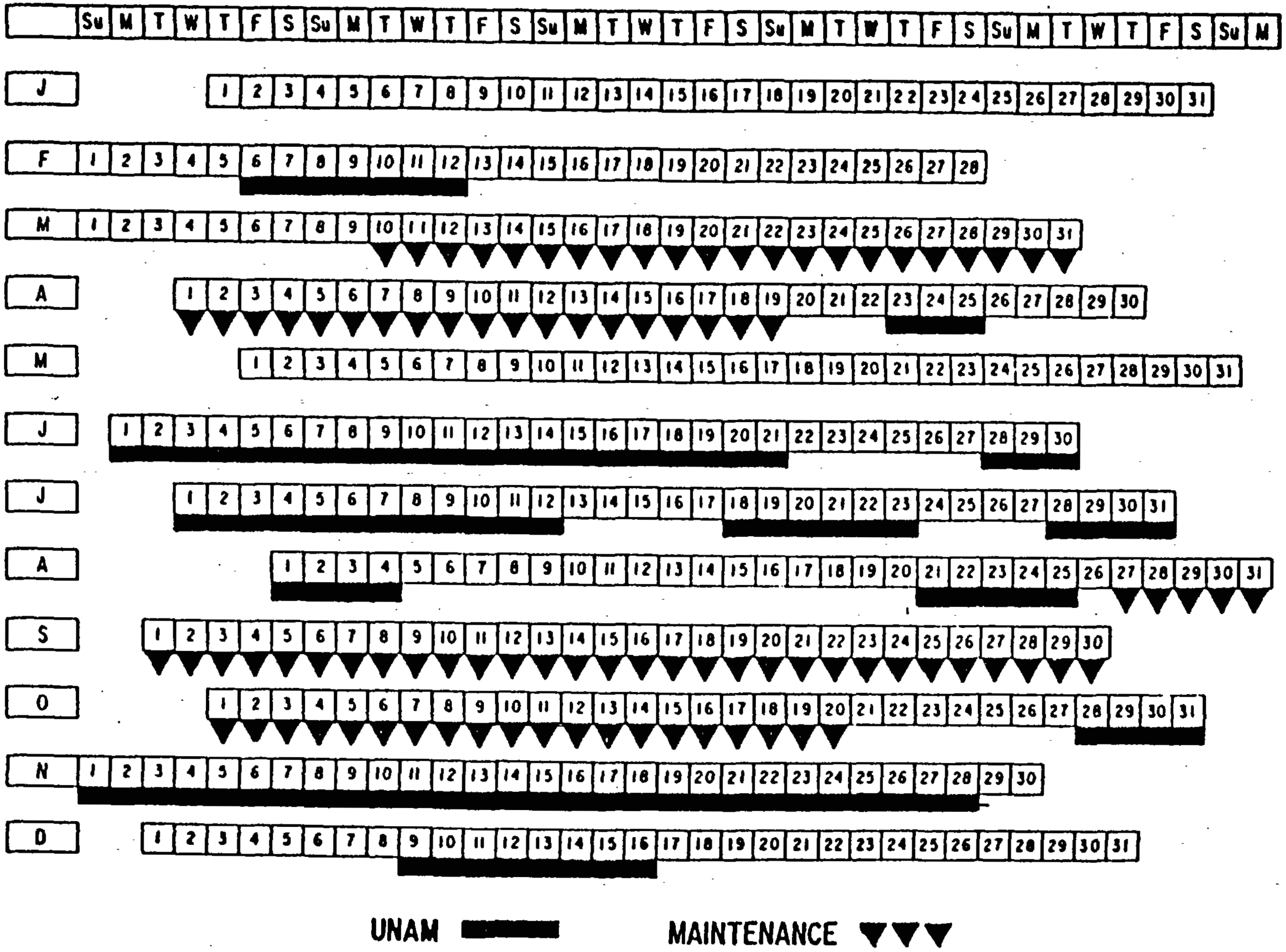
AND OCEANIC REGIONS OF THE MEXICAN EEZ FIGURE 3



OPERATIONAL SCHEDULE R/V "EL PUMA"

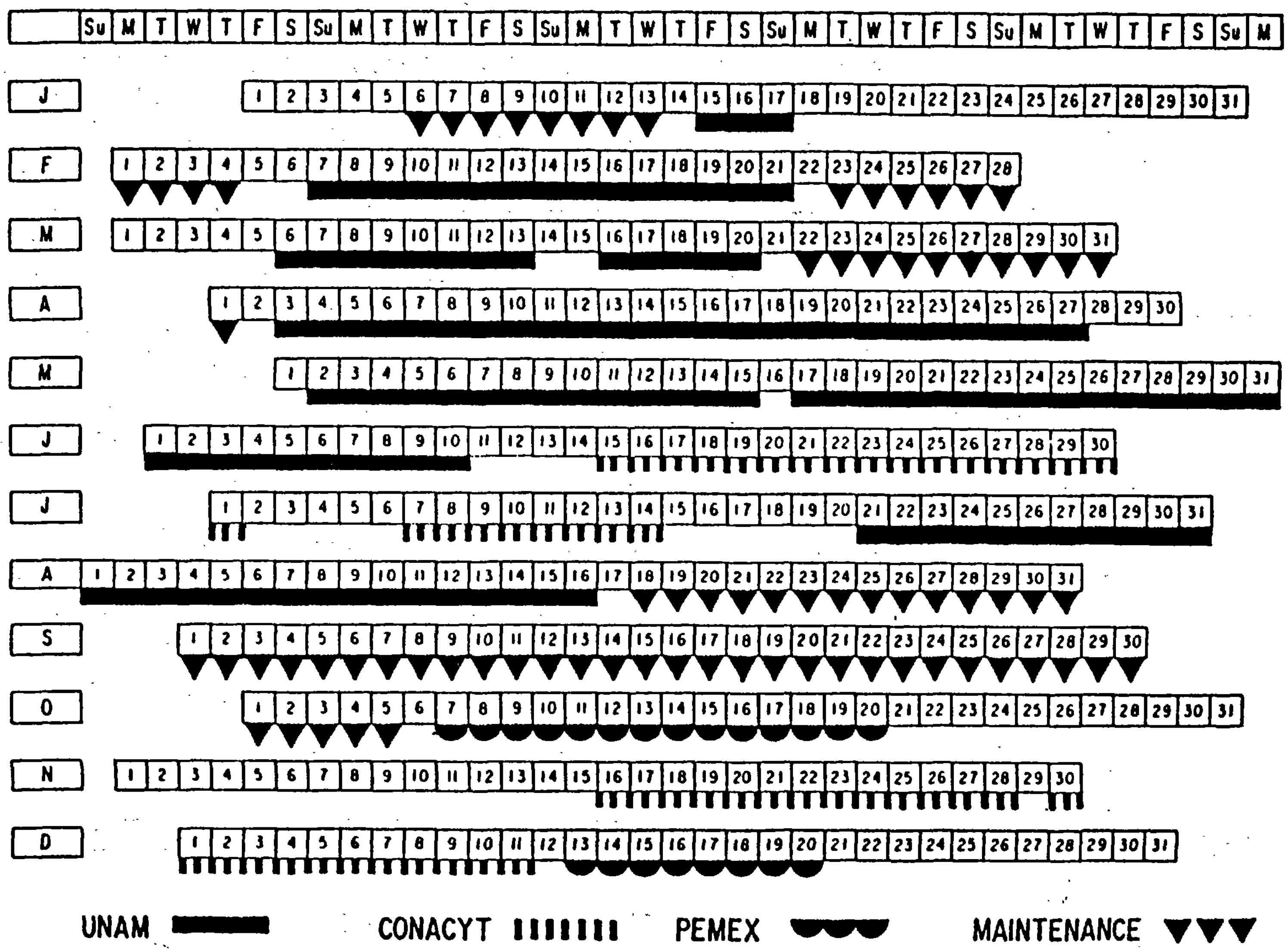
1981

FIGURE 4



OPERATIONAL SCHEDULE R/V "EL PUMA" Figure 5

1982



OPERATIONAL SCHEDULE R/V "EL PUMA" FIGURE 6

1983

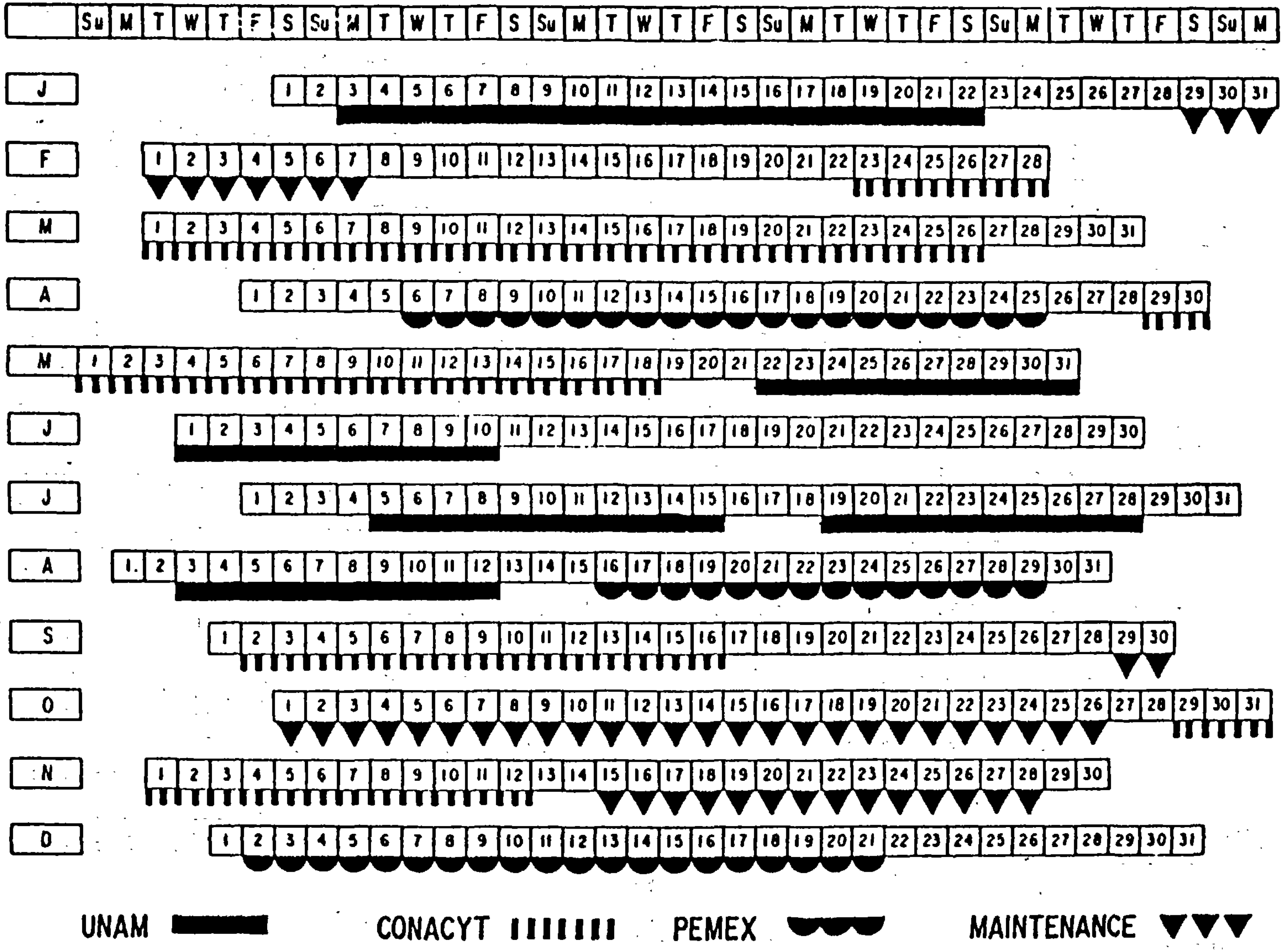
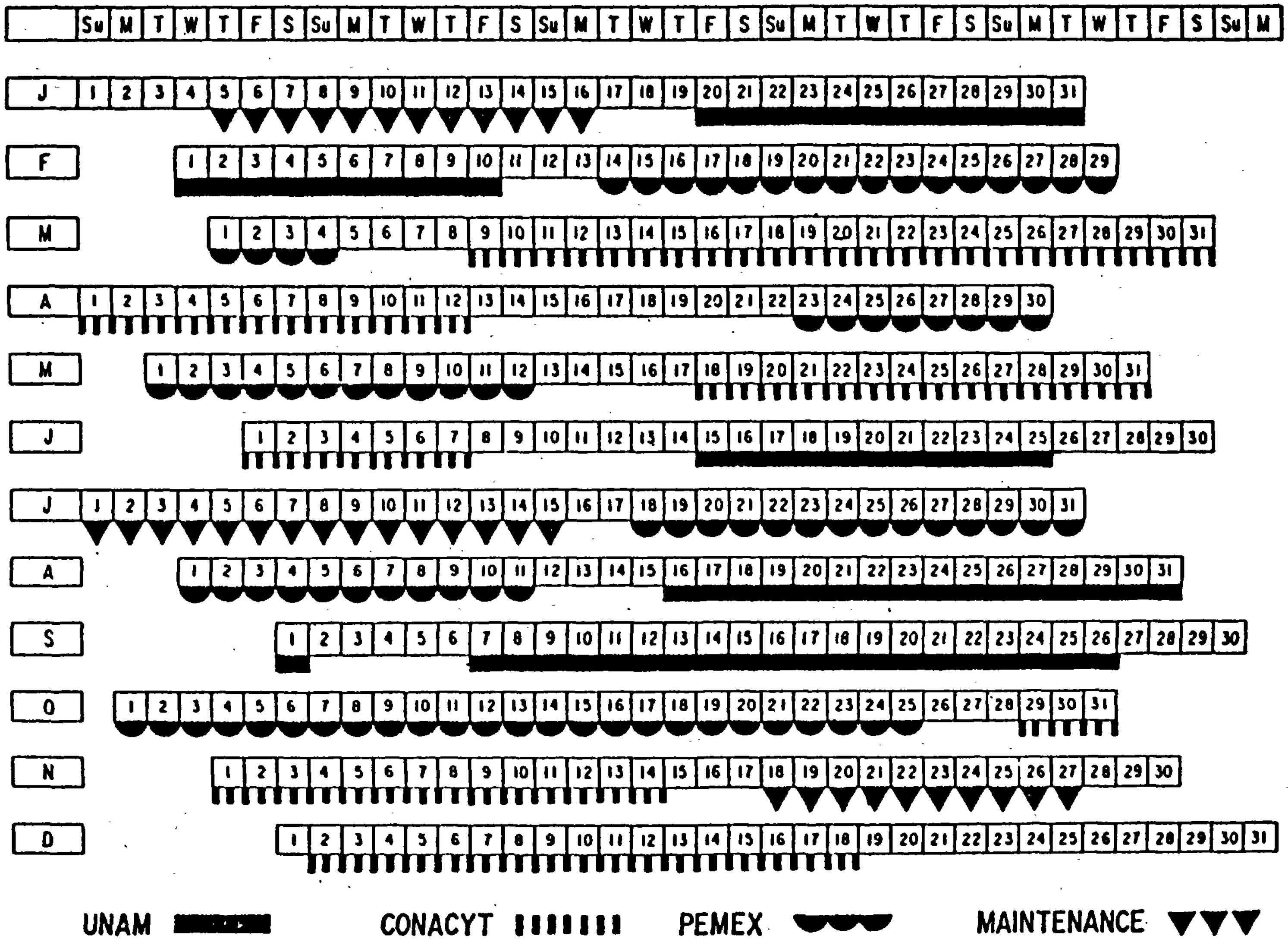


FIGURE 7

OPERATIONAL SCHEDULE R/V "EL PUMA"
1984



OPERATIONAL SCHEDULE R/V "JUSTO SIERRA" 1983

FIGURE 8

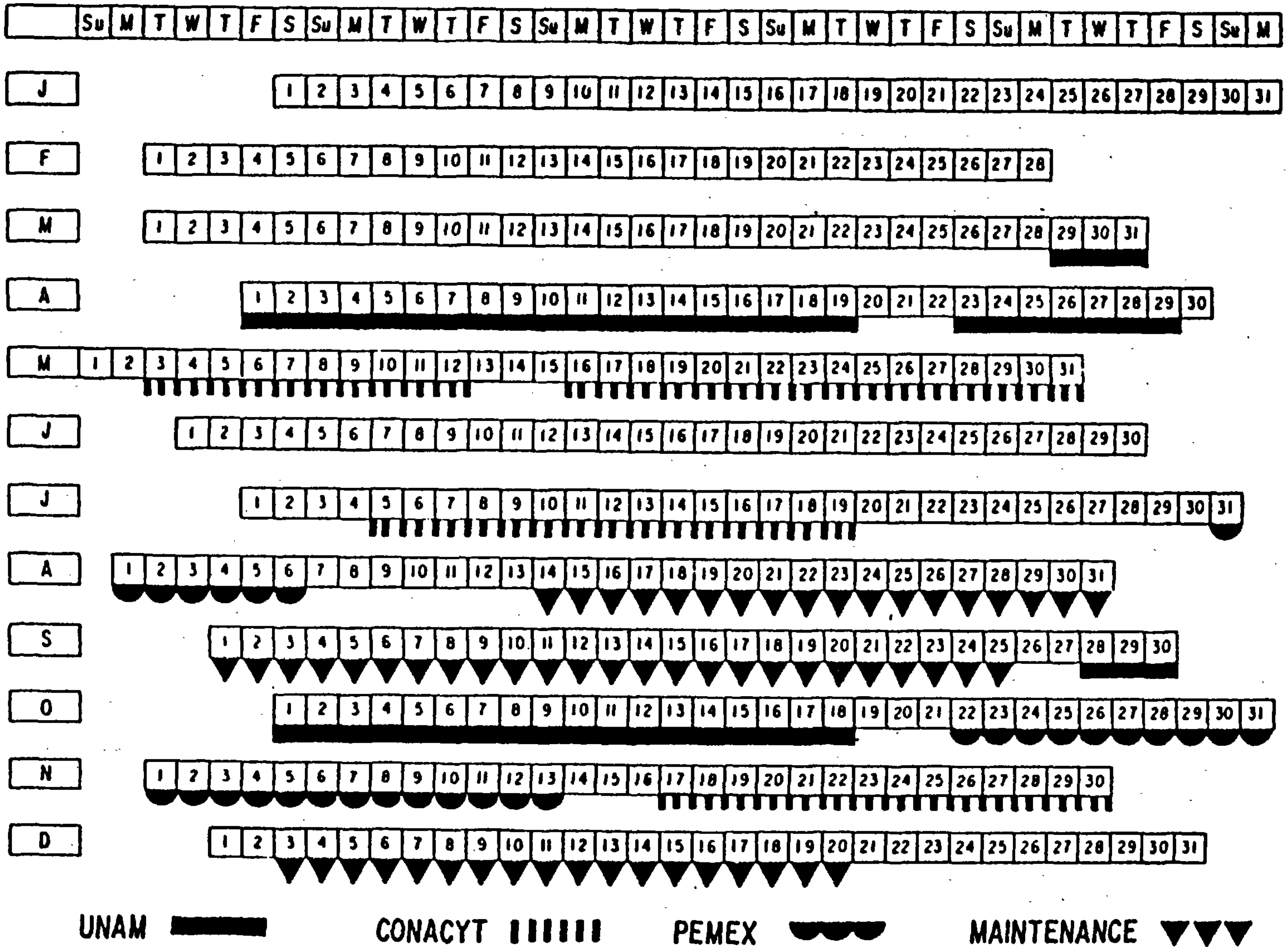
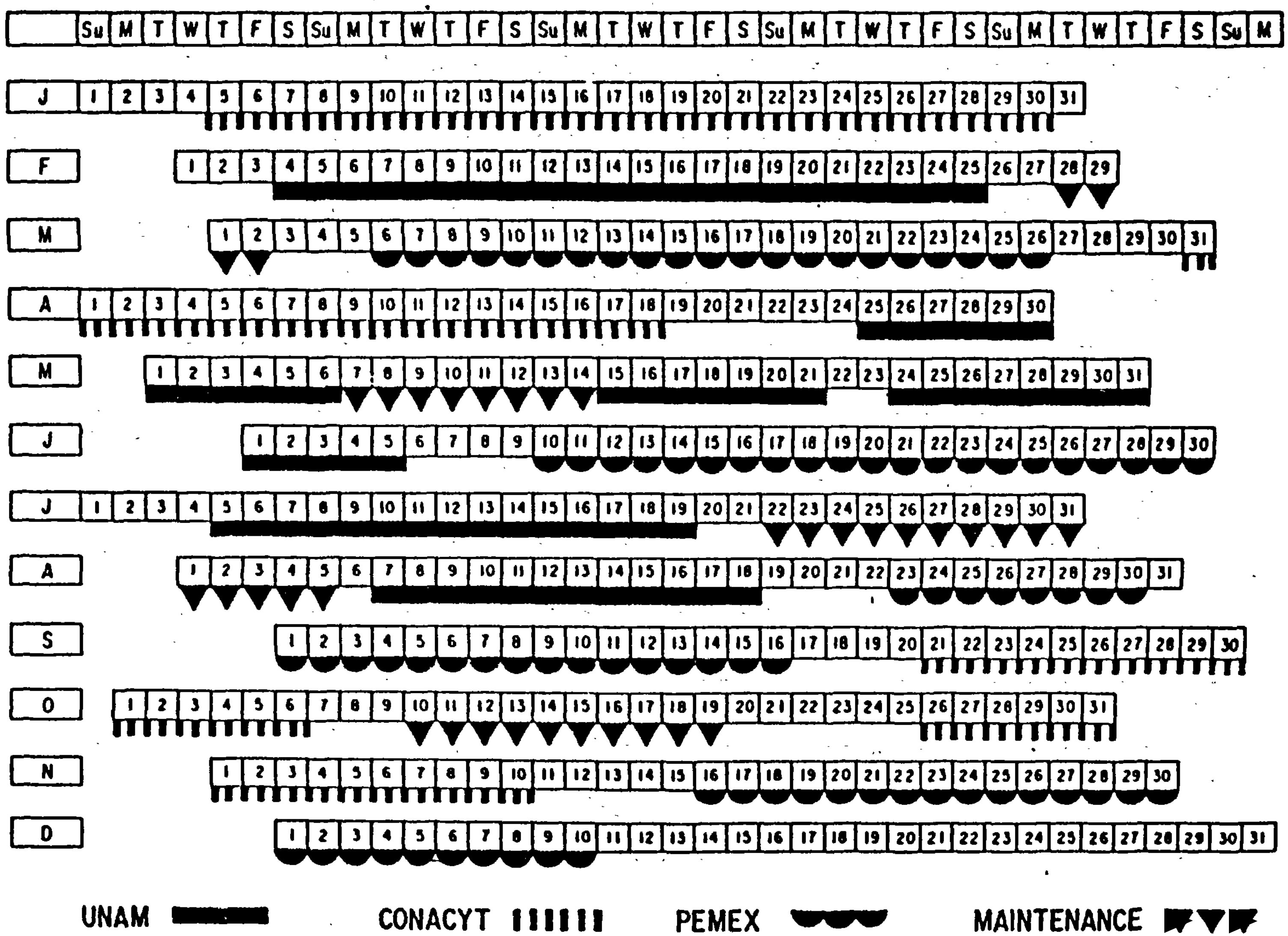


FIGURE 9

OPERATIONAL SCHEDULE R/V "JUSTO SIERRA"

1984



"ROYAL RESEARCH SHIPS" OWNED AND OPERATED BY THE NATURAL ENVIRONMENT RESEARCH COUNCIL

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CONTENTS

BACKGROUND

The Natural Environment Research Council, established by Royal Charter in 1965, has responsibility for planning, encouraging and carrying out research in the physical and biological sciences which explain the natural processes of the environment. Only through such studies can an understanding of man's impact on his surroundings and their influence on his activities be achieved and sensible policies for the exploitation of natural resources be formed.

The Council carries out this research and training through its own institutes and grant-aided associations, and by grants, fellowships and post-graduate awards to universities and other higher education establishments.

The Council is financed by a grant-in-aid from Parliament, received through the Department of Education and Science, and by commissioned research from Governemnt departments and other agencies. In the year 1982/83 under review, the Council's net expenditure was £84,139,181 of which £57,913,045 was funded from the Science Budget and £26,226,136 from commissioned research.

RESEARCH SHIPS

The "Questionnaire on Uses of Research Vessels" includes the following research ships owned and operated by the NERC.

GROUP 1 SHIPS (Below 25 gross tons)

SEPIA, SEOL MARA, TAMARIS, GAMMARUS

These small craft operate on a day-to-day basis in local estuarine and inshore waters off the UK mainland. They seldom operate away from their base port where laboratory facilities are located and samples are landed. They are primarily engaged in biological, physical oceanography, sea-bed sampling and pollution studies.

These craft are locally manned, operated, maintained, and programmed by the relevant NERC department which is allocated funds from NERC headquarters for this purpose.

GROUP II SHIPS (50-100 gross tons)

CALANUS, SQUILLA

These vessels operate in local UK continental shelf waters and are primarily engaged on biological, physical oceanographic, geological and pollution studies.

Although mainly employed locally on cruises of 1 to 3 days' duration, these vessels range up to 75 miles from their base port for 14-day periods.

Day-to-day maintenance is carried out locally, but annual refits are undertaken at the port submitting lowest tender price.

Deck crews are recruited locally, but officers are provided from NERC's Central Manning Pool. (see below).

A hybrid programming system operates for these small vessels. Normally, the ships are scheduled locally, but NERC's central programming system has priority to allocate time/cruises as demand dictates.

The finance to support these ships is allocated by NERC HQ on an annual basis to the relevant department.

GROUP IV SHIPS (250-450 gross tons)

FREDERICK RUSSELL, CHALLENGER, CHARLES DARWIN

Operating capabilities of this Group fall into two classes. The FREDERICK RUSSELL and CHALLENGER are considered by NERC as "middle distance" vessels operating in the North Atlantic, Azores and Mediterranean areas, whereas the new ship CHARLES DARWIN will operate world wide.

All ships in this Group are "general purpose" vessels capable of conducting all research disciplines, but the FREDERICK RUSSELL and CHALLENGER are primarily designed to undertake biological/physical oceanographic projects.

Deck hands are recruited via the Seamen's Union: officers are permanent NERC staff (see section on Central Manning Pool below).

Running maintenance is undertaken by ship's staff, but major alterations/additions are undertaken during the ship's annual refit, which can take place at any shipyard.

These ships are centrally programmed and funded.

GROUP V SHIPS (500-800 gross tons)

BRANSFIELD, JOHN BISCOE, DISCOVERY

Of the ships in this Group the BRANSFIELD and the JOHN BISCOE are logistic vessels mainly employed in support of NERC's bases in Antarctica. The BRANSFIELD has only limited research capabilities. The JOHN BISCOE, however, is equipped with deep wires and laboratory facilities, providing her with a biological/geological research capability.

Deck hands are, in the main, recruited from the Falkland Islands; the officer complement is permanent NERC staff. Running maintenance is undertaken by ship's staff, and major defects or additions are undertaken during the ship's annual refit.

Programming of Antarctic operations, amounting to approximately 180 days, is undertaken by the British Antarctic Survey (a NERC Institute), the remaining time (less refit period) is available to the NERC Central Programming Facility if required.

Funds to support these two ships are allocated by NERC HQ on an annual basis to BAS.

DISCOVERY - this ship has the capability of conducting all research disciplines world wide. Deck hands are recruited via the Seamen's Union; officers are permanent NERC staff. Maintenance is undertaken by ships staff, but major alterations/additions are undertaken during the ship refit which takes place at any shipyard. DISCOVERY is centrally programmed and funded.

CENTRAL MANNING POOL

This facility is provided by the Research Vessel Services (RVS), a NERC Headquarters section formed in 1969. The function of the RVS is to implement the annual cruise programmes compiled by the HQ Marine Planning section, and to operate and maintain the NERC research ships. The facilities provided by RVS include a large equipment pool of modern oceanographic instrumentation and a number of computer-based data-acquisition systems. The RVS also provides the scientific and technical support to operate and maintain these systems at sea.

Officers - Leave entitlement equates to approximately 1 day's leave for every 2 seadays served and therefore NERC officers on a rota system of 2 months' sea time and 1 month's leave, subject to ship operations. The total officer complement is 104, of which 67 are at sea at any one time, the remaining 37 being on leave or on standby as reliefs. All officers interchange between the ten ships and are permanent NERC staff.

Crew - As previously mentioned, with the exception of a few senior skilled hands who are permanent NERC staff, the remainder are recruited via the Seamen's Union on completion of refit through to next annual refit; i.e., usually for a 12-month period.

SHIP PROGRAMMING

The Marine Planning Section in NERC Headquarters has three main responsibilities: the planning of the cruise programmes, the planning of research vessel policy (particularly ship replacements); the planning and purchase of marine capital equipment.

The planning of the NERC cruise programme begins some three years before the cruises are actually undertaken. The primary scientific requirements are identified by the Research Vessel Strategy Committee whose membership is made up of scientists from NERC institutes and universities. Specific cruise requests are assessed for their scientific merit and then a cruise programme is prepared which attempts to reconcile the (often competing) demands of the strategic requirements, availability of scientific equipment, logistics and ship's capabilities.

The ship programming procedure is based on a 3-year rolling cycle. The procedure for the financial year 1985/86 is as follows:

1983 - MAY -	RESEARCH VESSEL STRATEGY COMMITTEE This Committee identifies future (2 to 4 years ahead) research priorities on a national and international basis and the major capital equipment required to support these projecs.
1983 - AUGUST - - DECEMBER	SEA-TIME APPLICATIONS - CIRCULATED Sea-time Applications returned
1983/84 - DECEMBER TO MARCH 1984	Sea-time applications together with Research Grant submissions assessed by peer review on scientific merit. Sea-time applications graded and timing priorities allotted. (See Appendic C).
1984 - APRIL TO MAY	Ship programme compiled in conjunction with applicants. If all sea-time demands can be met and programme agreed with the users, then the programme with financial cost is submitted to NERC Council for approval.
1984 - JUNE -	SHIP PROGRAMMING COMMITTEE If the demand exceeds ship capacity and high-grade cruises cannot be accommodated, then the most cost-effective programme with options are submitted to the Committee who recommend the programme to be implemented.
1984 - JULY	The 1985/86 NERC ship programes are approved and implemented.

SHIP COSTS

The full economic cost of the NERC ships for the period 1982/83 is attached as Appendix B.

Annex A
"ROYAL RESEARCH SHIPS"

OWNED AND OPERATED BY THE NATURAL ENVIRONMENT RESEARCH COUNCIL (NERC)

RRS BRANSFIELD

A polar vessel of 4816 tonnes gross built in 1970. This vessel is employed on the supply and support of NERC's British Antarctic bases and research in the Antarctic.

RRS JOHN BISCOE

A polar vessel of 1584 tonnes gross built in 1956, with the same rôle as BRANSFIELD above.

RRS CHARLES DARWIN

A general purpose oceanographic research ship of 1985 tonnes capable of world-wide service. Due to become operational early 1984.

RRS DISCOVERY

A general-purpose oceanographic research ship of 2665 tonnes gross capable of world-wide service, commissioned in 1962.

RRS CHALLENGER

Primarily for biological research but with general oceanographic research capability. Built in 1973, gross tonnage 650.

RRS FREDERICK RUSSELL

Primarily for biological research but with general oceanographic research capability. Built in 1974 and re-converted in 1982. Gross tonnage 547.

NATURAL ENVIRONMENT RESEARCH COUNCIL
MAIN PARTICULARS OF RESEARCH SHIPS OPERATED BY NERC

March 1984
STS2/G1/13
JCC

SHIP'S NAME (Base Port)	YEAR BUILT (Converted)	GROSS TONNAGE (net)	DIMENSIONS			HULL	MAIN PROPULSON (Propeller)	COMPLEMENT			OPERATIONAL LIMITS (Endurance/ days)	RESEARCH CAPABILITY
			L.O.A.	BREADTH	DRAUGHT			OFF:	CREW	SCIENTISTS		
RRS BRANSFIELD (Southampton)	1970 ROB CALLUON	4816 (1577) Displacement 6860	325'4" (99.1m)	60'3" (18.4m)	21'11" (6.7m)	Steel Class 1 Ice	Diesel Electric 5000 BHP 4500 SHP (Single VP)	12	24	58	World-wide (45 days)	Primarily for supply of UK Antarctic bases; total laboratory area - 550 sq ft; air conditioned cranes 1-20 ton fwd, 1-20 ton aft; cargo winches - one 6 ton and two 4 ton.
RRS DISCOVERY (Barry)	1962 HALL RUSSELL	2568 (748) Displacement 2800	261'3" (79.6m)	46'1" (14m)	15'7" (4.7m)	Steel Class 2 Ice	Diesel Electric 2450 BHP 2000 SHP (Single)	13	22	21	World-wide (33 days)	All oceanographic diciplines; total laboratory area - 4500 sq ft; air-conditioning; bow thruster; cranes - one fwd; one aft; gallows - two aft; gantry fwd; winches - twin drum trawl, two hydrographic; sonar trunk.
RRS JOHN BISCOE (Southampton)	1956 FLEMING & FERGUSON	1554 (357)	220' (67m)	40'3" (12.3m)	16'6" (5m)	Steel Class 3 Ice	Diesel 1784 SHP (Single VP)	10	21	29	World-wide (54 days)	Primarily for supply of UK Antarctic bases but with general oceanographic research capability; total laboratory area - 550 sq ft; bow thruster winches - single drum trawl; twin drum hydrographic; cargo derricks - two 10 ton fwd; cargo winches - two 5 ton fwd; aft crane and gantry.
RRS CHARLES DARWIN (Barry)	1984 BRITISH SHIPBUILDERS APPLEDORE	1936 (580)	228' (69.4m)	47' (14.4m)	16' (4.8m)	Steel	Diesel or diesel electric 2600 BHP (Single VP)	9	12	18	World-wide (42 days)	Primarily geological/geophysical research; total laboratory area 2300 sq ft; air conditioned; bow thruster; cranes two aft one fwd; gantries - aft and midships; winches - twin drum hydrographic; twin drum general purpose.
RRS CHALLENGER (Barry)	1973 JAMES LAMONT	650 (340) Displacement 1440	178'6" (54.4m)	37'1" (11.3m)	13'3" (4m)	Steel	Steam Turbine 1050 BHP/SHP (Single Kort Rudder)	8	14	12	North Atlantic and Mediterranean (22 days)	Primarily biological research but with general ocenographic capability; total laboratory area 1200 sq ft; air conditioned; bow bow thruster; stabilised; crane aft; derrick fwd; stern gantry; winches - trawling, 3-drum, 2 aux trawl winches, twin drum hydrographic.

March 1984
STS2/G1/13
JCC

NATURAL ENVIRONMENT RESEARCH COUNCIL
MAIN PARTICULARS OF RESEARCH SHIPS OPERATED BY NERC

SHIP'S NAME (Base Port)	YEAR BUILT (Converted)	GROSS TONNAGE (net)	DIMENSIONS			HULL	MAIN PROPULSON (Propeller)	COMPLEMENT			OPERATIONAL LIMITS (Endurance/ days)	RESEARCH CAPABILITY
			L.O.A.	BREADTH	DRAUGHT			OFF:	CREW	SCIENTISTS		
RRS FREDERICK RUSSELL (BARRY)	1974 SICCMA (1981) SCHEEPSWERNVE BELIARD OSTEND NV	546.7 (153.9)	142'9" (43.5m)	30'10" (9.4m)	13'1" (4.0m)	Steel	Diesel 1230 BHP (Single VP)	6	9	8	North Atlantic (20 days)	Primary biological with general oceanographic capability; total laboratory area 720 sq ft, air conditioned, bow thruster, stern gantry, crane aft and forward, winches-trawling 2 drum, dredge and twin drum hydrographic.
RV CALANUS (Dunstaffnage)	1980 J HINKS & SON BIDEFORD DEVON	117 (117)	65' (19.8m)	22' (6.7m)	9'6" (2.9m)	Wood	Diesel 240 BHP (Single VP)	3	2	6	Coastal Waters (7 days)	Primary biological with general ocenographic and diving support capability; total laboratory area 150 sq ft stern gantry, aft crane, winches - trawling twin drum, twin drum hydrographic.
RV SQUILLA (Plymouth)	1973 TEES MARINE	73 (19.6)	64'9" (19.7m)	20' (6m)	8'6" (2.6m)	Steel	Diesel 320 BHP (Single VP)	3	2	2	Coastal Waters (2 days)	Biological research; total laboratory area - 60 sq ft; winches - 1 twin drum trawl; 1 hydrographic; stern gantry with power block
RL SEPIA (Plymouth)	1967 KEITH NELSON	20	40' (12.2m)	11'9" (3.6m)	3'3" (0.99m)	GRP	Diesel 320 BHP (Twin)	1	2	-	Coastal waters (Day working)	Primarily biological - launch with stern trawling facility; 1 split drum trawl winch, capstan aft; stern gantry
RL SOEL MARA (Dunstaffnage)	1972 TYLER BOAT COMPANY	10.75 (4.8)	34'6" (10.5m)	13'1" (3.9m)	3.9" (1.1m)	GRP	Diesel 88.5 BHP (Single)	2	-	-	Inshore Waters (Day working)	Primarily biological projects with stern trawling facility; 1 twin drum trawl winch; stern gantry.
RL TAMARIS (Plymouth)	1978 ROTORK MARINE	6	41'6" (12.6m)	10'6" (3.2m)	3'6" (1.0m)	GRP	Diesel 2 x 130 BHP (Twin)	-	-	-	Inshore Waters (Day working)	Inshore and estuarine research; landing craft; Laboratory - 120 sq ft.
PILOT 520 (Dunstaffnage)	1974 DEL QUAY	-	18' (5.4m)	6' (1.8m)	10" (0.25m)	GRP	Petrol 40 HP (Single)	-	-	-	Inshore waters (Day Working)	Launch for local sampling - stern gantry with powered block.
RL GAMMARUS (Plymouth)	1970 SKANTELBURY	8	37'2" (10.4m)	9'2" (2.8m)	3' (0.9m)	GRP	Diesel 95 BHP (Single)	1	2	-	Inshore waters (Day working)	Primarily biological projects - launch with stern trawling facility; 1 split drum trawl winch; stern gantry.

Annex B

FULL ECONOMIC COSTS - NERC SHIPS 1982/83

	%	SHIP GROUP
BRANSFIELD	13.4*	V
JOHN BISCOE	8.9*	V
DISCOVERY	20.4	V
CHALLENGER	10.7	IV
FREDERICK RUSSELL	8.7	IV
SHACKLETON	12.9±	IV
SQUILLA)		II
CALANUS)		II
SEPIA)	2.6	I
GAMMARUS)		I
SEOL MARA)		I
TAMARUS)		I
SCIENTIFIC EQUIPMENT	-18.8	-
SHORESIDE ADMINISTRATION	3.6	-
	100%	- £ 9.9M expenditure 1982/83

* Operated for 8 months in 1982/83
± Replaced by Charles Darwin 1984.

Annex C

DEFINITION OF GRADING CRITERIA

Definitions of grading criteria for NERC Preparatory Groups, Grants Committees and the Ship Programming Committee (SPC) for assessing applications for ship time on vessels operated by NERC.

'CR' An approved commissioned research project. Should be afforded highest priority. If a Science Budget project is also included in the submission, this element should be graded 'A', 'B' or 'C'.

'A' An excellent research project, soundly based, which should be afforded high priority.

'B' A good project, soundly based, but of less high priority.

'C' A poor project which should not be supported.

'O' The suffix 'O' may be ascribed to an 'A' or 'B' graded application when it is considered that the project is worthy of support only if it can accommodated in a cruise programme constructed principally to support other projects.

The Preparatory Group should indicate its reasons for using the suffix 'O'.

<u>Definition of Priority Criteria</u>

1 - Exceptional opportunity which will not recur in future years.

2 - Urgent if scientific progress is to be maintained.

3 - Essential for continuity of long-term data collection.

4 - Preferably in first possible year though not essential.

5 - Can be undertaken when shiptime available, but of merit.

6 - To be undertaken if opportunity is available.

7 - No prioity to be given.

SOME EXPERIENCE IN THE USE OF RESEARCH VESSELS OF THE ACADEMY OF SCIENCES OF THE USSR

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CONTENTS

INTRODUCTION

The Academy of Science of the USSR is one of the leading organizations in the Soviet Union undertaking investigation of the seas and the oceans. These investigations are essentially of a fundamental character and aim at extending our knowledge of natural phenomena occuring in the sea, the ocean water layer and the seabed.

GENERAL CHARACTERISTICS OF THE ACADEMY OF SCIENCES FLEET

The scientific centres of the USSR Academy of Sciences presently own and operate about 60 marine research vessels. These vessels can be categorized as follows, based on their purpose and technical characteristics:

- vessels of unlimited sailing range 18
- vessels with limited sailing range 31
- vessels of the Space Service of the Academy of Science of the USSR 11

Research vessels of unlimited sailing range are comparatively large (over 1000 dt) and have good navigational capabilities, allowing their operation in any area of the World Ocean. They are primarily used to carry out research on a sub-regional scale.

Research vessels of limited sailing range are not so large (up to 1,000 dt) and possess only limited navigation capabilities.

Their operating area is limited to the inner and marginal seas of the Soviet Union, where they carry out oceanographic research. Their main function is to act as support (command/measurement) units for space objects , and to provide reception facilities for scientific and technical information obtained from space.

According to the statutes of the USSR Academy of Sciences, all vessels are the property of the institutes engaged in oceanographic research. These institutes are responsible for the use and management of the research vessels. The Department of Marine Expeditionary Works of the Presidium of the Academy of Sciences of the USSR supervises the co-ordination and management efforts of the individual oceanographic institutes. In addition, the Department supervises the development of the research fleet.

Table I shows the distribution of vessels with unlimited sailing range amongst the oceanographic institutions.

MANAGEMENT OF RESEARCH VESSELS

Oceanographic institutes owning research vessels are responsible for arranging all necessary facilities for the use of research ships. They take care of the ship's berth at the home port, hire crews, arrange bunkering and catering, provide facilities for repair and maintenance, etc.

Oceanographic institutes interact with appropriate bodies of the state economy to conclude formal agreements or establish other forms of co-operation concerning the management of research vessels. Financial support for vessel operations and marine expeditionary work is obtained from the state budget through the Academy of Sciences of the USSR. Based on this kind of co-operation, the management system has successfully solved all problems related to research vessel management. The effectiveness of this organizational mechanism may be judged from the high coefficient of use of the research vessels: 70 - 75%; i.e., from 250 to 270 days per year.

Crews of research vessels are recruited by means of free hire. The level of salaries on these ships permits the hiring of well-qualified specialists.

Each oceanographic institute has a small group of specialists (2 - 10 persons) in its administration to assist the Direction in matters related to ship management.

PLANNING AND IMPLEMENTATION OF OCEANOGRAPHIC EXPEDITIONS

On average, the research vessels of the USSR Academy of Sciences conducts 60 scientific cruises per year in the World Ocean and about 200 expeditions in the inner seas, rivers and lakes. Every year, several scientific expeditions are conducted by the USSR Academy of Sciences in the framework of international programmes.

Optimal values have been defined for the duration of cruises and the schedules of port calls. For ships of unlimited sailing range, optimal duration of the cruise is 90-120 days and 304 port calls of 2-3 days of rest. Optimal stay at the home port is 4-5 weeks to allow for preparation of the following mission and rest for the crew. For ships of limited sailing range, optimal duration of the cruise is 1-2 weeks.

POSSIBILITIES TO INCREASE EFFECTIVE USE OF RESEARCH VESSELS

The Academy of Science of the USSR considers it very important to increase the effective use of research vessels by imposing the technical capabilities and operational management.

As a result of 30 years' experience, Soviet specialists arrived at the conclusion that specially designed ships were the most efficient vessels for marine research. At present, the increase of the USSR Academy of Sciences' fleet follows this directive.

The oceanographic research institutes annually submit proposals for scientific research cruises to the Commission for Investigation of Problems of the World Ocean, which is part of the USSR Academy of Sciences. This Commission is composed of competent scientists in various disciplines, and other specialists with relevant expertise in the field of oceanographic research. The Commission studies the general feasibility of the proposed cruises, as well as their technical and financial implications, and amends the cruise proposals as necessary. The Commission then submits the proposals to the Presidium of the Academy for final approval. Financial support for the execution of the cruises is then provided to the institutes.

The scientific staff of marine expeditions is composed of staff from the institute owning the vessel, as well as from other natural research institutes. Foreign scientists and students often take part in the scientific voyages of the USSR research vessels. The procedure for including them in the staff of the expeditions is rather simple. For that purpose, a foreign scientists, student or administrator should write an official letter to the Director of the Soviet institute operating the vessel, or to the administration of the Presidium of the USSR Academy of Sciences. Participation of foreign scientists in expeditions of the USSR may also be arranged through the National Oceanographic Committee of the Soviet Union.

In this connection, great attention is being paid to the outfitting of ships with measuring and analytical equipment linked with computers for automated collection and processing of scientific data. The outfitting of research vessels with such automated systems is an important factor for the effective use of the ship.

It is obvious that the level of sophistication in outfitting ships with such automated systems should be dependent on the use of the vessel and should therefore be different from one ship to another. In addition, some groups of technicians should be included in the crew to ensure good maintenance of scientific facilities.

SOME CHARCTERISTICS OF THE USSR ACADEMY OF SCIENCES RESEARCH VESSELS OF UNLIMITED RANGE OF SAILING

Ship	Institute-shipowner	Year of issue	Displacement, tons	Main engine, hp	Range of sailing, days	Crew Scien. staff	Lab. premises Area	Availability auto-system
1. Akademik Mstislav Keldysh	Institute of Oceanology, Acad.Sc.	1980	6339	824TS 4x1460	72	65 65	16 600	Yes
2. Vityaz	Institute of Oceanology, Acad.Sc.	1981	6358	6Z140/48 2x3200	60	66 59	19 600	Yes
3. Akademik Kurchatov	Institute of Oceanology, Ac.Sci.	1966	6828	"MAN" 2x4000	50	84 79	26 640	Yes
4. Dmitry Mendeleyev	Institute of Oceanology, Ac.Sci.	1968	6838	"MAN" 2x4000	50	82 77	28 585	Yes
5. Professor Stockman	Institute of Oceanology, Ac.Sci.	1979	1611	RBV6M358 1x2000	30	35 25	9 135	Yes
6. Rift	Institute of Oceanology, Ac.Sci.	1981	1283	8NVD48/24 1x1320	30	26 11	7 90	No
7. Akademik Aleksandr Nesmeyanov	Far East Research Centre, Ac.Sci.	1982	6300	6ZL40/48 2x3200	65	66 59	31 469	Yes
8. Akademik Aleksandr Vinogradov	Far East Research Centre, Ac.Sci.	1983	6300	6ZL40/48 2x3200	65	66 59	31 469	Yes
9. Professor Bogorov	Far East Research Centre, Ac.Sci.	1976	1737	RBV6M358 1x2000	30	34 26	10 135	Yes
10. Morskoi geofizik	Far East Research Centre, Ac.Sci.	1975	1124	6MVD48A2U 1x875	40	27 13	5 88	No
11. Vulkanolog	Far East Research Centre, Ac.Sci.	1976	1100	6MVD48A2U	40	28 12	12 105	Yes
12. Akademik Vernadsky	Marine Hydrophysics Inst., Ac.Sci.Ukr.SSR	1968	6930	K6Z57/80C 2x4000	52	93 66	27 630	Yes
13. Mikhail Lomonosov	Marine Hydrophysics Inst., Ac.Sci.Ukr.SSR	1957	5960	Lenz-10 1x2450	35	74 62	16 290	Yes
14. Professor Kolesnikov	Marine Hydrophysics Inst., Ac.Sci.Ukr.SSR	1962	820	8NVD48A 1x1000	9	33 22	4 60	No
15. Professor Vodyanitsky	Inst.of Biology of South. Seas, Ac.Sci.Ukr.SSR	1976	1700	RBV6M358 1x2000	40	36 22	12 140	Yes
16. Zarya	Inst.of Earth Magn.and Propagat.Radiowaves, Ac.Sci.	1952	600	1x300	12	27 9	2 16	Yes
17. Dal'nie Zelenzy	Inst.of Marine Biology, Murmansk, Ac.Sci.	1978	1100	6NVD48A2U 1x1000	35	27 13	8 72	No
18. Ayu-Dag	Ac.Sci. of the Estonian SSR	1961	820	1x100	9	30 22	6 66	No

EXPERIENCE WITH THE USE OF SMALL RESEARCH VESSELS IN CUBA

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CONTENTS

INTRODUCTION

Cuba, being an archipelagic state, depends heavily for its development on the marine resources of her continental shelf and the adjacent waters under national jurisdiction. The growth of oceanographic research in Cuba is closely tied to the socio-economic development and strengthening of the nation.

The establishment of the Cuban Academy of Science in 1962 created concrete possibilities for research in the different fields of marine sciences. As a result of the widening areas of research and the resulting specific needs and demands of the oceanographic community, new research centres have been created, each with its own specific objectives and needs.

Essential to these studies was the acquisition of suitable research vessels which, apart from being a means of transportation, would also provide indispensible techical support. This point has been, and will continue to be, vital in the development of any plan related to oceanographic research.

It has been said that serious problems, caused by the present international economic situation, are presently hampering the exploration, exploitation and rational utilization of marine resources in the industrialized countries. The same problems obviously hamper to an even higher degree the expansion of marine scientific research in developing countries, since their economy is often characterized by a very high dependence on the international balance of payments.

It is hoped that the experience of Cuba in the conduct of marine scientific research using small research vessels, as presented in this paper, will be of use to other countries, especially the developing ones, in the exploration and exploitation of their marine resources.

VESSEL ACQUISITION

The recent one-sided technical development has resulted in increased sophistication of techniques used in marine scientific investigation and in marine research itself. This has lead to an ever greater imbalance in the levels and quality of research between industrialized and developing nations, and to increased problems for developing nations in the acquisition of vessels that are appropriately outfitted for oceanographic research.

The need for oceanographic research in Cuba is presently being met, against great odds, by six small vessels owned and operated by the Oceanological Institute, of the Academy of Sciences. Only one of these vessels, based on the design of a fishing boat, was designed originally for research work. The other five vessels were yachts that have been adapted to meet the specific requirements of oceanographic research. This adaptation demanded the acquisition of numerous spare parts and other essential components, which was not done without difficulty.

We feel that it is advisable to design integral research vessels, of highly developed technological and scientific complexity, rather than building a general-purpose vessel and afterwards adapting it to the specific needs of research work. The absence of purpose-built research vessels seriously limits the field of research open to the scientific community and especially hampers research in waters at some distance from the shore.

ECONOMIC EVALUATION

The costs related to the ownership and operation of research vessels in Cuba is detailed in Tables I - III. Table I gives an overview of all costs, based on 1983 figures. Table II provides details on the operational costs. Table III shows different cost indicators. Such indications are then used to study the evolution of costs as a function of the size of the vessel (Figures 1 to 4).

Figure 1 shows on the left ordinate the relation between unit operation cost as a function of tonnage. The data presented shows that there is a distinct tendency to diminished operational costs with increased ship size. This is of course a strong argument in favour of the construction of bigger (e.g. multi-purpose) vessels which can be used intensively at lower operating costs. At present, Cuban research vessels have not yet reached the optimum size indicated by Figure 1, but a steady increase in size may be observed.

Figure 2 shows the relation of capital costs to operational costs as a function of tonnage. The observed slight rise in this relation is due to the increase of direct costs with improved investigation capacity of the vessel. This pointer would probably be of better use if it were possible to incorporate the increased useability of the vessel for different area of marine scientific research as a function of its increased size.

Figure 3 shows the relation of fuel consumption to operational costs as a function of tonnage. Figure 4 shows the relation of operational costs to days at sea. Monetary unit used in figures and tables is the US dollar.

Figure 5 shows the procedures applied in the planning of research cruises in Cuba.

as a function of tonnage. A strong increase can be noted, as a function of tonnage, in the relation of fuel consumption to operational costs, but less so in the relation of operational costs to size. This is especially so in the higher tonnage vessels, capable of carrying out more extended research programmes.

The following conclusions may be drawn from our experience with small research vessels:

(i) increased tonnage leads to substantially lower operating costs; bigger, multi-purpose research vessels are therefore an economic necessity.

(ii) since fixed costs represent more than 50% of the operational costs, it is important to ensure full utilization of the vessel.

(iii) since several countries of the region experience serious difficulties in achieving full utilization of their vessels, it is suggested that the IOC develop a set of guidelines to increase the efficiency of research vessel utilization on a regional and sub-regional basis, giving due regard to technological development. The IOC should also promote the participation, in marine research, of these countries that, owing to their restricted financial resources, remain on the fringe of ocean-science development.

RESEARCH CRUISE PLANNING

Timely planning and appropriate internal co-ordination are of vital importance to the rational implementation of scientific research cruises, and for obtaining optimal results from these investigations. This process is closely related to the other activities of the Cuban Institute of Oceanology, and will be briefly described.

Planning of research cruises is done on an annual basis giving due regard to the experience gained in planning previous expeditions.

A time-table is then proposed showing, for each proposed research, the area of operation, the estimated time needed for completion of the work and the scientific equipment required. The initial approach is carried out by the department in charge of the research vessels. It must give due regard to existing possibilities and perform daily adjustments to the proposed time-table if needed. Only the centre directly responsible for the scientific investigations has the authority to set priorities in conflicting research plans. Based on these comments a final time-table for oceanographic work and ship usage is established for the coming year (Figure 3).

At the end of each quarter, actual usage is evaluated against planned usage and the necessary adjustments can be made for the following quarter. This periodic review is necessary to solve unforeseen problems that may have arisen in the execution of the original timetable.

NATIONAL CO-ORDINATION

Use of oceanographic research vessels may be offered to other institutes of the Academy of Sciences, with the Institute of Oceanology acting as the co-ordinating mechanism.

The great diversity of research projects and limited availability of vessels necessitates correct co-ordination planning at various levels in order to achieve the desired scientific results with optimum use of resources.

PRESENT DIFFICULTIES

Problems that hamper the full use of a research ship are the excessive cost of the vessels and the scientific equipment, as well as the non-availability of accessories and spare parts needed for repair and general maintenance.

This problem is especially serious in Cuba because the vessels were foreign-built. Great losses in time, funds and extra resources are incurred by the maintenance and repair needed to ensure maximum availability of the research vessels.

Similar critical problems occur in the acquisition, maintenance and repair of equipment on board research vessels, a situation which, in a great many cases, calls for large additional investments.

PLANNED FUTURE ACTIVITIES

The Institute of Oceanology plans, with the support and close co-operation of the National Oceanographic Commission, to acquire a new oceanic vessel of 1100 tons dead weight in the next five years. This acquisition responds to Cuba's own needs for future development and takes into account the need for future regional development through co-operation amongst the member countries of the I.O.C., especially in the Caribbean region.

CONCLUSION

While considerable technical obstacles exist, there are nevertheless no serious infra-structural problems that can seriously impede the success of oceanographic research in Cuba. The State's plans for the development of the marine sciences enable us to train qualified personnel, capable of carrying out different tasks within the national framework for oceanographic research. After having worked for long years along the lines described in this paper, Cuba now has sufficient experience and know-how to collaborate with and assist those countries in the Caribbean area that need to develop their oceanographic research taking into account the indispensable need for joint research work and maximum use of scientific interest and resources.

We appreciate the interest shown by the Intergovernmental Oceanographic Commission in improving the use of research vessels, since this will, when implemented through the appropriate international, regional and local channels, permit access of developing countries to our research facilities, thus enabling them to carry out important research.

Table I

Review of Total Costs

	Name of Vessel					
	VOLGA	CARIBE	ACUARIO	XIPHIAS	MACAIRA	TRITOM
Investment	70.0	120.0	120.0	150.0	150.0	220.0
Tonnage	10.0	36.0	46.0	46.0	64.0	192.0
Operational Costs	19.5	45.0	49.5	54.0	58.3	96.2
Salaries	5.0	12.0	14.0	11.0	15.0	16.0
Fuel	0.7	2.0	2.0	2.0	2.0	26.4
Maintenance	1.2	10.0	12.1	17.0	16.9	18.0
Sea-days per Year	120	230	200	230	130	80

Table II

Review of Operating Costs

	70,000 VOLGA	120,000 CARIBE	120,000 ACUARIO	150,000 XIPHIAS	150,000 MACAIRA	220,000 TRITOM
1. Amortization	6180	10600	10600	13250	13250	18330
2. Additional Material	310	530	530	660	660	920
3. Fuel	700	2000	2000	2000	2000	26400
4. Salaries	5130	11940	13990	10880	15370	16600
5. Social Security	513	1194	1399	1088	1537	1660
6. Total Direct Costs	12833	26264	28519	27878	32817	63910
7. Maintenance & Repairs	1200	10000	12100	17000	16900	18000
8. Other Materials	4010	6410	6200	6410	5346	6656
9. Administrative Expenses	350	1240	1590	1590	2200	6630
10. Miscellaneous	1060	1060	1060	1060	1060	1060
11. Total Indirect Cost	6620	18710	20950	26000	25506	32346
12. Total Operating Cost (6 + 11)	19453	44974	49469	53938	58323	96256
Rel. Cost/Size	IS NOT REPRESENTATIVE					
- Administrative Costs		845				3002

Annex to Table II. Cost Calculation

1 - Amortization Calculations for obtaining the different cost elements defined by the following algorithm:-

$$\frac{V_i}{A} \times C_i + M_a \times A$$

Where:

V_i - Initial purchase-price of the vessel

A - Estimated number of years of deterioration

C_i - Constant equivalent to 15% of the (REPARATION TASK) initial cost of the vessel

M_a - annual preventive maintenance, equivalent to 5% of initial cost

It should be pointed out that these vessels were not new when purchased and some were in almost total ruin, a fact which falls back on the unplanned repair bill, besides the fact that the Vessels were not designed for specialized oceanographic work.

2 - Additonal Material. The annual budget for replacements of accessories is estimated at 5% of the out-lay.

3 - Fuel. The fuel-consumption figures shown for each vessel are those for 1983. It should be pointed out that in the case of Cuba, fuel prices within the country are fixed by the government and stable. Any international price-fluctuation is compensated for by the government.

4 - Salaries. The figure shown for salaries and wages are those of 1983. Salaries are fixed and stable and do not depend on days at sea worked. A co-efficient increase in salaries for abnormal work-conditions is being contemplated.

5 - Social security is worked out at state level of 5%.

6 - TOTAL DIRECT COST (sum of items 1 - 5).

7 - Maintenance and Repairs. The figures shown are due to the age of the vessels.

8 - Other Material Expenditures. These include victualling, water, protective clothing and accessories, etc.

9 - Administrative Expenses. These are calcualted on the basis of actual administrative expenditures as against total tonnage.

10 -. Miscellaneous Expenses. These include docking, tie-up time, fines, bank rates and interest, etc.

Table III

Cost Indexes

	INDICES					
1. Op Cost/Size	1.95	1.25	1.08	1.17	0.91	0.50
2. Capt. Cost/ Op. Cost	0.28	0.37	0.41	0.36	0.39	0.43
3. Fuel/Op. Cost	3.6	4.4	4.0	3.7	3.4	27.4
4. Op. Cost/ Sea Days	0.16	0.19	0.25	0.23	0.45	1.20

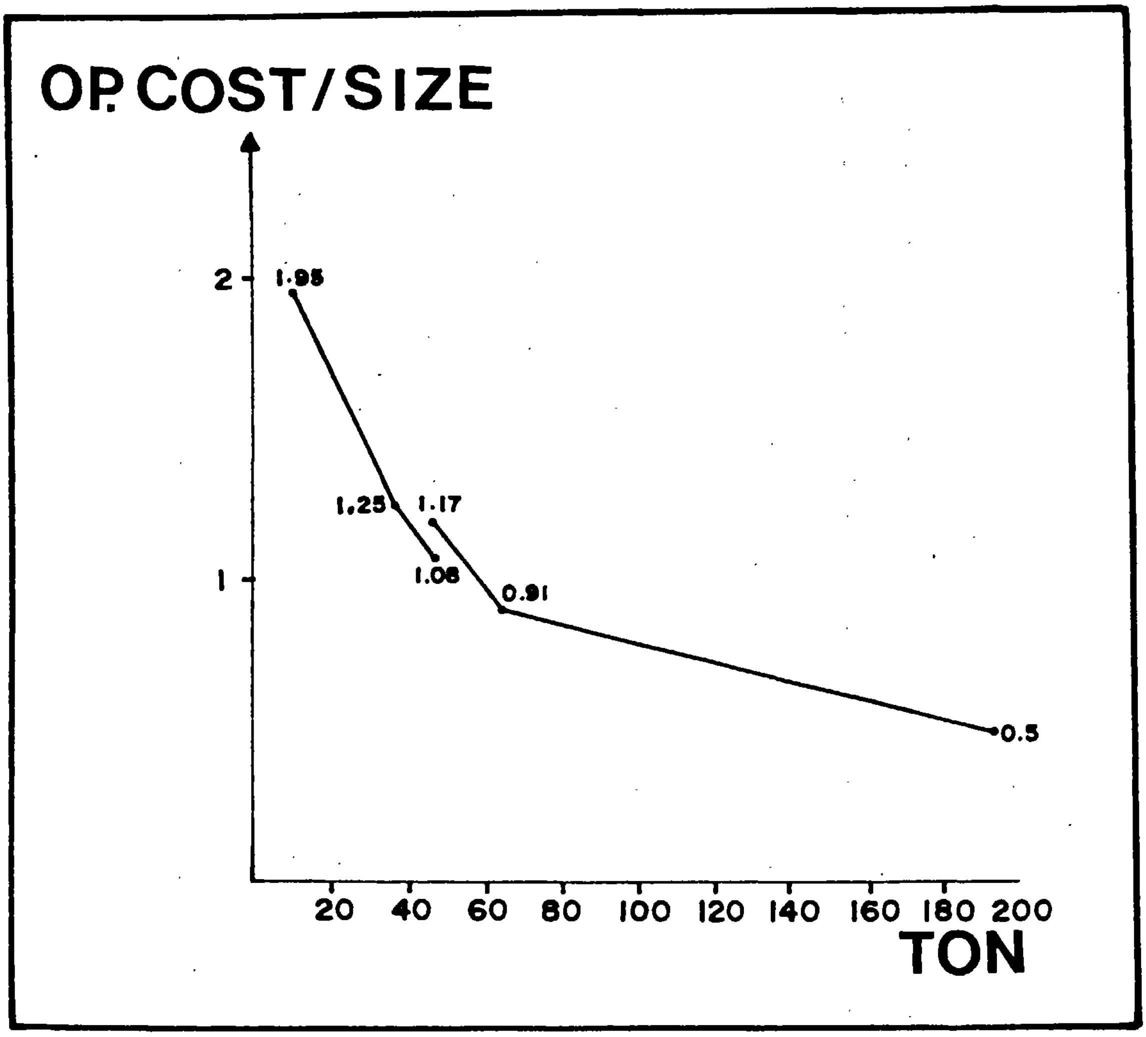


Figure 1.

Relation between unit operation costs and tonnage

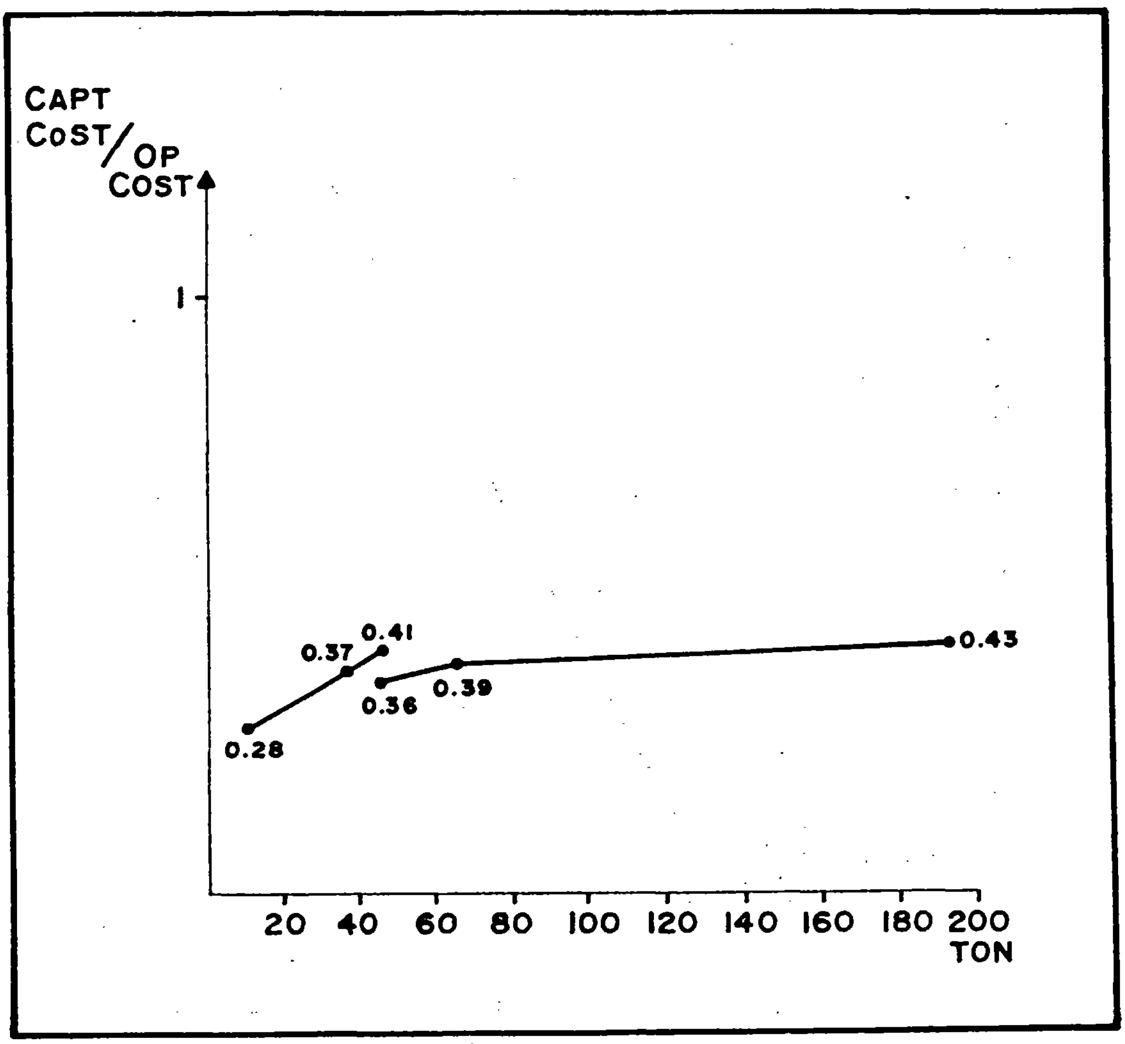


Figure 2.

Relation of capital costs to operational costs as a function of tonnage

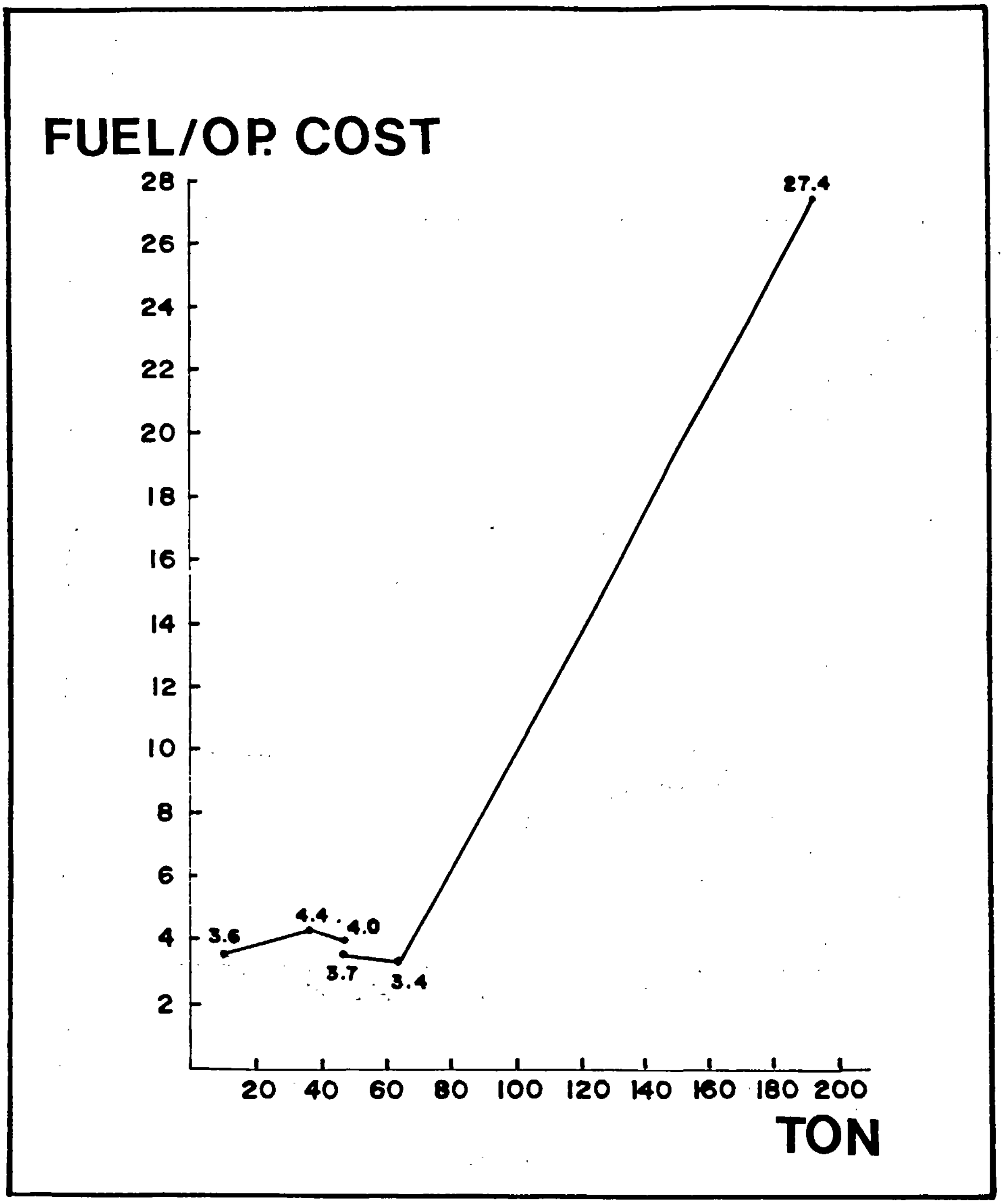


Figure 3.

Relation of fuel consumption to operational costs as a function of tonnage

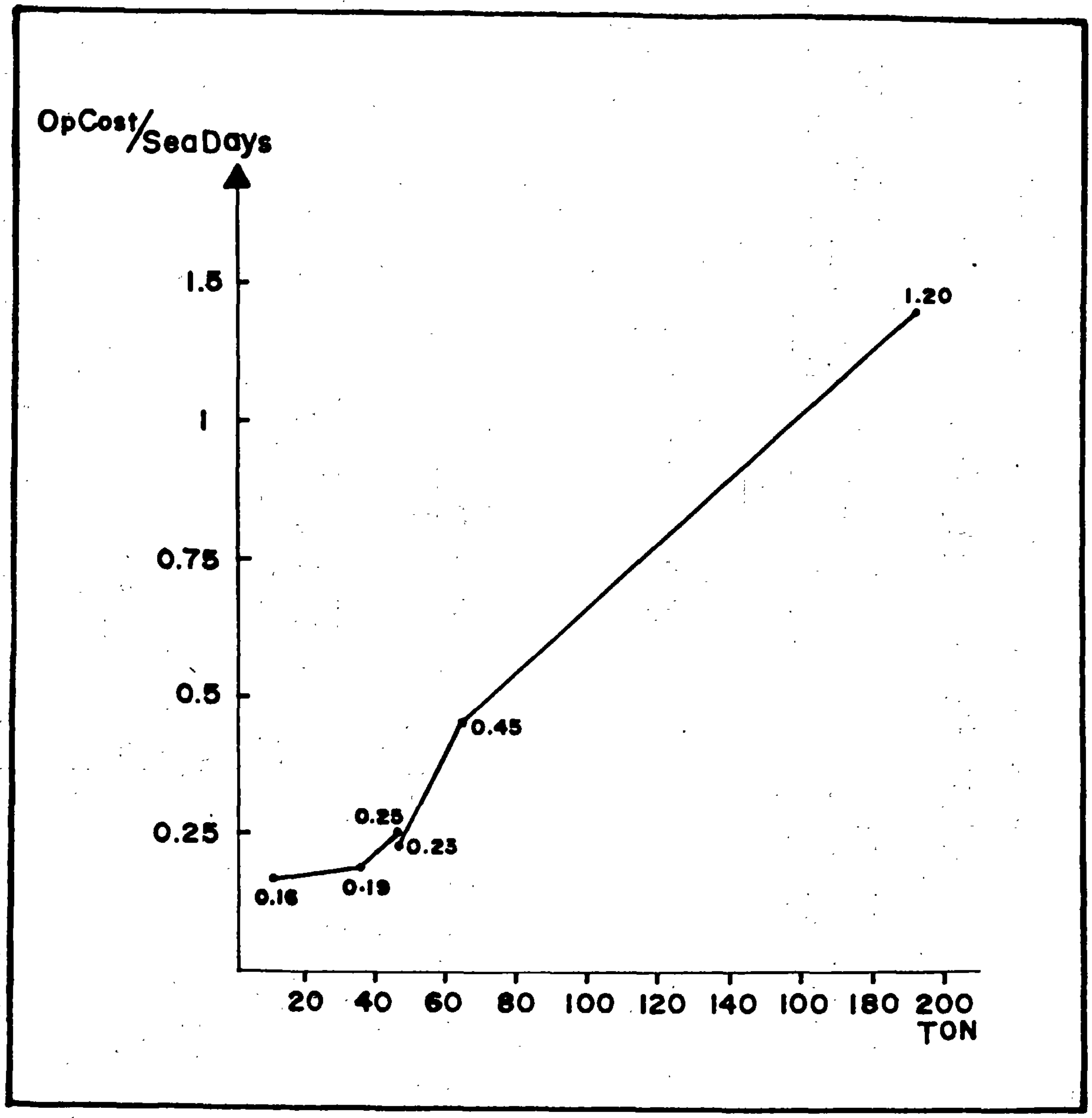
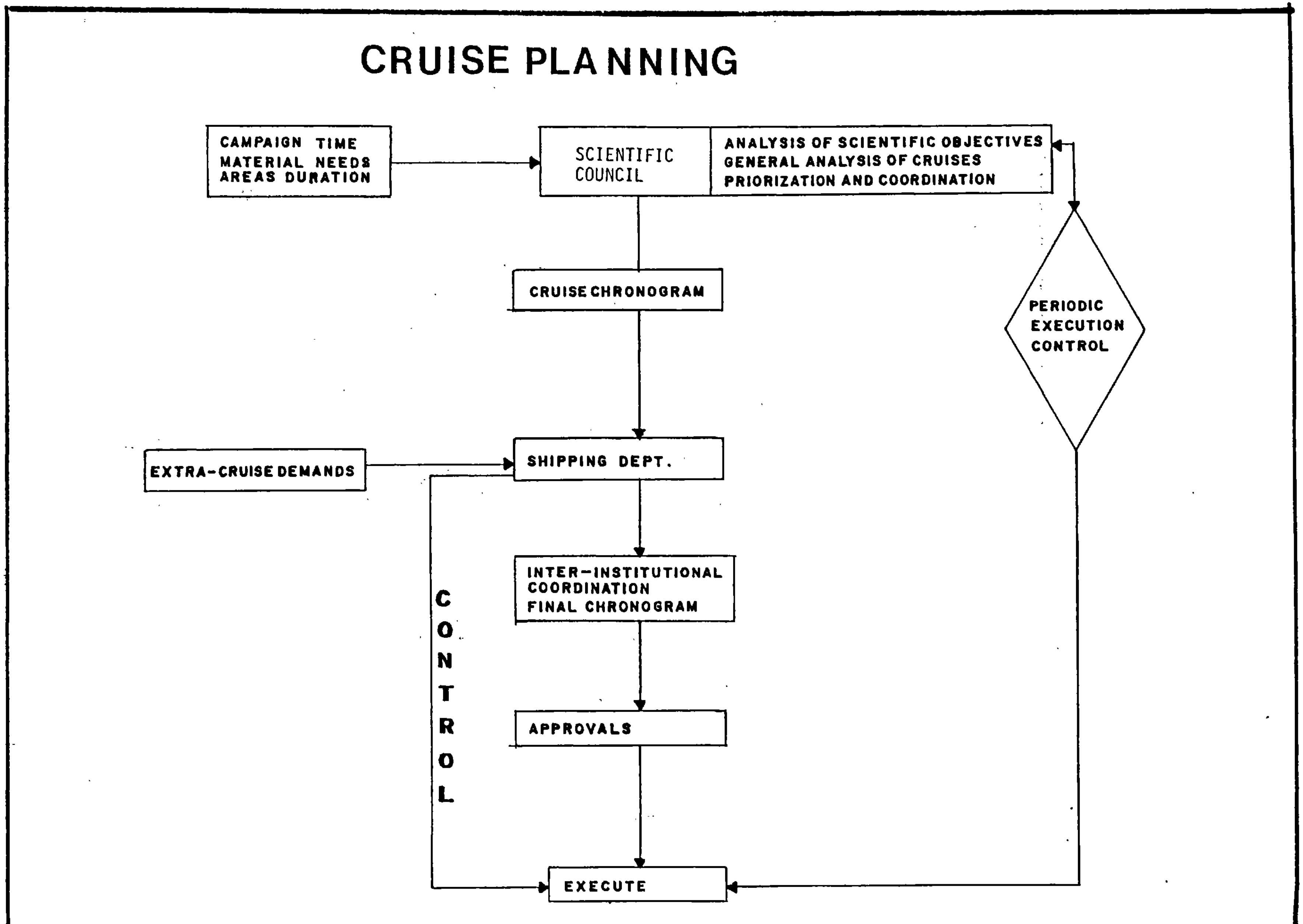


Figure 4.

Relation of operational costs to days at sea in function of tonnage

Figure 5.

Cruise planning procedure in Cuba.



THE USE OF RESEARCH VESSELS IN THE NETHERLANDS

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CONTENTS

INTRODUCTION

The Intergovernmental Oceanographic Commission has been so kind as to invite a representative of the sea-going departments of the Geological Survey of the Netherlands to inform the IOC/FAO Workshop on Improved Uses of Research Vessels as to the situation in the Netherlands and current practices and trends there. We hope that some of the technical philosophy used in oceanographic research in the Netherlands will be relevant to IOC's aim to stimulate oceanographic research in many parts of the world. On the other hand we are quite sure that we can benefit from the oceanographic and technical expertise of the participants in the Workshop.

BRIEF HISTORY OF DUTCH OCEANOGRAPHIC ACTIVITIES

In the Netherlands, as well as probably in many other parts of the world, oceanographic activities in the first half of this century consisted largely of some surveying and charting programmes. This was mainly done by the Hydrographic Office of the Royal Dutch Navy. There were a few other activities of which Prof. Vening Meinesz and his submarine gravity studies are probably best known. Gradually, interest in the sea and seabed, especially in Dutch coastal waters and in the North Sea, increased. Regular oceanographic programmes, largely of an applied nature, started in the sixties and seventies, most of them in the North Sea but gradually, also in the Atlantic Ocean and more recently elsewhere. Not only the number, diversity and complexity of the sea-going programmes increased, but also the number of sea-going research groups and the number of vessels that are used permanently, regularly or on an _ad hoc_ basis. This resulted in various, partly complicated,partly highly lexible systems to organize and plan sea-going research. Also, the technical facilities and technical philosophies developed rapidly in recent decades. We will try to elaborate on a few technical aspects in the following paragraphs.

AVAILABILITY OF RESEARCH VESSELS IN THE NETHERLANDS

The present situation concerning the use of oceanographic research vessels is governed by the availability of the various types. Very few ships are operated for oceanographic research purposes only. Most ships are available for limited periods of time, in between other missions.

Most oceanographic work in the Netherlands is done on the North Sea. For nearshore activities, several small ships, mainly of the Ministry of Public Works, are available, but generally for programmes that are of an applied nature and that are of interest to the owner/operator. Most ships are of a patrol-boat type, small ships with a shallow draught, few places for technicians and scientists and very limited facilities (deck space, hoisting gear, power, lab. and storage space). A recent addition to this category are a few flat-bottomed pontoon-shaped ships, with enough deck space for containers. These ships were especially designed for work in inlets and tidal flat areas.

Other ships are in use in the North Sea proper. Most ships are normally employed for surveying and charting and other routine measurements by the Department of Public Works or the Royal Dutch Navy. Some are especially adapted for pollution prevention or water quality control. Most others are just chartered for the occasion.

Ship types vary from converted fishing vessels to supply boats, small freighters and hydrographic (navy) vessels with occasional use of coasters and tugs. These 30-60 meter ships are generally employed on one-week missions, although longer cruises also occur. Ships are bigger than the previous category, with more facilities for equipment and personnel. Within the last ten years there has been a trend to look for ships with sufficient open deck space to enable the use of containerized labs.

Most programmes outside the North Sea, generally in the Atlantic Ocean, are carried out from a converted 85-m freighter owned by the Netherlands Council for Sea Research (NRZ) or by a 90-m hydrographic vessel of the Royal Dutch Navy. Cruises generally extend over many weeks and the amount of equipment and number of personnel required may be considerable.

The freighter was built in the 1960s for general cargo, pellets and cattle transport with some passenger accommodation. In 1983, the ship was taken over by NRZ. A refit included a more flush fore deck and permanent installations (lockers) to place standard 20-foot containers on and to provide them with various types of power, compressed air, nitrogen, fresh water, etc. Up to 25 20-foot containers can be placed on and in the ship. The lower decks have a lot of space for big quantities of gear. The main deck is flush with the after deck and can be employed as a store for equipment that has to be deployed over the stern.

The 90-m hydrographic vessel was built in the 1970s. It is completely built up with a limited deck space but with a great number of fixed labs in several parts of the ship. It may hold up to 4-5 containers that are mainly stacked in two small holds. Some ocean-going programmes use commercial freighters that are willing - against payment - to have one or two containers with scientific instrumentation on top of their load of other containers and that are, at times, prepared to deviate from the shortest route to enable the study of some interesting phenomenon.

PROCEDURES AND COSTS

A great variety of oceanographic programmes is carried out by a much smaller number of sea-going groups from a limited number of ships. Procedures for the organization of pure oceanographic research and for applied research generally are different in the Netherlands.

Scientific (fundamental) ocean-going research as carried out by various groups at universities and related institutes usually starts with a proposal to the Netherlands Council for Sea Research (NRZ), which has obtained a budget for ship operation from the Ministry of Education and Science. The proposals are evaluated, compared and selected in NRZ subcommissions and combined into a national programme for a given year. The technical organization of a programme can start as soon as a proposal has been accepted. Ship time is provided then by NRZ free of charge. If necessary, equipment and, to some extent, technicians may be obtained for the duration of the cruise(s) from the national pool of oceanographic equipment. The only obligation is to present a summary report on the cruise results to NRZ as soon as possible. In addition, there are some possibilities to do fundamental research in the North Sea on small ships.

Applied research is organized whenever there is a distinct need for a specific type of information. Most of the applied marine research in the Netherlands is being carried out by governmental organizations that are part of a ministry. Many of the applied research programmes initiated by the same ministry extend over several years. The majority of applied sea-going work is done from generally rather small vessels owned by a few of these organizations. These organizations, which generally also own oceanographic equipment, operate the ships from their normal budgets. The employment of these vessels is decided by one or arranged between several co-operating governmental organizations. In other cases, the special funding needed can usually be provided if there is a strong governmental support. Technical details of such a programme will be formulated by the organizations involved. NRZ does not play a role in applied oceanographic research except when their co-operation is needed to charter their ship or to use an ocean-going navy vessel. At present the cost for ship time on these ships is fixed between Dfl. 16.000 - 17.000 a day including fuel.

TECHNICAL IMPLICATIONS

In other paragraphs, some information has been presented on the number and nature of sea-going programmes in the Netherlands, the various organizations involved and the diversity in ships that are employed. From the viewpoint of logistics, this situation calls for a flexible approach, although it took some time before the Dutch oceanographic community realized that. In the past, surveys tended to be not too complicated and, although cumbersome, there were no strong objections to carrying most single pieces of equipment to the ship for a specific cruise and back again. At present, the demand for ship time has increased, as well as the number and complexity of equipment used on each cruise. Moreover, in order to improve efficiency, there is a strong tendency to cut as much as possible the time needed for loading, installation and unloading. As there was always some uncertainty when and on what ship the next cruise of a similar nature would be, permanent installations on board ship proved a waste of time and money. Gradually a certain degree of containerization of oceanographic equipment was thought to be the best possible solution.

CONTAINERIZATION

Some ten years ago, several sea-going groups started to acquire their first fully instrumented containers. At present, there are about 60 of them, more than half of which are part of the national pool of oceanographic equipment. The containers are of the standard 20-foot type, with a few half that size. Most are converted commercial containers that were obtained second-hand for 2000 - 3000 Dutch guilders a piece. They are used now for a multitude of purposes. There are, amongst others, chemical, sedimentological, biological and other lab containers, cool lab, cool storage and freezer containers, containers for X-ray and normal photography, for compressed air, for various kinds of electric and hydraulic power, for storage of spare parts and geophysical, sampling and other oceanographic equipment, machine shop containers, containers for geophysical measurements, computer containers, containers for physical oceanography experiments, office containers and a few general-purpose containers. The interior design of each one is different and is adapted to its use. Most have various kinds of electric power, heating and air conditioning, some have fresh and sea water, others oxygen, nitrogen and compressed air. The idea is to have everything, including spares, for a specific type of work installed in a container. Once a container is fixed on deck with four standard container-lockers or chains, a few plugs are connected and, if necessary, cables and hoses are installed and the container is ready for action. All this takes a minimum of time.

The technical departments of the five organizations that own or operate the containers also take care of the maintenance and, if necessary, of any improvements and replacements. Most have a covered storage to put containers in that are not at sea. As it is at times not efficient to take the installations in the interior of a container apart, some of the work that was formerly done in the onshore office or lab now tends to take place in those container storage areas where there are similar facilities (power, water, etc.) as on board or in the office.

As said before, more than half of the containers are included in the national pool of oceanographic equipment. These, but also most others, can be made available to other organizations that do not have containers of their own or that do not possess the specific type of container required. There is, for similar reasons, a mobile oceanographic deep-water winch in the Netherlands that is also container-sized.

FINAL REMARKS

It seems to us that some of the practices in oceanographic research in use in the Netherlands might also be useful in other settings and situations. We feel especially that the use of mobile, instrumented containers that can be placed on many vessels, including commercial ships, might be a rapid way to stimulate oceanographic research in certain regions and countries. In this way, research, maintenance and training can be geographically separated, or regionally concentrated, whichever seems necessary, efficiency improved and expenses saved. The Geological Survey of the Netherlands is, for instance, assisting in the design of a container for marine drilling and sediment sampling equipment to be shipped to the South Pacific and is also involved in a relevant technical training programme. The authors are quite willing to give more detailed information on the containerization of oceanographic research in the Netherlands.

SHORT ASSESSMENT OF THE TURKISH RESEARCH VESSELS, MARINE PROGRAMMES AND CRUISE PLANNING

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DESCRIPTION OF THE TURKISH RESEARCH FLEET

Turkey has various institutions and organizations involved with marine scientific and oceanographic activities. University institutes and government departments together own and operate eight research vessels, including the vessels used by the Hydrographic and Oceanographic Office of the Navy.

With the exception of the R.V. PIRI REIS, all ships were designed and built in Turkish shipyards. All vessels are run and managed by Turkish scientists and crew. Repair and maintenance can be carried out in Turkish shipyards which also offer their services to foreign vessels. University vessels are funded partly from the national budget and partly from the income generated by projects carried out by them. Only the R.V. M.T.A. SISMIK I is fully funded by the Government.

These institutes and agencies are described below:

UNIVERSITY INSTITUTES

- Dokuz Eylül University, Institute of Marine Sciences and Technology (formerly within the Ege University), Izmir.

  The institute has three research vessels all of which are less than 10 years old. The biggest of these vessels, R.V. K. PIRI REIS is only six years old.

  The other two vessels are small and both are 1 year old. The R.V.K. PIRI REIS is 170 days at sea per annum on average, whereas the smaller vessels are up to 60 days at sea per annum.

- Middle East Technical University, Institute of Marine Sciences, Ankara (the Institute is located in Erdemli, Mersin).

  This institute has three research vessels all of which are less than 10 years old. One of the research vessels is the R.V. BILIM and is 140 days at sea per annum, on average. The other two are smaller vessels and are 80 days at sea per annum.

- Istanbul University, Institute of Marine Sciences and Geography, Istanbul.

  This institute has only one research vessel, the R.V. ARAR which is 27 metres long, and of fishery type. It is more than 10 years old and it is used for marine biological purposes only.

- Faculty of Marine Sciences and Ship Building, Isbanbul Technical University, Istanbul.

- Advanced School of Marine Sciences and Technology, Karadeniz University, Trabzon.

GOVERNMENTAL MARINE DEPARTMENTS

- Mineral Research and Exploration Institute, Ministry of Natural Resources and Energy, Ankara

  This government institute has one research vessel equipped only for marine geophysical survey purposes. This vessel, the R.V. M.T.A. SISMIK I, is less than 10 years old. It is 90 days at sea per annum.

- Hydrographical and Oceanographic Office of Navy, Istanbul

- Water Resources Department, Ministry of Agriculture and Forestry, Ankara

ADVANCED SCHOOLS OF LIVING AQUATIC RESOURCES
(Within the Universities)

- Ondokuz Mayis University, Samsun

- First University, Elazig

- Cukurova University, Adana

- Akdeniz University, Antalya

- Ege University, Izmir

- Istanbul University, Istanbul

OPERATION OF RESEARCH VESSELS

CRUISE PLANS

The main users of research vessels are, as far as is known, the universities, the government departments, government economic institutions, private establishments and industrial companies.

Some of these are:

- Universities with Marine Science Programmes (living and non-living resources)

- General Directorate of Fisheries (under the Ministry of Agriculture and Forestry)

- Mineral Research and Exploration Institute

- Department of Marine Pollution (Undersecretary of Environment)

- Petroleum companies

- Marine engineering companies, etc.

These users of research vessels prepare proposals for the use of the research ships and submit these to the General Council for Navigation, Hydrography and Oceanography (SNOGK). This Council meets once a year in June and decides on cruise plans for the coming year.

SALARIES

All crew are paid according to the international maritime regulations in the Turkish ships. They have special sea allowances and holiday bonuses determined in accordance with these regulations. The average salaries of the officers are around $800 to $1400 (U.S.) whereas the scientists from universities working in the research vessels earn about half of this.

OPERATIONAL DIFFICULTIES

The main problems hampering the development of marine sciences in the developing countries are a lack of technological know-how and the rapid evolution of marine scientific equipment.

Another important problem is the availability of spare parts for oceanographic equipment in developing countries. While each country has its own laws and regulations on foreign trade, it is generally a problem to obtain the necessary permission for transfer of hard currency needed to purchase spare parts.

Fuel is another problem, which is especially significant in a country like Turkey which imports most of the fuel it requires.

ACTIVITIES OF THE RESEARCH FLEET

The eight research vessels mentioned above are distributed to different institutions operating the vessels in different areas surrounding Turkey: eastern Mediterranean, Aegean Sea, Marmara Sea and Black Sea, on research programmes that deal with living and non-living resources. Examples are:

R.V. M.T.A. SISMIK was desginged to carry out only geophysical survey programmes for oil companies working in Turkish territorial waters. The Turkish National Oil Company is the main customer.

The R.V. K. PIRI REIS, of Dokuz Eylül University, was built and equipped for multi-purpose marine operations. This vessel can be (or has been) used for physical oceanography, chemical oceanography, marine pollution, marine biology, marine geology and geophysics, hydrography and fisheries. Training facilities are available to the university students and scientists at post-graduate level.

The research vessel R.V. BILIM of the Middle East Technical University was again designed for multipurpose marine operations. This vessel can be used for physical oceanography, chemical oceanography, marine pollution, marine biology, hydrography and fisheries; it has also been used for the training of university students and scientists.

INTERNATIONAL CO-OPERATION

Some of the oceanographic studies carried out on living and non-living resources of the Black Sea, Marmara Sea, Aegean Sea and Mediterranean were carried out by Turkish research vessels in a national and international context. Turkey has the capacity to increase its involvement in the study, on a regional scale, of the eastern Mediterranean and the oceans of the Near East.

At present, the R.V. K. PIRI REIS and the R.V. BILIM are available for international co-operation in the field of marine research and for about 30 days per annum. The R.V. PIRI REIS, of the Dokus Eylül University, has participated in joint international and national cruises. The average leasing fees of the vessels are around $1000 to $5000 per day in the year 1984 according to the type of work being considered (including fuel and accommodation).

For binational and/or multinational cruises, the permissions or involvement of the Turkish Foreign Ministry and the Hydrographical and Oceanographic Office of the Navy are required.

EXPERIENCE IN THE USE OF RESEARCH VESSELS IN THE PLANNING AND PERFORMANCE OF OCEANOLOGICAL EXPEDITIONS AND IN DATA INTERPRETATION

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INTRODUCTION

The Institute for Marine Research (IMR) in Rostock-Warnemuende was founded as part of the Academy of Sciences of the German Democratic Republic in 1960. Extensive experience in the use of research vessels, in the planning and performance of oceanographic expeditions, and in the interpretation of data has been gained since then. In addition, scientific staff members have participated in many foreign marine expeditions and have also gained international experience.

About 250 people, mainly physical, but also chemical, biological and geological oceanographers, and engineers, are employed at the IMR Warnemuende. This number also includes the crews of the two research vessels belonging to the institute.

DESCRIPTION OF THE RESEARCH FLEET

The smaller research vessel is the R.V. PROFESSOR ALBRECHT PENCK, a logger type built in 1951 and modernized in 1963 and 1974. A further refitting is planned for 1987. This ship has an overall length of 38.6 m, a gross tonnage of 306 GRT and a cruising speed of 8 knots. The crew, including officers, consists of 13 men. Nine oceanographers can work on board in 3 laboratories, the computer room and the winch room, which is located under the deck.

The larger research vessel is the R.V. A.v. HUMBOLDT, a trawler type, with an overall length of 64.2 m, a gross tonnage of 1270.6 GRT, a speed of 10 knots and a crew, including officers, of 20 men. This ship was built in 1967 and modernized in 1978, when air conditioning was installed to permit service in tropical and sub-tropical sea regions. Thirteen oceanographers can work on board in 4 laboratories, the computer and service rooms, the expedition workshop and the meteorological station. The separate winch room has a hydraulically actuated side port.

In our opinion, the best size for oceanographical research vessels operating in near-shore areas is 250 to 400 GRT, whereas ships with 1000 - 1500 GRT are most suitable for offshore areas in low and middle latitudes. The scientific staff on board should not exceed 15 oceanographers. Otherwise, the complexity and specialization of the programme restricts the continuous employment of the marine scientists and technicians.

The laboratories of both research vessels can be used for studies of physical, chemical, biological and pollution problems as well as palaeo-oceanography and sediment dynamics (multi-purpose laboratories). These differ only in being designed as dry or wet laboratories, and their equipment is changed to suit the objectives of the different expeditions.

The ships are equipped with the computer-monitored oceanographical "OM 75" measuring system developed by the IMR Warnemuende. The OM 75 consists of a submersible unit and a small computer with a commercial periphery and works semi-automatically. The submarine probe can be used at depths down to around 3000 m. Submersible transducers with frequency-analogue outputs are available for pressure (depth), conductivity (salinity), oxgen and sound velocity. A current profiler can also be connected. The signals from the submersible probe are transmitted by a one-wire coaxial cable to the on-board comupter, where they are decoded. The oceanographic parameters are integrated over 1 second. Data are registered every 0.25 to 2 m, depending on the lowering speed of the probe.

The probe is combined with a rosette water sampler with 12 teflon bottles, each of 2.7-ℓ capacity. The bottles can be closed automatically at the desired depths with the help of the pressure transducer or by hand. The water samples are mainly used for nutrient and other trace-element analysis and for biological investigations, but they are also used for calibrating and the checking the transducers.

Meteorological parameters recorded by the OM 75 are air temperature and humidity, radiation and wind speed and direction. They are integrated over 1 minute.

Data are stored on magnetic tapes. They are processed by several programmes including those for data validation, graphical representation and storage. Finally, corrected data are archived in an international format and sent to the World Data Centres in Moscow, Washington and Copenhagen.

Hydrographic winches for taking net plankton and bottom grab samples (6000 m) are also installed on both research vessels. The ships are not equipped for fishery research. These problems are studied in co-operation with the fishery research vessels of the Institute of Sea Fisheries and Fish Processing in Rostock-Marienehe.

Exact positions and water depths are of great importance in marine research. Therefore, the R.V. A.v. HUMBOLDT is equipped with satellite and Decca navigator systems and with echosounders for scientific research. The R.V. PROFESSOR ALBRECHT PENCK has no satellite navigator because she only operates in areas covered by the Decca system.

SYSTEM OF OPERATION

The crews of both research vessels are employed on a two-watch system. The scientific staff on board the ships are also included in this system, working round the clock. The permanent crew is exchanged on a rota basis when in port, thus giving them the spare time due to them. Incentives to go to sea are sea allowances ranging between half and the full salary, depending on the region of the sea, as well as compensatory leave of one day for every Saturday, Sunday and holiday spent at sea. Normally, both ships are at sea for 200 - 240 days per year.

The smaller research vessel, the R.V. PROFESSOR ALBRECHT PENCK is used mainly for joint marine scientific research in northern European waters adjacent to the Atlantic Ocean, with particular emphasis on the Baltic proper and the North Sea. The maximum duration of the cruises is about 4 weeks.

The cruise leader is the head of the department "science" on board the research vessel (other sections are as usual nautical, engine, deck and catering). In cooperation with the master, he is responsible for the coordination and conduct of the research programme during the cruise and for the preliminary scientific report. This also includes data processing, validation and archiving. The cruise leader is also responsible for the welfare of the guest scientists, organizes contacts with marine research institutions in ports of call and visits of foreign marine scientists on board.

CRUISE PLANNING

The utilization and maintenance of research vessels is very expensive. Therefore, the planning and realization of oceanographic expeditions demand a great deal of care and experience. Interdisciplinary co-ordination of marine scientific research is very desirable because of the complex character of the processes in the sea. Programmes in physical oceanography and marine meteorology can be combined with chemical oceanography and marine biological studies without difficulty. In contrast, marine pollution investigations demand large amounts of water, special water samplers and space-consuming devices. This problem, therefore, should be studied on separate expeditions. Special equipment, such as sediment corers, are also needed for palaeo-oceanography. The use of this equipment and the small distances between sampling stations also restrict the combination of this research with other programmes.

Not only the specialized equipment but also different research programmes are the reasons why the scientific staff is sometimes changed in the course of a cruise. This occurs when the research vessel is operating far away from its home port.

Planning of the oceanographic research programme begins with broad discussions of the logistic and scientific problems one to three years before the expedition is scheduled. When the programme includes oceanographic investigations in foreign Exclusive Economic Zones (EEZ), institutes and scientists of the coastal states concerned are invited to participate in these discussions. In this case, one or two places on board are reserved for guest scientists during the expedition.

The research programme, including station and time schedules, station maps and cruise tracks with ports of call, is prepared by a working group under the direction of the cruise leader. This programme is finalized and authorized at least eight months before the beginning of the expedition. In accordance with the New Ocean Regime, notifications are sent six months in advance to all countries whose EEZ is touched. The short version of the research programme is also submitted to IOC or ICES, depending on the area under investigation. The ship is announced via the normal diplomatic channels to all foreign ports of call in good time.

One set of validated data from each EEZ is submitted to the coastal state as soon as possible. The data are analysed in co-operation with the foreign scientists participating in the expedition. The final report, usually printed in the publication series of the GDR National Committee for Geodesy and Geophysics ("Geod. Geoph. Veröff."), is distributed not only to the coastal state but also to the other countries of the region.

INTERNATIONAL CO-OPERATION

The R.V. A.v. HUMBOLDT operates predominantly in the central and northern Atlantic Ocean, but has also worked in the Channel of Mozambique in the Indian Ocean, contributing to IOC global marine scientific research programmes -- notably "Ocean Sciences in Relation to Living Resources" (OSLR), and the oceanographic component of World Climate Research Programme (WCRPO). Cruises of up to six months' duration are carried out with this research vessel.

High priority is given to the IOC programmes of Training, Education and Mutual Assistance in Marine Sciences (TEMA) through international and bilateral projects. Besides joint marine research and monitoring programmes with all the Baltic countries and with

Bulgaria, Romania, Cuba and Vietnam, the IMR Warnemuende co-operates with oceanographic and fishery institutions in Mauretania (National Centre of Oceanological and Fishery Research, Nouadhibou) and Mozambique (Institute of Fisheries Development, Maputo). We also expect to collaborate with Morocco, Senegal and other countries interested in upwelling research off West Africa and in other problems in the field of marine scientific research related to marine living resources, marine pollution and climatic changes.

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RESEARCH VESSELS IN MADAGASCAR

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INTRODUCTION

Marine research is done by five Malagasy institutions:

- Institut de Géodésie et Cartographie (F.T.M.), with a department of hydrography and physical oceanography.

- Université de Madagascar, with its Marine Station at Tuléar.

- Service de la pêche maritime (S.P.U.) of the Ministry of Animal Production.

- Office Militaire National pour les Industries Stratégiques (OMNIS), in charge of the offshore oil prospections in Malagasy waters.

- Centre National de Recherches Océanographiques (CNRC), replacing Office de la Recherche Scientifique et Technique Outre Mer (ORSTOM) which in 1972-1973, assigned to Republika Demokratica Malagasy all the buildings of its Station Océanographique at Nosy-Be.

In the past, FTM, SMT and SPM had their own research vessels. OMNIS is chartering some specialized units belonging to large oil companies. At present, CNRO is the only one to own its research vessels. These are:

R.V. TELONIFY, property of the Malagasy Government;

R.V. BONITO, property of the Federal Republic of Germany, lent to CNRO for a 2-year period within a bilateral German-Malagasy co-operation project.

RESEARCH VESSELS TYPES AND ACTIVITIES

All of the research vessels owned by the Republika Demokratica Malagasy were given to it within bilateral or multilateral cooperation projects. None was larger than 20 meters long and, in all cases (except one hydrographic boat for FTM), they were trawlers with the following capabilities:

- trawling;
- dredging for sedimentology and benthos;
- hydrological studies close to shore;
- plankton studies.

The R.V. TELONIFY attached to CNRO, is a 20-metre trawler (300 HP) that undertakes biological studies (Penaeid shrimps, demersal fishes, etc.), hydrological studies (currents, etc.) along the N-W Malagasy shoreline.

The R.V. BONITO, also attached to CNRO, is a 22-metre trawler (750 HP) that makes exploratory fishing studies (deep trawling, snappering, traps, etc.) within the same geographical area as R.V. TELONIFY.

It should be noted that CNRO was also responsible for the RV LEMURU (25 meters long, 510 HP) during 1980-1981, and the JURONS (35 meters long,750 HP), during 1981-1982. These two research boats belonged to FAO and have made hydroacoustical studies within Malagasy waters.

MAIN DIFFICULTIES

VESSEL ACQUISITION

Problems connected with the buying of research vessels have never arisen, since the Malagasy Government has never been asked to purchase research vessels for the various specialised institutions.

OPERATION OF RESEARCH VESSELS

The running cost of RV TELONIFY, which is at sea 180 days per year, is totally covered by the national budget and is of the order of 46,550 U.S. dollars (1984):

- crew salaries.. 5,500
- food, medicines, miscellaneous supplies................. 5,850
- maintenance 7,300
- pilot fees .... N.A.
- fuel 21,000
- management expenses..................................... 4,900
- insurance 2,000

The budgetary allocation is sufficient to pay all these expenses. The biggest problems are:

- the absence of spare parts on the local market.
- the shortage of well-qualified national mechanical officers.

Moreover, the location of Nosy-Be, the vessel port of registry, on an island without plant or animal production and receiving but a few products from the country, makes the boat supply in food and essential items (table oil, rice, meat, soap, etc.) somewhat acrobatic.

It has been possible to check some of the other difficulties met by the other institutions for running their respective research vessels. They are:

- inadequacy of shore logistics (no organized assistance such as ship chandler for buying food supplies and fuel and for helping in solving the administrative formalities);

- crew salaries not stimulating;

- shortage of financial supplies;

- inability to overcome the various administrative obstacles (a tendancy has been noted to manage a marine research vessel according to regulations made for administrative shore units).

CO-OPERATION

AT NATIONAL LEVEL

The common uses and management of research vessels by the local institutions has been tried several times but without large success:

- the compulsory co-ordination of the activities, needed to establish a common cruise plan, by various institutes, has never been satisfactory (each of them has to respond to multiple obligations);

- organizing a research cruise for the benefit of one institute on board a vessel, not owned by this institute, creates administrative and budgetary problems not solved until now (definition of the responsibilities of the ship-owner and the user, budgetary sources for the payment of expenses, etc...).

Moreover, it has to be said that, in some cases, there is no real will for inter-institute co-operation.

REGIONAL CO-OPERATION

As far as regional co-operation is concerned, it should be noted that Malagasy scientists are put aboard foreign research vessels making research cruises within the territorial waters. This is mainly a representation process, since the effective participation of national scientists does not exist in the majority of the cases. This is mainly due to the fact that:

- the specialities of the embarking scientists are not matched with the studies being undertaken;

- the data are often thought to be the exclusive property of the foreign institute organizing the cruise, and the national scientists, even if they are interested in the work, are not and cannot be associated with the future studies based on these data in laboratories located thousands of kilometres from their own working areas.

Moreover, it is generally impossible to enable local scientists to undertake additional studies during such cruises.

RESEARCH VESSELS IN INDIA - A CASE STUDY IN CRUISE PLANNING AND UTILISATION

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INTRODUCTION

Research vessels are an essential tool for marine research and therefore an important component of marine research programmes and institutes. Since the cost of operation of the research vessels is very high, the vessel account in many cases forms a substantial part of the budget of marine research institutes. Proper planning of cruise programmes and the optimum utilization of the vessels is therefore important to ensure optimum utilization of the available resources.

In the present study, the term research vessel is not restricted to only the vessels specially designed and built for research, but also includes vessels converted for research and those chartered for short-term and fitted with suitable equipment for research. A variety of jobs near the coast can be effectively and economically carried out by smaller vessels (about 15 m length) and these are also covered in this study.

The present paper is based on the study of the performance of the research vessels owned or chartered by the Council of Scientific and Industrial Research and the Department of Ocean Development. The authors because of their specialization have paid greater attention in the present study to the utilization of vessels for marine geosciences and marine mineral exploration.

RESEARCH VESSELS IN INDIA

Marine research in India was initiated in 1875 on the Royal Indian Marine Survey's vessel (Sewell, 1938). RIMS INVESTIGATOR was perhaps one of the first vessels to carry out marine research in the Indian waters (Fig. 1). The scientists on the vessel carried out the pioneering work on the waters, geomorphology and sediments of the Bay of Bengal (Carpenter, 1885, 1887; Sewell, 1937) and the Arabian Sea (Oldham, 1895) and reported the occurrence of barium nodules (Jones, 1887, 1888) and phosphorite concretions (Tipper, 1911) from the Indian continental margin. These studies were a landmark for the period and provided the basic data for future work.

After these pioneering efforts, there was a considerable pause and oceanographic studies in the country were only renewed in the early 1950's when the Oceanography Department of the Andhra University was formed. The work was then largely carried out on naval vessels INS KONKAN, MADRAS, BENGAL, RAJPUTANA, ROHILKHAND and CIRCARS.

India played a significant role among the countries of the region in the International Indian Ocean Expedition (1959 to 1965). In the expedition, the Indian scientific programme was largely carried out on Indian naval vessel KISTNA and to a lesser extent on RV VARUNA, RV CONCH and FV BANGADA.

The International Indian Ocean Expedition developed a cadre of trained marine scientists in the country, generated interest in the Indian public and scientific community in oceanographic research and the resources of the oceans. The formation of the National Institute of Oceanography is perhaps a sequel to the expedition. In the post-IIOE period, the absence of research vessels proved to be a serious handicap for the trained marine scientists in the country. The gap was filled to some extent by the cruises organized by the Indian Naval Hydrographic Office in 1973-74 on INS DARSHAK. These cruises generated a wide variety and large volume of data on the physics, chemistry, biology and geology of the north-eastern Arabian Sea and the north-western continental margin of India.

In the 1960s, the need for the exploration and and exploitation of the food resources of the sea for the rising population of the country was felt. This led to the development of facilities for the exploration and exploitation of the living resources, and programmes for the modernization of the fishing industry. As a part of this programme, institutions were developed and fisheries research vessels acquired, and bases built at Indian ports. During this period, the Oil and Natural Gas Commission and the Geological Survey of India initiated the planning and, to some extent, programmes to extend the exploration for oil and minerals and geological mapping offshore.

The 1970s marked an increasing interest in the oceans, but the period was largely devoted to the development of infrastructure and the creation of facilities for marine research work. The Council of Scientific and Industrial Research (National Institute of Oceanography) acquired a hopper barge and the Garden Reach Ship Builders, Calcutta, converted this to R.V. GAVESHANI. This was the first multi-disciplinary oceanographic research vessel in India and formed a useful platform for the training of Indian scientists, which was essential for providing the manpower for the increased activities in the 1980s. The 1970s also witnessed a steep rise in the price of oil and, with the increased import bill, the exploration of offshore areas for oil was taken up. The Oil and Natural Gas Commission during this period acquired the seismic vessel ANVESHAK.

The increased interest in the resources of the ocean, the deliberations at the Third Session of the UN Conference on the Law of the Sea, the Large Exclusive Economic Zone and the proposed International Area provided an impetus to marine research in India. The expeditions to the Antarctica and the Surveys for Polymetallic Nodules are perhaps the result of the increased interest in marine research. It was realised that, by this time, the country had the trained manpower, but to meet the time targets and possibly to narrow the gap with other countries in the field, it would be advantageous to charter vessels for Antarctic research and Surveys for Polymetallic Nodules. A vessel is now regularly chartered for the expeditions to the Antarctic and two vessels were chartered for the Surveys for Polymetallic Nodules. The new oceanographic reseach vessel SAGAR KANYA was received from West Germany in 1983 and negotiations with Denmark for a fisheries oceanographic research vessel SAGAR SAMPADA were finalized. The Indián research vessels (including those chartered) provided about 100 berths at a time for scientific research (Table I). The area of operation of these vessels covers the Arabian Sea, Bay of Bengel, central Indian Ocean, and the Antarctic waters. The vessels are also being used for collaborative programmes with Seychelles, Sri Lanka and Maurtitius.

MANAGEMENT OF CRUISE PROGRAMMES AND RESEARCH VESSELS

RESEARCH CRUISE PLANNING

Planning for cruises is the first step towards the optimal utilization of the research vessels and in India annual cruise plans are prepared initially at the National Institute of Oceanography (disciplinary/divisional levels, Figs. 2 and 3). Subsequently, these are reviewed at an Inter-Agency Workshop (living resources, non-living resources and environment, Fig. 4). The Inter-Agency Workshop provides a useful forum for scientists of same and different disciplines to draw common programmes and build linkages between the institutional and interdisciplinary programmes. The national committee ensures that the programmes are within the priorities assigned to different sectors and duplication is avoided.

MANAGEMENT OF CRUISES

The cruises are operated under two categories: the individual institutional and multi-institutional. The multi-institutional cruises require co-ordination between different organizations, the co-ordiatión is usually carried out by a Project Co-ordinator from the discipline.

The operation of the scientific programmes has two components: the manpower (scientists and technicians) and equipment. The operation of the scientific programmes or collection of data and samples by the scientists does not pose any problems since the country now has sufficient expertise and manpower. However, problems were initially faced in the training of the technicians and engineers as the technology in the field advances faster and the engineers/technicians are required to be trained for every new equipment. The Institute has adopted an approach that equipment for which service and maintenance facilities are available in the country will be serviced and repaired in the port by the manufacturers' representatives. Equipment for which facilities are not available in the country and which has to be operated continuously on the cruise will be maintained and serviced by the Institute's personnel. The assigning of a priority to the training of the engineers and technicians and linking the training with the acquisition of the equipment and vessels has improved the situation considerably.

In 1982-84, over 40 scientists, engineers and technicians were trained abroad in various aspects of marine science and instrumentation.

The Institute, during the last few years, has operated many programmes. One of the priority and time-targeted programmes was for the Surveys for Polymetallic Nodules. The analysis of man-days (scientists, engineers and technicians) in the laboratory and on the vessel (Figs. 5 and 6) shows that a ratio of 1 (ship): 3 (laboratory) causes a strain for cruises of 45 days duration and it was felt that an ideal ratio would be 4 or 5. The development of manpower therefore has been assigned a high priority because of the need for the operation of the vessels and equipment round the clock.

Since many teaching institutes do not have research vessels, facilities for training are extended liberally on the research vessels. The Council of Scientific and Industrial Research provides the passage and free stay of the students and teachers on research vessels, and the Department of Ocean Development has given over a hundred fellowships under the Marine Research Development Fund. The facilities enable the students and teachers from a number of universities to work on ships and thus create a wider base of scientific manpower for future expansion of activities. It is estimated that, during 1982-84, over 38 teachers and students have participated in the cruise programmes and two short cruises of RV GAVESHANI were specifically arranged for training of university teachers and students. The total manpower in marine sciences in the country is about 950 (1981) but most of this is not available for ship-board work.

OPERATION OF THE VESSELS

The operation of the research vessels, excluding the chartered vessels, has been entrusted to the Shipping Corporation of India. The Shipping Corporation of India, a government agency, has a fleet of about 150 vessels. The operation of the vessels by the Shipping Corporation of India reduces the Institute's problems considerably in the matter of rotation of officers and crew and logistic support for the vessel at various Indian and foreign ports. The system has worked satisfactorily for the last few years. The chartering of vessels further reduces the problems for a research Institute in cruise management; this may not be possible for all projects and institutes but such an approach needs to be examined and encouraged. The growth of a fleet of supply vessels (for the offshore oil industry) and of research vessels in India has led to the formation of a number of shipping companies (though smaller) for the operation of supply vessels. The development needs to be watched and possibly encouraged to ensure a healthy competition in the market.

MONITORING OF THE CRUISES

The monitoring of the cruise programmes requires monitoring of two different aspects: the adherence of the operating agency or vessel to the schedules; and fulfilment of the assigned quantum of work for the cruise by the scientists. The deviation from the schedule (longer stays in port) are brought to the notice of the operating agency, the Shipping Corporation of India and remedial measures suggested. However, some delays in the port are related to factors beyond the operating agency's control; i.e. to the level of development of a port. The monitoring of the quantum of scientific work is carried out to identify areas of weakness, especially failures of instruments and machinery and measures adopted to improve the performance in future cruises.

The performance of the cruise is monitored by daily and monthly reports and annual reviews, which thus provides a system of checks and balances (Fig. 7).

BOATS AND SMALLER CRAFT

Boats can be used effectively and economically for surveys to a distance of up to 15 km from the coast with conventional position fixing. The range for surveys can be considerably increased with the use of electronic position-fixing systems. Because of the limited number of participants and restricted scope of operation, the programmes for boats are mainly finalized at the divisional/disciplinary level and are not reviewed by the national Cruise Planning and the Programme Priorities Committee. A wide variety of geological and geophysical surveys with position fixing by miniranger, echosounding, side-scan sonar, seismic profiting (sparker) and magnetometer have been carried out for a distance of about 15 km from the coast. The boats have been used for surveys for offshore placers, calcareous sands, oil and effluent pipeline routes and development of ports and harbours (Quantum of work, Table II, Typical configuration of equipment in Fig. 8). Smaller vessels (about 15 to 20 m LOA) are available for hire at many places along the coast. Hiring of a vessel for survey in an area has advantages, since the crew know the local navigational conditions and hazards. It has been the authors' experience that hiring of the boats for specific jobs along the coast has definite advantages compared to maintenance of a fleet of boats by the Institute.

UTILIZATION OF RESEARCH VESSELS AND COSTS OF SURVEYS

UTILIZATION OF RESEARCH VESSELS

The utilization of research vessels over the last decade (Fig. 9) was studied and the results indicate that the utilization of the vessels operated by the Institute (RV GAVESHANI of the CSIR and ORV SAGAR KANYA of the DOD) ranged from 42 to 78 per cent. The utilization of the chartered vessels for the project Surveys for Polymetallic Nodules ranged from 79 to 89 per cent which is considerably higher (Table III: Fig. 10). Based on this analysis the possibility of improving the utilization of RV GAVESHANI and ORV SAGAR KANYA was examined. The ORV SAGAR KANYA has been recently acquired and the vessel as usual required longer stays in the port for warranty repairs of deck machinery, scientific equipment and dry docking. It is expected that, with the completion of the warranty period, the utilization of the vessel would improve. A major refit of RV GAVESHANI is planned in the next few years, which will include the installation of a desalination plant and laundry on board, and these may also reduce the port stays. It is felt that the utilization of the vessels depends considerably on the planned endurance. RV GAVESHANI was planned for an endurance of 15 to 20 days and there will therefore be limitations in increasing the utilization by reducing the port stays. The port stay will not reduce proportionately for vessels with endurance of 6, 4 or 3 weeks.

The analysis of the utilization of the vessels for various scientific disciplines indicates that RV GAVESHANI has been utilized for a large part of the time for marine geosciences (Table III). It is related to the priorities at the Institute which are in turn related to the national priorities. Because of the national priorities, more funds were available for oil exploration and exploitation and to some extent mineral exploration, and therefore many of the surveys were entirely or partially funded by the oil industry or the Geological Survey of India.

The Council of Scientific and Industrial Research (CSIR) encourages collaboration in research programmes with other government departments, R & D institutions and the industries. These programmes are carried out as a part of an agreement between two organizations in which the expenditure on the programmes including shipboard work is shared. The analyses of the data indicate that most of the collaboration has been carried out in marine geosciences (Geological Survey of India, Oil and Natural Gas Commission and to some extent India Meteorological Department and Naval Research Laboratories). In the case of commercial surveys or research, the industry pays the charges according to a formula laid down by the CSIR. Such an arrangement develops a mutually beneficial relationship between the industry and research. It also provides an opportunity to the scientists to be associated with major projects of national development and application-oriented research. These also expose the scientists to a new technology, which noramlly would not have been available within the resources of research intstitutes in a developing country and provide a very valuable financial input for the marine sciences programmes. The spin-off of these surveys has been the preparation of detailed surfacial geological maps of the western continental margin and magnetic-anomaly maps of offshore oil structures.

The analyses indicate that: (i) almost the entire sponsored surveys on research vessels were assigned to the Institute by the Oil and Natural Gas Commission; and (ii) most of the work has been carried out for problems in marine geosciences (surveys for development of offshore oil fields and pipeline routes).

COST OF SURVEYS

A system of costing of projects and surveys is useful to create an awareness in the scientists of the costs involved and the cost/benefit ratios. The CSIR therefore organizes short-term courses for the scientists in project planning and management. The cost of regional geological and geophysical surveys and precise surveys for offshore oil-field development on large vessels is expectedly considerably higher than the costs of exploration from small boats (Table IV). This is particularly important when planning for near-shore work and indicates undoubtedly that quite large areas of the continental shelf can be covered economically and perhaps more effectively with boats rather than large multidisciplinary oceanographic vessels. This should be considered by developing countries and is important not only in planning the programme but also for training the personnel.

CONCLUSIONS

The optimum utilization of the research vessels requires:

(i) proper planning of the cruise, research and survey programmes and co-ordination with other organizations and the industry;

(ii) availability of trained scientific and techical manpower for managing the cruise programmes, and servicing and repair of instruments;

(iii) arrangements for the operation, servicing, and repair of research vessels.

The delegation of the operation of the vessel to a shipping company allows the scientists and Institute to devote more time to the scientific programmes rather than the management of the vessels.

The chartered vessels provide a better ship-time utilization for research institutes and the possibilities of utilizing these should be favourably examined for short-term and time-targeted programmes.

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Table I-a

Research Vessels at Present in Operation in India

VESSEL	OWNER	YEAR OF BUILDING/ LAUNCHING	LENGTH (M)	BREADTH (M)	DRAUGHT (M)	CRUISING SPEED (KNOTS)	ENDURANCE (DAYS)
1	2	3	4	5	6	7	8
RV CONCH	UNIVERSITY OF KERALA	1956	15.25	-	1.40	11	-
FV BANGADA	MINISTRY OF FOOD AND AGRICULTURE	-	17.38	-	2.13	8	6
RV VARUNA	CENTRAL MARINE FISHERIES RESEARCH INSTITUTE	1961	30.6	7.4	3.9	10.0	30
SV ANVESHAK	OIL & NATURAL GAS COMMISSION	1973	-	-	-	-	-
RV GAVESHANI	NATIONAL INSTITUTE OF OCEANOGRAPHY	1975	68.33	12.19	3.0	10	25

Table I-a
(continued)

VESSEL	DISPLACEMENT TONNAGE	BEAM	ACCOMMODATION CREW	ACCOMMODATION SCIENTISTS	SCIENTIFIC CAPABILITIES
	9	10	11	12	13
RV CONCH	40	4.5	6	7	N: Electric ship's log C: Radio telephone S: Echosounder, hydrographic winches
FV BANGADA	50	5.12	9 (TOTAL)		N: Magnetic compass, Ship's log, radio direction finder: C: Radio telephone S: Echosounder, roller-type trawl winch
RV VARUNA	160	-	13	5	N: Magnetic compass, electric ship's log, Decca radar, direction finder S: Echosounder C: Radio telephone; Two hydraulic winches, Three laboratories
SV ANVESHAK			24	16	N: Integrated navigation system C: Radio telephone S: Multichannel seismic equipment
RV GAVESHANI	1900	-	45	19	N: Omega, Decca Navigator, Mini Ranger gyrocompass, radars, Tracor Magnavox, satellite position fixing system; C: Radio telephone, VHF S: 12 KHz narrow-beam precision depth recorder, narrow-beam echo-sounder ± 1.4 degree gyro stabiliser, 3.5 KHz sub-bottom profiler sparker, magnetometer, bathysonde, deep sea grabs, free-fall grabs, free-fall corer, dredges, coring winch, traction winch, bathysonde winch

Table I-b

1	2	3	4	5	6	7	8
ORV SAGAR KANYA	DEPARTMENT OF OCEAN DEVELOPMENT	1983	100.34	16.39	5.6	14.25	45

Table I-b
(continued)

VESSEL	9	10	11	12	13
ORV SAGAR KANYA	4209	-	59	32	N: Integrated satellite navigation system, visual radio direction finder, Decca navigator with track plotter, automatic VHF radio direction receiver, radar navigational echosounder for graphic display, electromagnetic speed log, gyro compass and electronic automatic pilot. C: SSB radio, Marconi radio telex, radio station, satellite radio unit, VHF. S: 3-frequency narrow-beam sounder, deep-sea sediment echosounder, shallow-water echo-sounder, TV with tripod sub-sea camera equipment, photo camera sledge, free-fall grabs with camera, underway sampler, radiograph for cores, proton magnetometer, marine gravitymeter, 24-channel digital seismic equipment, side-scan sonar with sea-floor mapping system, expendable bathythermo-graph, hydrocarbon water sampler, shipborne wave-recorder system, mooring system, thermosalinograph, CTD-02 profiling system, spectrofluorometer, UV-spectrophotometer, atomic absorption spectrometer, fluorometer, high-speed plankton net, standard pressure meter, midwater trawling net, combined wind weather radar, pyranometer, pyrheliometer, meteorological data logging system, radio-sonde, general-purpose computer system, and multipurpose data-logging system, etc.

Table I-c

1	2	3	4	5	6	7	8
RV SAMUDRA-MANTHAN	GEOLOGICAL SURVEY OF INDIA	1983	88.83	12.95	5.05	12.4	25
MV POLAR CIRCLE*	A/S G.C REIBER BERGEN, NORWAY	1972	42.35	11.5	4.79 (Summer middle) 4.10 (Ice breaker)	13	-
MV SKANDI SURVEYOR*	P/R OCKLAND AND CO., NORWAY	1974	73.26	11.58	-	14	-
MV FARNELLA*	M/S J.MARR AND SONS LTD. U.K.	1976	76.6	-	-	11	-

* Chartered vessels now dembobilized.

Table I-c
(continued)

VESSEL	9	10	11	12	13
RV SAMUDRA-MANTHAN	1272.5	-	36	25	N: Integrated satellite navigation system, Doppler sonar, gyrocompass, direction finder, radar C: VHF, main and emergency transmitter, main and emergency receiver S: Dual-frequency echosounder, dual-channel side-scan sonar, marine proton magnetometer, hydrosonde system, finger, vibrocorer, free-fall grab, spade corer.
MV POLAR CIRCLE	495.71 Rt		34 (total)		N: Satellite navigation C: Satellite communication S: Echosounder, magnetometer, side-scan sonar, sparker
MV SKANDI SURVEYOR	1200		44 (total)		N: Dual-channel satellite navigation system C: Radio transmitter S: Echosounder, magnetometer, facsimile weather recorder, free-fall grabs with camera, ocean mining dredges, X-ray, fluorescence analyser
MV FARNELLA		12.65			N: Satellite and Omega navigator C: Radio transmitter, satellite communication S: Magnetometer, echosounder, weather recorder, free-fall grab with camera, ocean mining dredges, boomerang corer, box corer, atomic absorption spectrometer

Table II : Surveys by Small Craft - Quantum of Work

Surveys	Echosounding (ℓ km)	SSS* (ℓ km)	Seismic (ℓ km)	Magnetic (ℓ km)	Samples	Approx. area sq.km.	Scale
1. Offshore placers	2088	54	897	1136	1640	94	1:10,000
2. Calcareous sands	1123	-	-	-	2605	385	1:5,000 & 1:10,000
3. Oil pipelines	860	915	918	-	55	252	1:10,000 & 1:25,000
4. Effluent pipelines	427	347	407	-	73	85	1:10,000 & 1:15,000

* Side-Scan Sonar

Table III: Research Vessels: Utilization, R & D Disciplines and Sponsored Surveys

Year	Disciplines (Days)					
	Physical Oceanography	Chemical Oceanography	Biological Oceanography	Marine Geosciences	Ocean Engineering	Multi-Disciplinary
		RV GAVESHANI				
1976	29	48	12	59	-	7
1977	1	-	-	133	-	49
1978	4	-	-	127	-	81
1979	59	-	-	60	-	35
1980	3	-	-	120	-	113
1981	-	-	-	29	11	157
1982	19	-	-	121	6	55
1983	-	13	-	12	-	196
1984*	-	-	13	45	-	21
		ORV SAGAR KANYA				
1983	-	-	-	33	-	184
1984*	-	-	-	63	-	-
		MV SKANDI SURVEYOR				
1982	-	-	-	132	-	-
1983	-	-	-	259	-	-
		MV FARNELLA				
1982	-	-	-	19	-	-
1983	-	-	-	309	-	-
1984	-	-	-	25	-	-

* up to April 1984

Table III
(continued)

Year	Surveys (Days)			Port Calls and Repairs (Days)				Remarks
	R & D Surveys	Sponsored Surveys Chiefly Oil Field Development	Total for Surveys	Port Calls	Annual Repairs and Dry Dock-ing	Total Port Calls and Repairs	Utilization Per Cent	
		<u>RV GAVESHANI</u>						
1976	92	63	155	40	132	172	47.4	
1977	115	68	183	114	68	182	50.1	
1978	138	74	212	99	54	153	58.1	
1979	125	29	154	146	65	211	42.2	
1980	187	49	236	53	76	129	64.5	
1981	197	-	197	112	56	168	53.9	
1982	201	-	201	78	85	163	55.1	
1983	221	-	221	83	61	144	60.5	
1984*	79	-	79	42	-	42	65.3	
		<u>ORV SAGAR KANYA</u>						
1983	217	-	217	61	-	61	78.1	
1984*	63	-	63	22	36	58	52.1	
		<u>MV SKANDI SURVEYOR</u>						
1982	132	-	132	23	-	23	80.7	The ship was chartered from 30.7.82 to 29.10.1983
1983	259	-	259	43	-	43	85.8	
		<u>MV FARNELLA</u>						
1982	19	-	19	5	-	5	79.2	The ship was chartered from 7.12.82 to 22.1.1984
1983	309	-	309	56	-	56	84.7	
1984	25	-	25	3	-	3	89.3	

* up to April 1984

Table IV: Cost of Various Surveys

Surveys	Cost (in Rs.)		
	per line Km.	per sq. Km.	per sample
1. Regional Geological and Geophysical (20-km. grid)	150 - 500	20 - 135	1,000-1,700
2. Precise for oil-field development			
i) Platform (4 x 2 km grid)	-	1,500 - 5,200	-
ii) Pipeline	325 - 1,100	-	-
3. On small craft			
i) Offshore placers	100 - 250	1,700	125 - 150
ii) Oil pipelines	550 - 750	-	-
iii) Effluent pipelines	200 - 400	2,000	-

Figure 1

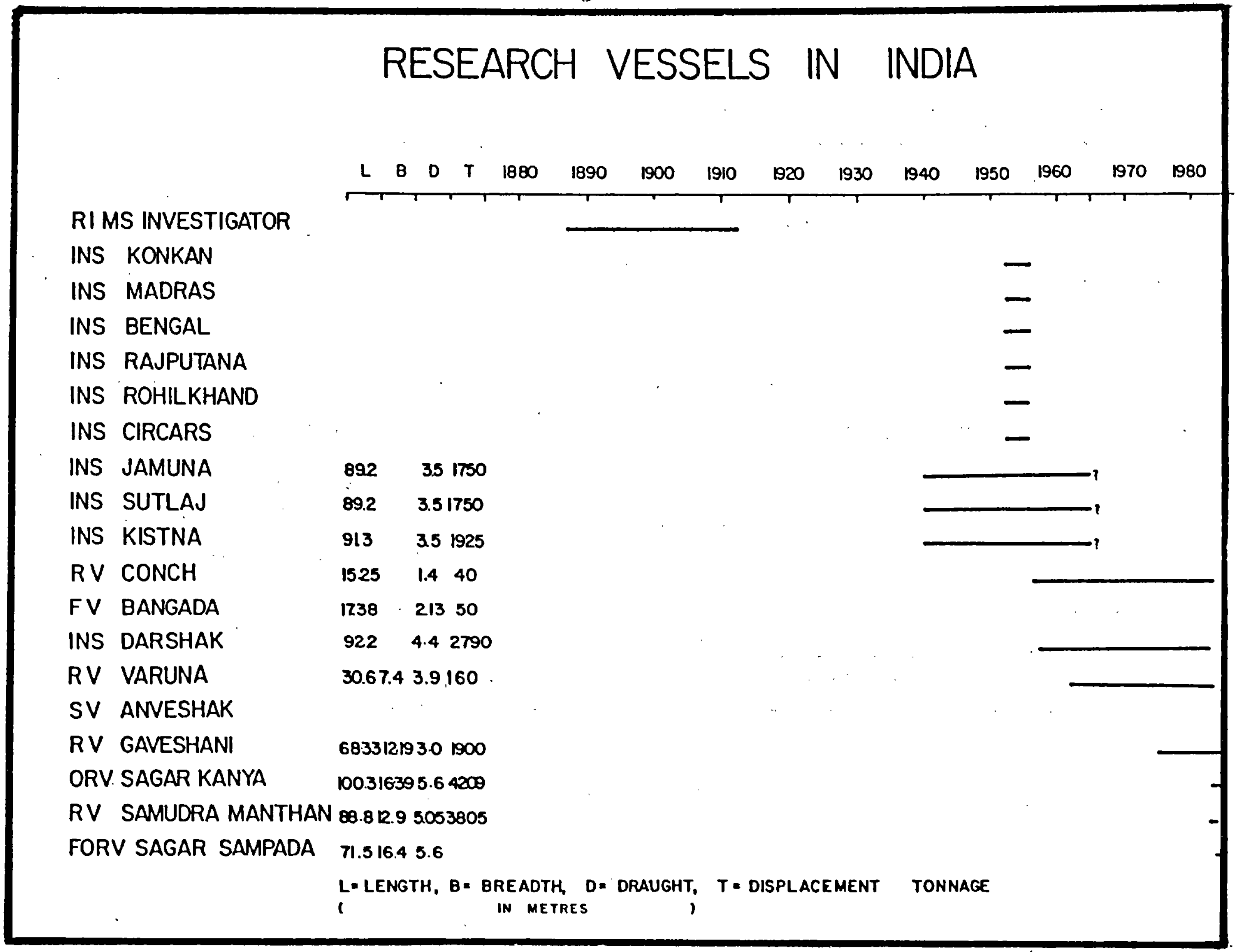

RESEARCH VESSELS IN INDIA
L B D T 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980
RIMS INVESTIGATOR
INS KONKAN
INS MADRAS
INS BENGAL
INS RAJPUTANA
INS ROHILKHAND
INS CIRCARS
INS JAMUNA 89.2 3.5 1750
INS SUTLAJ 89.2 3.5 1750
INS KISTNA 91.3 3.5 1925
RV CONCH 15.25 1.4 40
FV BANGADA 17.38 2.13 50
INS DARSHAK 92.2 4.4 2790
RV VARUNA 30.6 7.4 3.9 160
SV ANVESHAK
RV GAVESHANI 68.33 12.19 3.0 1900
ORV SAGAR KANYA 100.3 16.39 5.6 4209
RV SAMUDRA MANTHAN 88.8 12.9 5.05 3805
FORV SAGAR SAMPADA 71.5 16.4 5.6
L= LENGTH, B= BREADTH, D= DRAUGHT, T= DISPLACEMENT TONNAGE
(IN METRES)

Figure 2
Planning and decision-making for cruises,
financial support and operation and maintenance of research vessels

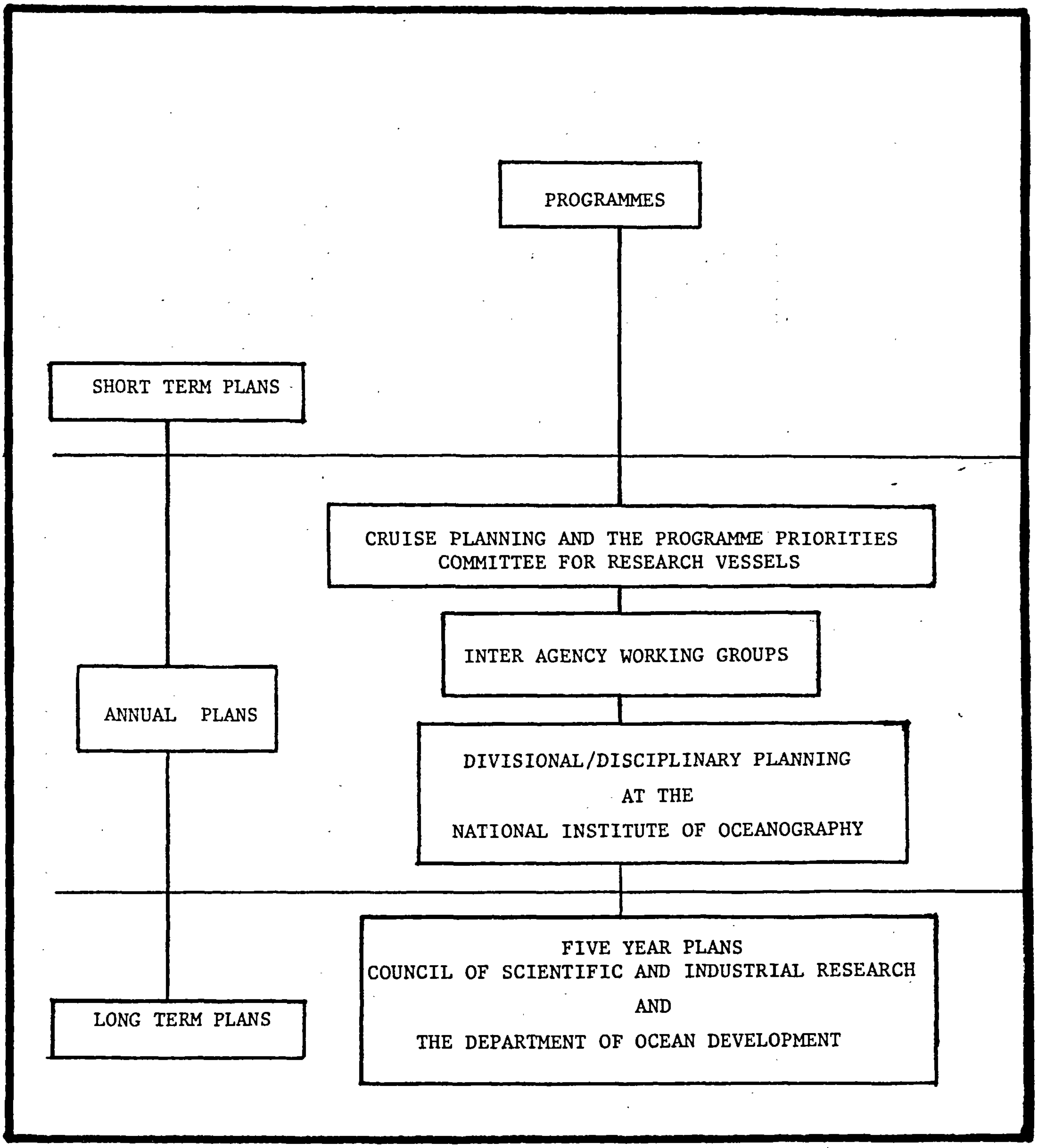


Figure 2 cont.

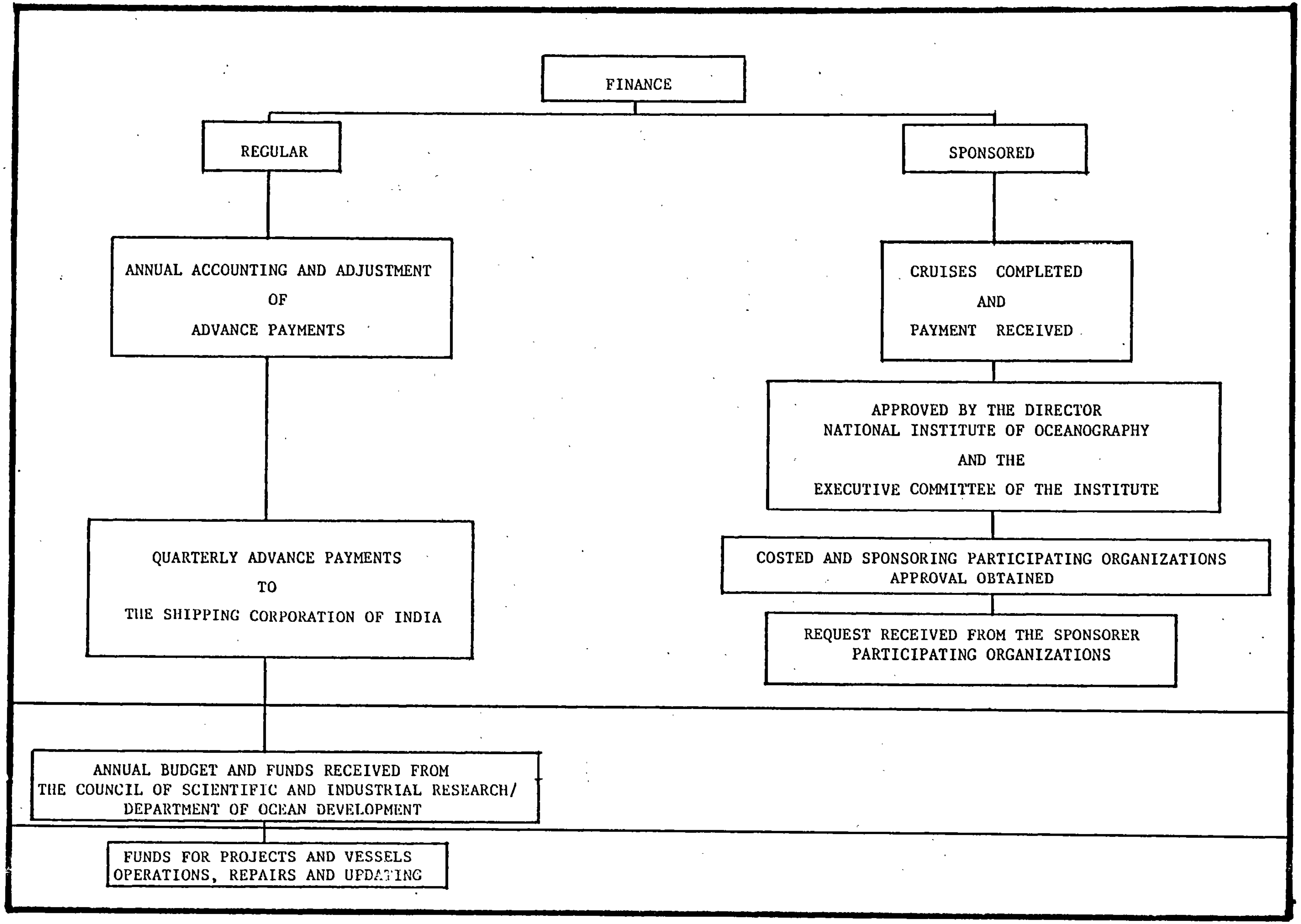


Figure 2 cont.

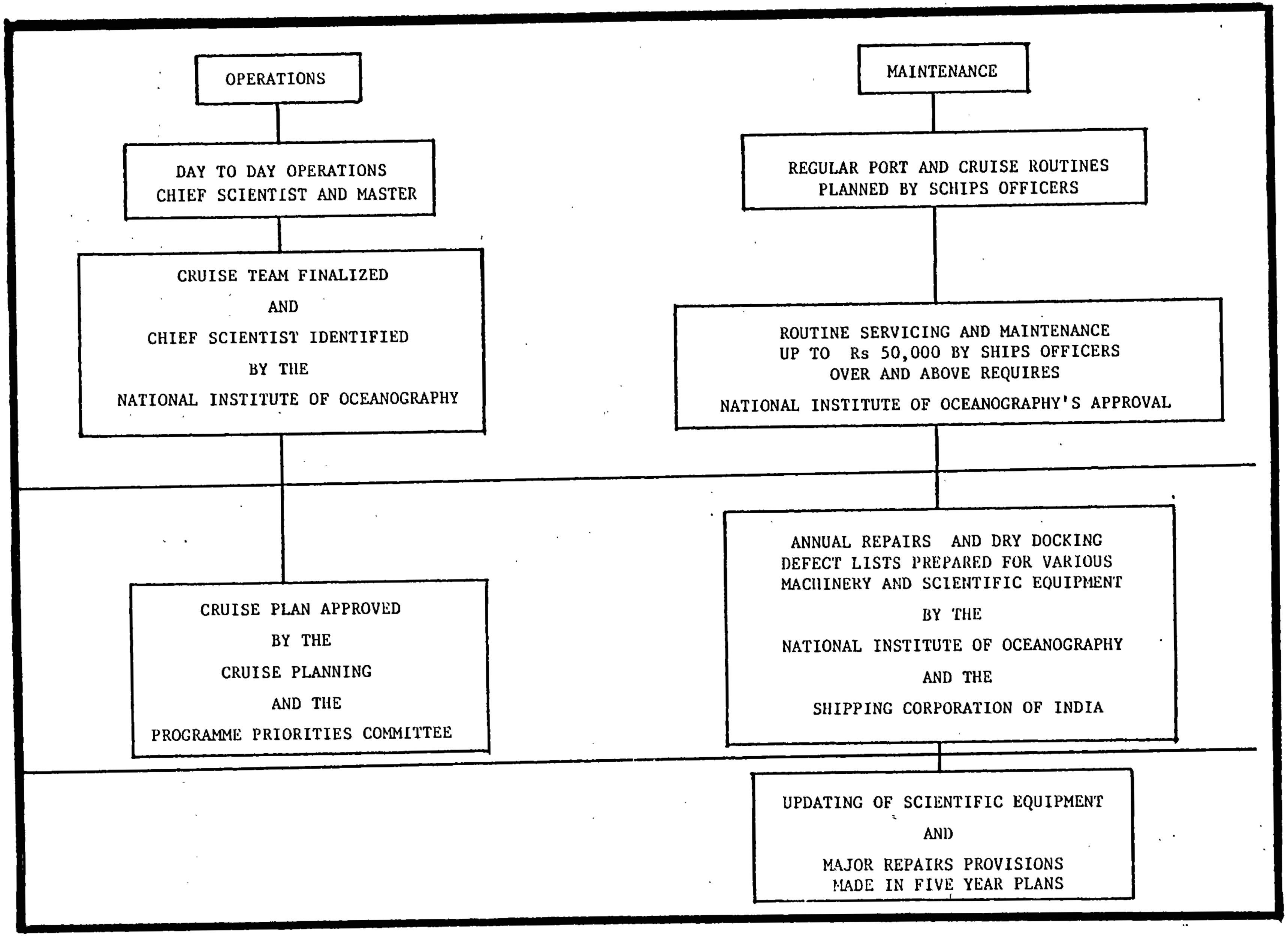


Figure 3

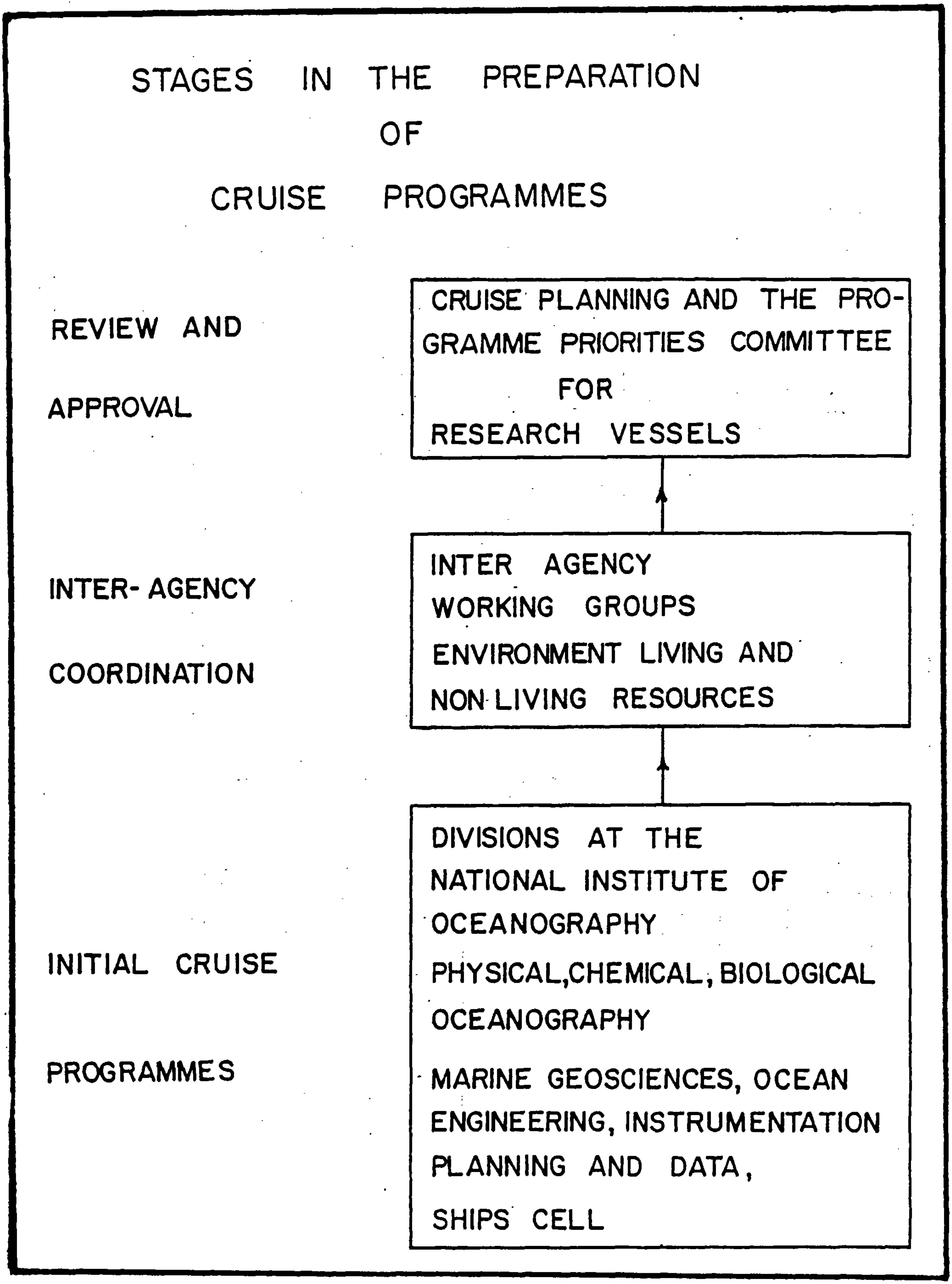

STAGES IN THE PREPARATION OF CRUISE PROGRAMMES
REVIEW AND APPROVAL
CRUISE PLANNING AND THE PROGRAMME PRIORITIES COMMITTEE FOR RESEARCH VESSELS
INTER-AGENCY COORDINATION
INTER AGENCY WORKING GROUPS ENVIRONMENT LIVING AND NON-LIVING RESOURCES
INITIAL CRUISE PROGRAMMES
DIVISIONS AT THE NATIONAL INSTITUTE OF OCEANOGRAPHY
PHYSICAL, CHEMICAL, BIOLOGICAL OCEANOGRAPHY
MARINE GEOSCIENCES, OCEAN ENGINEERING, INSTRUMENTATION
PLANNING AND DATA,
SHIPS CELL

Figure 4

CRUISE PLANNING AND THE PROGRAMME PRIORITIES COMMITTEE FOR RESEARCH VESSELS (R V GAVESHANI AND O R V SAGAR KANYA)

CHAIRMAN

Secretary Department of Ocean Development

(Government of India)

PLANNING COORDINATION MANAGEMENT AND EXECUTION OF SCIENTIFIC PROGRAMMES	National Institute of Oceanography Council of Scientific and Industrial Research Department of Ocean Development
OPERATION OF RESEARCH VESSELS	Shipping Corporation of India
LIVING RESOURCES	National Institute of Oceanography Central Marine Fisheries Research Institute Indian Council of Agricultural Research
NON-LIVING RESOURCES	National Institute of Oceanography Geological Survey of India Oil and Natural Gas Commission National Geophysical Research Institute
ENVIRONMENT	National Institute of Oceanography India Meteorology Department Central Board for Water Pollution and Control
OTHER INTERESTED AGENCIES	Ministry of External Affairs Ministry of Communication Ministry of Shipping and Transport Department of Science and Technology Naval Hydrographic Office Naval Physical and Oceanographic Laboratory University Grants Commission Coast Gourd Central Electrical Authority Centre for Earth Science Studies

Figure 5

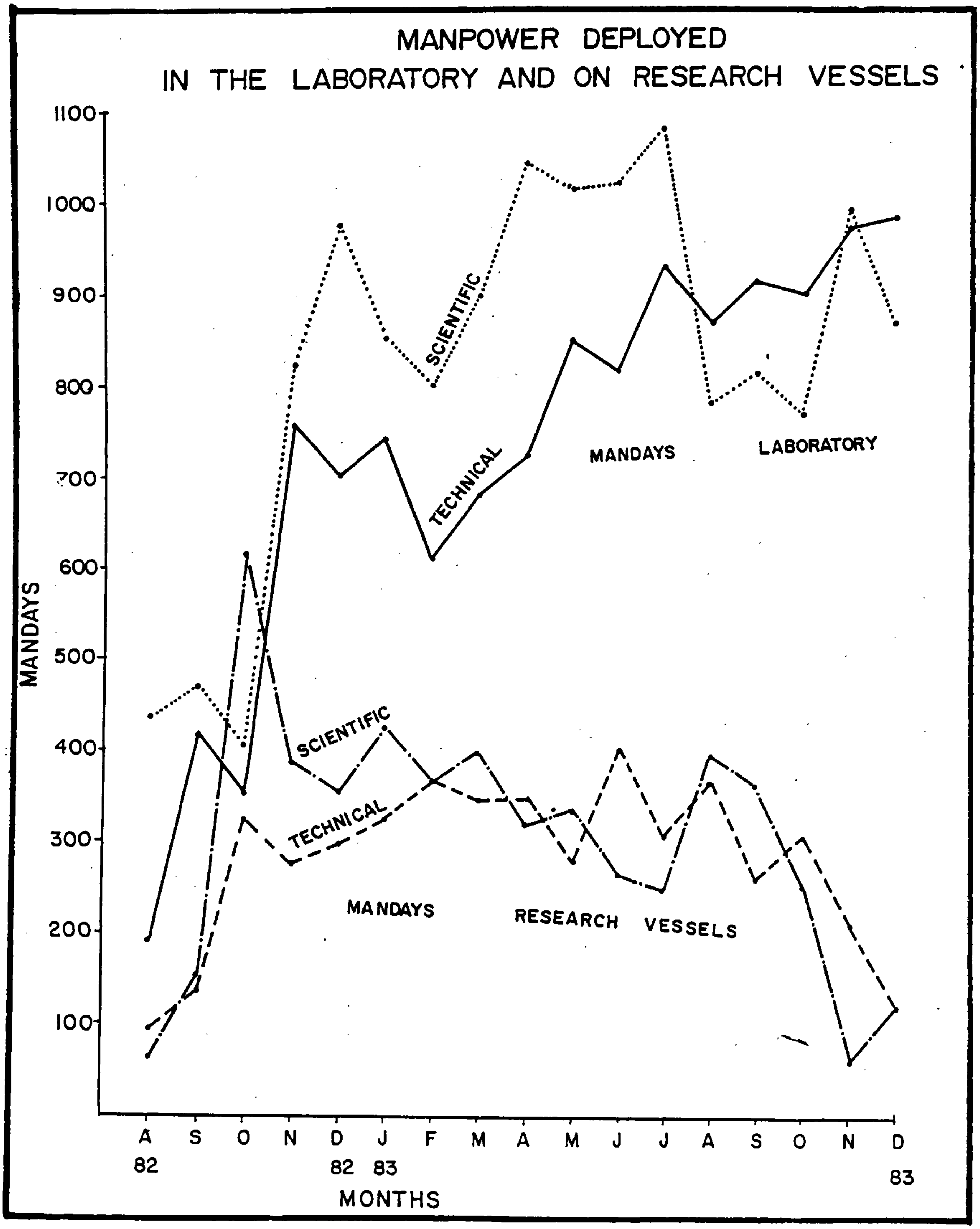

MANPOWER DEPLOYED
IN THE LABORATORY AND ON RESEARCH VESSELS
MANDAYS
1100
1000
900
800
700
600
500
400
300
200
100
SCIENTIFIC
TECHNICAL
MANDAYS
LABORATORY
SCIENTIFIC
TECHNICAL
MANDAYS
RESEARCH
VESSELS
A S O N D J F M A M J J A S O N D
82
82 83
83
MONTHS

Figure 6

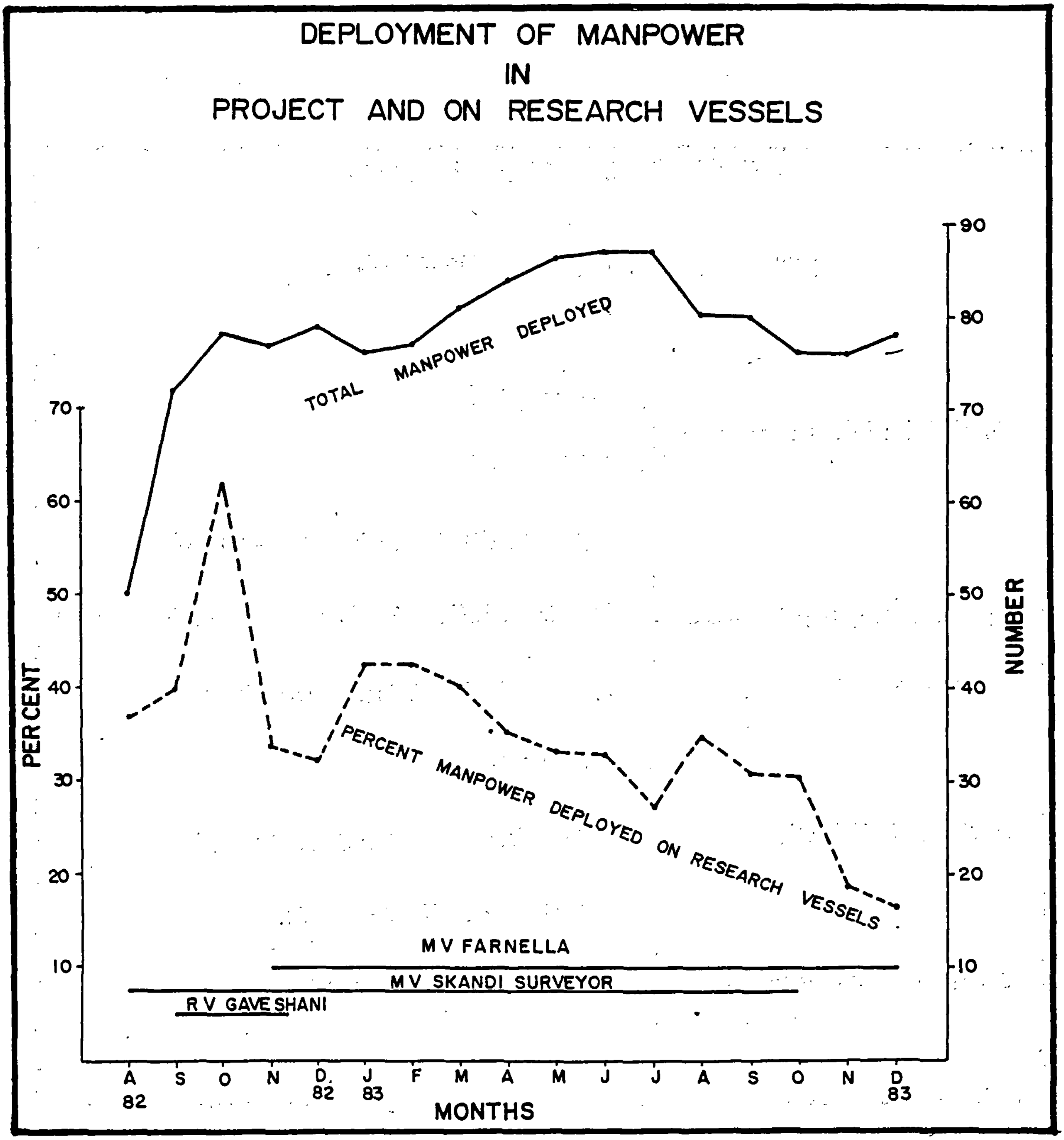

DEPLOYMENT OF MANPOWER
IN
PROJECT AND ON RESEARCH VESSELS
TOTAL MANPOWER DEPLOYED
PERCENT MANPOWER DEPLOYED ON RESEARCH VESSELS
M V FARNELLA
M V SKANDI SURVEYOR
R V GAVESHANI
PERCENT
NUMBER
70
60
50
40
30
20
10
90
80
70
60
50
40
30
20
10
A 82
S
O
N
D 82
J 83
F
M
A
M
J
J
A
S
O
N
D 83
MONTHS

Figure 7

MONITORING AND REVIEW OF CRUISES AND PROGRAMMES

DAILY REPORTS	SHIPS CELL INSTITUTE
MONTHLY/CRUISE REPORTS	ALL PARTICIPATING ORGANISATIONS AND MEMBERS OF THE CRUISE PLANNING AND PROGRAMME PRIORITIES COMMITTEE
PROJECT REPORT	SPONSORING ORGANISATION
ANNUAL REVIEW	CRUISE PLANNING AND PROGRAMME PRIORITIES COMMITTEE

Figure 8

TYPICAL CONFIGURATION OF EQUIPMENT ON SMALL CRAFT

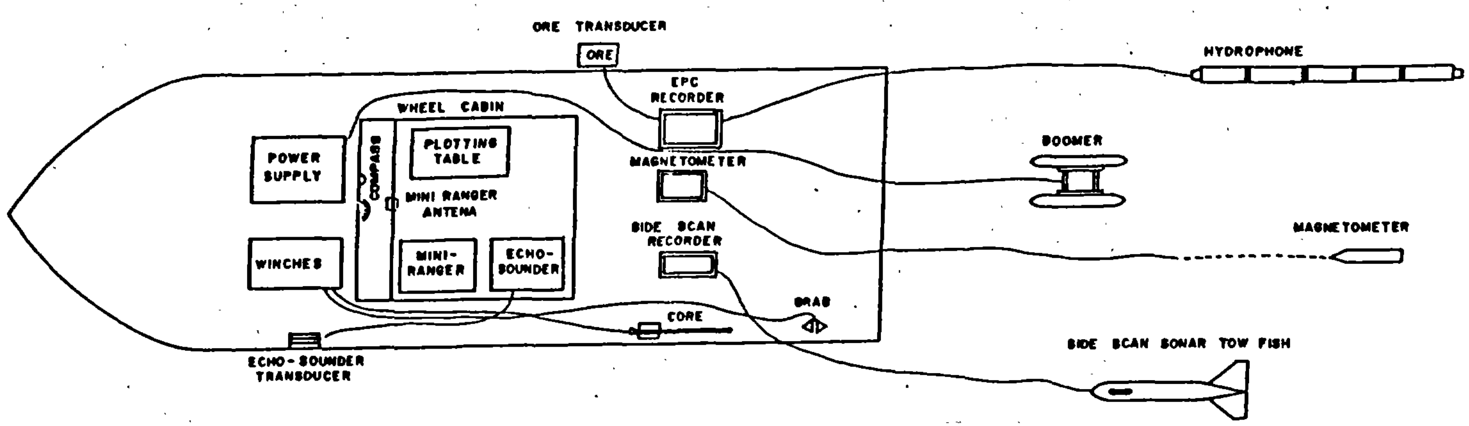


Figure 9

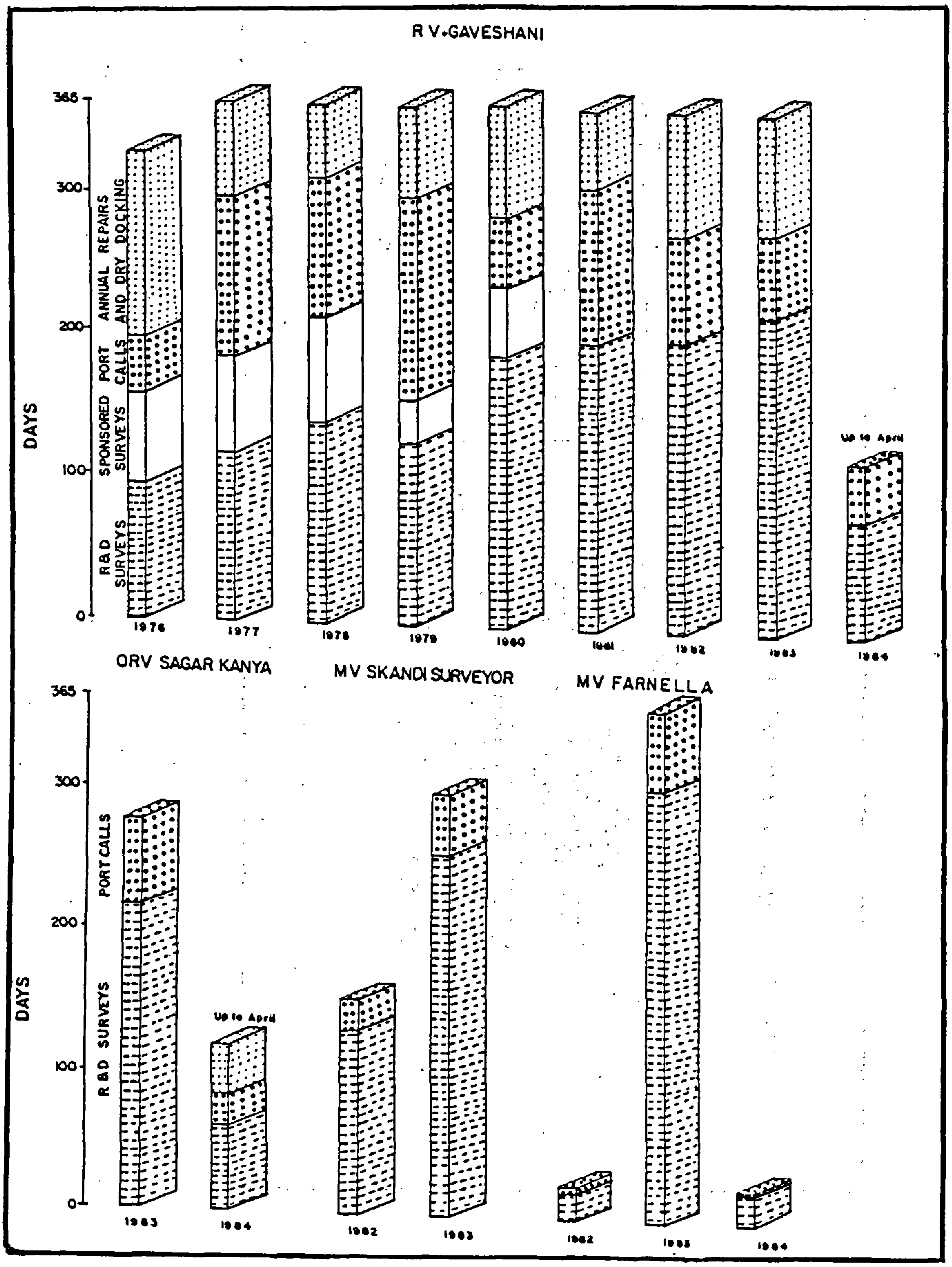
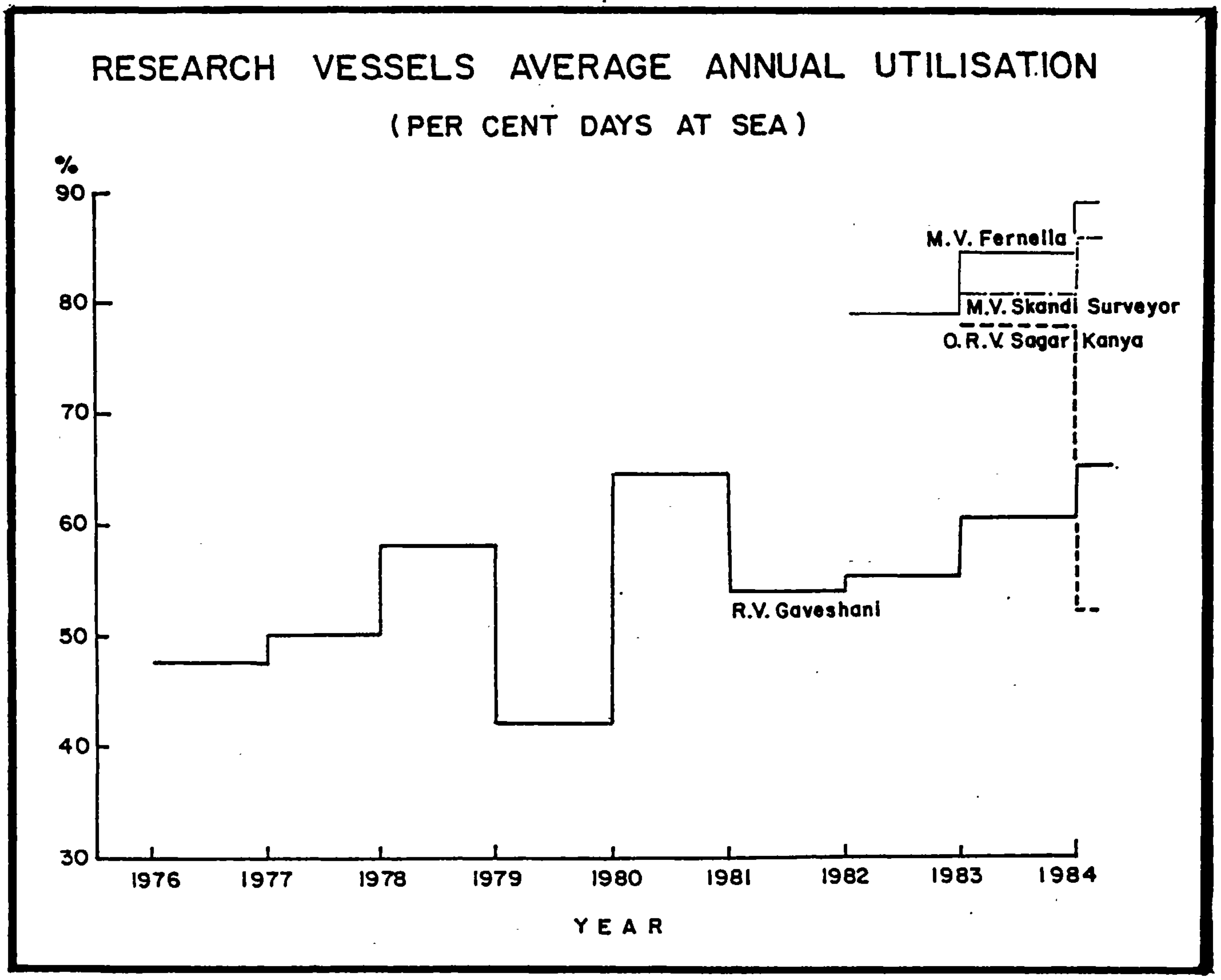

R V. GAVESHANI
DAYS
365
300
200
100
0
R&D SURVEYS
SPONSORED SURVEYS
PORT CALLS
ANNUAL REPAIRS AND DRY DOCKING
1976
1977
1978
1979
1980
1981
1982
1983
1984
Up to April
ORV SAGAR KANYA
MV SKANDI SURVEYOR
MV FARNELLA
DAYS
365
300
200
100
0
R&D SURVEYS
PORT CALLS
1983
1984
Up to April
1982
1983
1982
1983
1984

Figure 10


RESEARCH VESSELS AVERAGE ANNUAL UTILISATION
(PER CENT DAYS AT SEA)
%
90
80
70
60
50
40
30
M.V. Fernella
M.V. Skandi Surveyor
O.R.V. Sagar Kanya
R.V. Gaveshani
1976
1977
1978
1979
1980
1981
1982
1983
1984
YEAR

THE DEVELOPMENT AND LEVEL OF UTILIZATION OF THE RESEARCH FLEET IN CHINA

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National Bureau of Oceanography
Beijing
China

CONTENTS

INTRODUCTION

Over the last decade, despite the wide utilization of many new results gained in the field of modern science and technology, such as spaceflight, remote sensing, deep-sea diving, scuba, etc., in marine investigations and research, marine research vessels, due to their high manoeuverability and multipurpose use, have developed very rapidly, occupying a very important place in the means of marine investigation and research.

The purpose of this paper is to describe briefly the status and management of the research vessels in the People's Republic of China.

THE GENERAL SITUATION OF THE RESEARCH FLEET IN CHINA

China is a developing country. Marine investigation has expanded considerably since the establishment of New China, and now includes 165 marine research vessels of all types. Before the 1960s research vessels were produced mainly through the re-equiping of old fishing vessels, cargo vessels and vessels which were released from the Navy. A typical example of this period is the 1300-ton multipurpose research vessel JINXING, which was rebuilt in 1969. In the 1970s, research vessels were newly built. An example is the pelagic, 10,000-ton multipurpose research vessel XIANGYIANGHONG 10. Meanwhile, in order to satisfy needs in offshore oil exploration and exploitation, many geophysical survey vessels and petroleum prospecting vessels were either constructed locally or imported from foreign countries. This contributed further to the rapid development of the research fleet. While the expansion still continues, much attention has been given after 1980 to the improvement of the quality and function of the research equipment and instruments used on board the vessels.

NUMBER, TYPE OF RESEARCH VESSELS AND THEIR MAIN REPRESENTATIVES

There are altogether 165 research vessels of various types and uses at present, totalling 150,000 tons in terms of displacement. Among them, over 50 vessels have a tonnage more that 500: 22 vessels, 1000-5000; 20 vessels, 500-1000; 50 vessels, less than 500; and there are 50 auxiliary vessels. These vessels are mainly allocated to the National Bureau of Oceanography, the Ministry of Geology and Mineral Resources, the Ministry of Petroleum, the Ministry of Agriculture, Animal Husbandry and Fisheries as well as Academica Sinica.

Research vessels can furthermore be categorized by purpose into the following 9 groups (representative vessels are indicated for each group):

(i) Comprehensive marine research vessels:
PRACTICE, XIANGYANGHONG 05, XIANGIANGHONG 09, XIANGYANGHONG 10 and EXPERIMENT 3;

(ii) Geophysical survey vessels:
HAIYANG 1, HAIYANG 2, HAIYANG 3, HAIYANG 4, SCIENCE 1, NANHAI 501 and NANHAI 502;

(iii) Petroleum-prospecting vessels:
BINHAI 511, BINHAI 512, BINHAI 513 and BINHAI 516;

(iv) Geological drilling vessels:
PROSPECT 1, PROSPECT 2;

(v) Aquatic survey vessels:
DONGHAI, NANFENG 704, DONGFANG;

(vi) Acoustic survey vessels:
HAISHENG 581, XIANGYANGHONG 04 and XIANGYANGHONG 06;

(vii) Marine survey practice vessels:
DONGFANGHONG

(viii) Gulf survey vessel:
SEAGULL

(ix) Sea-lane measurement vessel:
HANGOE 11.

MAIN FEATURES OF THE RESEARCH FLEET

After 35 years of development, our research fleet has become very large and played a tremendous role in the development of ocean sciences. This fleet has the following main features:

(i) Most of the vessels were built or re-equipped after the 1960s. In recent years, the government has attached great importance to the development of marine science and technology. Investment has increased and many medium-sized research vessels have been constructed.

(ii) The function of the marine research vessels (e.g., navigability) has been improved. Many passive anti-rolling tanks have been used on board the vessels, with the desired results. The newly built 10,000-ton pelagic research vessel XIANGIANGHONG 10 has for the first time been equipped with roll-damping fins, which have proven to be highly efficient.

(iii) With interest developed in the exploitation of marine resources, new types of geophysical survey vessels and petroleum-prospecting vessels have been developed in large quantity, occupying 15% of the total number of research vessels.

(iv) Most of the pelagic research vessels have been equipped with satellite positioning systems and electronic computers. The newly built vessels have for the first time been deployed with helicopters. (Table I).

THE LEVEL OF UTILIZATION OF RESEARCH VESSELS

Like other developing countries, the equipment and technology of our marine research vessels have had a great leap forward; however, compared with developed countries, there exists a big gap due to historical reasons. New technology, such as remote sensing, drifting buoys, etc. has already been used in the marine research investigations of many developed countries, but research vessels still continue to be their main means for marine investigation. Even for a long time to come, the role of research vessels in the development of ocean sciences and marine resources in the People's Republic of China cannot be neglected.

THE ASSESSMENT OF THE LEVEL OF UTILIZATION THE THE COST-EFFECTIVENESS OF RESEARCH VESSELS

The assessment of the level of utilization and the cost-effectiveness of research vessels is a very complicated task. The operation of these vessels at sea is not only affected by natural factors such as weather, but also by the function (e.g., form, size and speed of vessels) of the vessels themselves and the research instruments deployed. In addition, the qualification of crews and personnel engaged in scientific investigations, as well as the measures adopted on the operation of research vessels at sea, have improved. The cost-effectiveness of the vessels is closely linked with the number and the value of investigations conducted, as well as with the second influence resulting therefrom. Generally speaking, in assessing the level of utilization and the cost-effectivenesss of research vessels, the following factors should be taken into consideration: the number of personnel engaged in scientific research, units from which information is received, voyages, the number of papers published, sea conditions, annual cost, turnover rate, crews, the influence of papers on scientific work and the literature reference. At the same time, the second influence of research data on ocean sciences as well as on industrial, military, economic and recreational aspects should also be taken into account. Therefore, it is very difficult to have an adequate and comprehensive assessment of the level of utilization and the cost-effectiveness of research vessels. In spite of that, we can still characterize them from different standpoints

Analysis and research show that the level of utilization and the cost-effectiveness can be described by the following four indicators, namely, the coefficient of vessel utilization, of cruise efficiency, of fund returns and of cost of observation.

A. The Coefficient (A), Actual Utilization Coefficient (A') and the Loss Coefficient (A'')

The relative utilization (A) can be indicated by the ratio between the number of days at sea and the total number of days, annually. The actual utilization coefficient (A') can be indicated by actual days of observation at sea (substract transition days from one station to another and the number of days at ports and harbours from the number of days at sea) versus the total number of days, annually. The loss coefficient (A'') can be indicated by the number of days in which no operation is conducted at sea (the number of days for transition and for stopping at ports and harbours) versus the number of days at sea. If we indicate the total number of days by Dy, the number of days at sea by Dr, the non-operation days at sea (in China this mainly indicates the transition days, since our vessels seldom stop at foreign ports and harbours) by Dt, then the aforesaid three coefficients can be expressed as follows:

$$A = \frac{Dr}{Dy}$$

$$A' = \frac{Dr-Dt}{Dy}$$

$$A'' = \frac{Dt}{Dr}$$

From this it can be seen that the three coefficients can quite clearly indicate the work efficiency of crews from different angles, and its calculation is very simple. (Table II).

Cruise Efficiency Coefficient

The cruise efficiency coefficient (R) indicates the work efficiency of different vessels in terms of the value of data obtained from a certain cruise versus the total investment value of that cruise. If we indicate the value realized in the observation made by one vessel of a certain cruise by CH, the total investment value by CP, then the cruise efficiency coefficient can be expressed as follows:

$$R = \frac{CH}{CP}$$

here the cruise efficiency coefficient obtained first can be considered as a common basis, so that the work efficiency of all research vessels involved in a certain cruise can be accurately compared.

Fund Returns Coefficient

The fund returns coefficient (f) is one of the main standards of determining the cost-effectiveness of research vessels. Through this coefficient the most economical or cost-effective vessels can be identified. It can also indicate the quantity of returns gained from the basic investment on research vessels. Fund returns coefficient can be indicated in two forms: (i) the basic fund returns coefficient in which only the annual value of the basic production fund (f1) is taken into account; and (ii) the total fund returns co-efficient in which both the annual value of the basic production fund and the annual value of the mobile production fund (f2) are taken into account.

If we represent the basic production fund by Vb, the annual value of the mobile fund by Vc and the annual investigation value of research vessels by Vs, then the basic fund returns coefficient (f1) and the total fund returns coefficient (f2) may be expressed as follows:

$$f1 = \frac{Vs}{Vb}$$

$$f2 = \frac{Vs}{Vb+Vc}$$

In these calculations, the annual value of the basic production fund is the total sum of the depreciation charge of vessels and the instrument, and the mobile fund is the consumption of other things such as food, salaries, work, clothes, etc.

Coefficient of Observation Cost

The coefficient of observation cost can be indicated by the ratio between the actual cost of a certain observation of a vessel and the planned or the most reasonable expenses (the average value of departments). This coefficient can also clearly indicate the cost-effectiveness of marine research vessels.

RAISING THE LEVEL OF UTILIZATION AND THE COST-EFFECTIVENESS OF RESEARCH VESSELS

Due to defects in the function of the vessels themselves, the low level of automation of shipboard instrumentation and equipment, the low qualification of the crews, and management problems, the work efficiency of the Chinese research vessel is comparatively low. So far as the level of utilization of research vessels, is concerned, the total sea days tabled annually is at most 100 days, although their total ship-time is all right, being 200-300 days. The sharp differences between the ship-time and the days at sea of research vessels show that there exists a great potentiality for raising the level of utilization and cost-effectiveness of the research vessels. However, for historical reasons, the cost-effectiveness of our research vessels was not given due consideration. Not only was the examination and the verification of such economic indicators as observation value and cruise value lacking, there was not even a standard for the consumption of vessels; what was used for a long time was the method of reimbursing all expenses. All in all, the level of utilization and cost-effectiveness of our research vessels are quite low. But it is rewarding to note that this problem has aroused great attention in various responsible departments, especially the National Bureau of Oceanography, which is adopting various pertinent measures to find a solution.

The raising of the level of utilization and the cost-effectiveness of research vessels should be conducted from the following four standpoints:

The Function of Vessels

The improvement of research vessels is an important aspect of raising the level of utilization, the major indicator being the form, size and the speed of the vessels.

(i) The design of the vessels

The research vessel is a special type of ship. Under a certain tonnage, the function and the form of the vessels are closely related. The statistical analysis shows that the following ratios are optimal for the design of research vessels: length to width, 5.0-6.0 (small vessels below 5.0); width to waterline, 12.0 - 14.5; and the displacement to length, smaller than 250.

Some of our research vessels have a design that gives more importance to speed, and does not conform with the criteria mentioned above; e.g., length-to-width ratio of 6.2 up to 6.6. Consequently, the navigability, cruising endurance and reliability of these vessels becomes adversely affected.

The problem is presently being studied and some vessels are being redesigned. For example the 1000-ton marine petroleum property vessel HAIBIN 505 is rebuilt on the design of the XIANGYANGHONG 07, a multi-purpose marine research vessel.

Lowering the water line and increasing the length-to-width ratio in ships of ordinary displacement can dampen rolling.

(ii) The rate of sailing

Though high speed can shorten the navigation time and raise the work efficiency, it does not mean that faster research ships are better research ships. Generally speaking, 12-15 knots is the economical speed for research vessels, the optimum being 14 knots. The research vessels must have 0.1-6.0 low propeller speed so that the requirement of the marine investigation, especially the measurement requirement of trawled instruments, can be satisfied. At present, China has begun to apply such advanced technology as active helm, low-speed electronic propelling and adjustable oars to the research vessels for the purpose of raising the low-speed operating capability of the research vessels.

Presently, however, there are only a few vessels so equipped, and efforts must be made to improve it.

(iii) Size of vessels

In contrast to other kinds of vessels, the research vessels are not the better for being larger. Although the increase of tonnage, length, width and water-line contributes a lot to raising the efficiency of vessels, it has many defects which are not easy to overcome. Increases in size are not necessarily improvements to research vessels. Work efficiency and cost-effectiveness should be taken into account when determining the size of research vessels. From an economic point of view, research vessels should develop towards medium and small size. Practice shows that it is appropriate to have coastal research vessels with a tonnage less than 100, offshore research vessels not smaller than 500 to 1000 tons, and the blue-ocean research vessels not smaller than 1500 tons, the most appropriate being 3000 tons.

(iv) Power-generating, routing and positioning equipment

Selection of adequate power sources is of great importance, since they may greatly contribute to an increase in effective ship-time and an improvement of general useability of the vessel. It has been learned that factors other than the mere power of the main engine should be taken into consideration; e.g., its reliability. Efforts should also be made to abate vibration and noise as they may adversely affect (acoustic) marine research. A positive example illustrating these remarks is the marine petroleum property vessel HAIBIN 505: equipped with two 83002 mode main engines, producing 2200 HP, it achieves an economic speed of 13 knots with good reliability.

In addition, better navigation equipment (e.g., satellite navigation), and positioning equipment (e.g., dynamic positioning systems) are key factors in increasing the efficiency of research vessels.

Distribution of Laboratories, Operation Areas, Equipment and Instruments

Comprehensive utilization and flexibiltiy of research vessels should be presented. Laboratordes should be multipurpose to allow for comprehensive research and interchangeability of equipment. Containerized laboratories should be promoted, using bolt fixing methods to facilitate their replacement and re-equipment. Operation decks should be spacious in order to widen the field of vision and to accommodate multipurpose machinery such as winches, cranes, U and A racks, etc. A helicopter landing pad, dicing machinery, trawling equipment, and loading and unloading devices should also be present on large vessels, so as to ensure the lifting and lowering of instruments in rough weather. All these aspects will play a significant role in raising the efficiency of the research vessels.

The People's Republic of China has already undertaken many efforts in this regard, and is presently conducting further studies in the concerted utilization of research equipment. Also, for vessels with a tonnage below 2000, the single-side operation method is being promoted for vessels with a tonnage below 2000 tons to increase cabins and deck space.

The most important thing to implement these recommendations is to raise the level of automation of marine instruments and equipment, and to increase the application of computer systems.

The Qualification of Crews

Raising the qualification of crews involved in marine investigation is one of the key factors in raising of the efficiency of vessels. For the purpose of economy, crews should be composed of very reliable persons who at the same time are specialized in one field. The post-responsibility system should be strictly applied. The introduction of various advanced investigation techniques and advanced equipment has raised the desired qualification for the crew even higher. A qualified seaman should not only be good at operating various advanced pieces of equipment, but should also be able to do maintenance work when needed. In recent years, efforts have been made in this regard and the qualification of our crews has been raised, but much remains to be done.

Management

Scientific management of research vessels has become an urgent issue since the continuous rise in costs since the 1970s. In a broad sense, management of these vessels involves such aspects as the assessment of cost effectiveness, determination of management forms, improvement of vessel function, development of investigation techniques, training of personnel, preparation of cruise plans and national co-ordination. Local conditions in the People's Republic of China make it necessary to give priority to the improvement of repair and maintenance of vessels and relevant equipment.

The experience gained during the expansion period of the research fleet has allowed some departments, in particular the National Bureau of Oceanography, to develop quite efficient management systems. However, since research vessels are owned by different departments, and are managed according to the different methods in each department, co-ordination and close co-operation between different departments is extremely important and needs to be strengthened.

Withing the system of the National Bureau of Oceanography, the procedure for co-ordination and utilization is as follows: users submit their plans, which are examined and harmonized by the Department of Comprehensive Planning. Priorities are then established for the execution of these plans and finally execution of the proposed cruises is ordered by the Department of Survey and Command.

Cruise programmes are worked out by the following procedure: identification of tasks according to needs verified by relevant divisions and departments; convening of consultative meetings of relevant parties to develop a proposal for the implementation of the proposed research; implementation of the programme after approval by the highest authority of the Bureau.

Another aspect of the strengthening of scientific management is the improvement of the capability of management personnel to utilize electronic computers and control systems. Serious attention should be given to the identification of methods that are both efficient and well-suited to the local conditions in China.

CONCLUSION

It can be predicted that the marine investigation vessels will be an important means to understanding and exploiting the oceans in the near future. Even after the year 2000, marine research vessels will still play an important part in the exploitation and management of oceans. Therefore, marine research vessels will develop continuously, but the direction and the content of the development will be quite different from those of the past. The number of vessels will increase and their quality will be raised in an unprecedented way. Old vessels will be re-equipped and new vessels will be constructed. More recent achievements of various branches of modern science and technology will be used and the form of the vessels will probably be confined to medium- and small-sized vessels, one of the main characteristics of which will be the great strengthening of the automated recording capability in navigation.

The raising of the cost-effectiveness of research vessels has already become a very important topic in many maritime countries of the world. China, as other countries, has devoted great attention to this problem and has taken many effective steps. But what should be pointed out is that the raising of the cost-effectiveness of the research vessels needs not only the cutting down of the consumption (of labour and materials consumed per unit), but also that the work load (quantity of observation per vessel) be increased. The latter is the most important observation. In other words, the most effective method of raising the cost-effectiveness of the research vessels is to raise the level of utilization so as to increase the quantity of observations. During the cruise, every effort must be made to carry out the carefully established comprehensive plans so as to avoid a waste of time. As many scientific and technical personnel as possible should be enabled to participate in the investigation so as to assure full use of equipment and instruments. Finally, mutual exchange of information should be encouraged so as to eliminate completely the waste resulting from useless, repeated investigations.

Table I

Major Specifications of Some of the Marine Research Vessels in China

Name of Vessels	Displacement (ton)	Length (m)	Width (M)	Draught (m)	Speed (Knot)		Endurance (nautical mile)	Self-sustaining Capability	Laboratory (m^2)	Year of Production	Subordinate to
					max.	economical					
Shuguang 01	635.7	59.1	8.8	2.5	15	12	1900	20	66.5	1971	South China Sea Sub-Bureau, NBO
Shuguang 02	635.7	59.1	8.8	2.5	15	12	1900	20	66.5	1971	Ibid
Shuguang 04	777.6	65.3	9.2	2.9	16	14	3000	20	61.8	1972	North China Sea Sub-Bureau, NBO
Shuguang 05	777.6	65.3	9.2	2.9	16	14	3000	20	61.8	1972	Ibid
Shuguang 06	777.6	65.3	9.2	2.9	16	14	3000	20	61.8	1972	East China Sea Sub-Bureau, NBO
Shuguang 07	777.6	65.3	9.2	2.9	16	14	3000	20	61.8	1972	Ibid
Practice	3167	94.7	14.2	5	16	14	7500	45	294	1969	Ibid
Xiang-yiang-hong 05	13200	152.6	19.4	6.85	18	15	18000	100	293.4	1973	South China Sea Sub-Bureau, NBO
Dong-fanghong	2345	86.84	13.20	4.4	15	14				1965	Shandong College of Oceanography

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Table I(cont.)

Major Specifications of Some of the Marine Research Vessels in China

Name of Vessels	Displacement	Length(m)	Width(M)	Draught (m)	Speed (Knot) max.	Speed (Knot) economical	Endurance (nautical mile)	Self-sustaining Capability	Laboratory(m^2)	Year of Production	Subordinate to
Xiang-yang-hong-01	1120	65.2	10.2	3.5	15	13	6800	40		1970	East China Sea Sub-Bureau, NBO
-02	1178	74	10	3.6	17	15	4000	40		1972	South China Sea Sub-Bureau, NBO
-03	1178	74	10	3.6	17	15	4000	40		1972	Ibid
-07	1178	74	10	3.6	17	15	4000	40	68	1973	North China Sea Sub-Bureau, NBO
-08	1178	74	10	3.6	17	15	4000	40	68	1973	Ibid
-09	4440	111	15.2	5.5	19	18	10000	60	260.7	1977	Ibid
-10	13100	156.2	20.6	7.8	20	18	18000	120	846.8	1978	East China Sea Sub-Bureau, NBO
-14	4440	111	15.2	5.5	19	18	10000	60	260.7	1981	South China Sea Sub-Bureau, NBO
-16	4440	111	15.2	5.5	19	18	10000	60	260.7	1981	East China Sea Sub-Bureau, NBO

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Table I (end)

Major Specifications of Some of the Marine Research Vessels in China

Name of Vessels	Displacement (ton)	Length (m)	Width (M)	Draught (m)	Speed (Knot) max.	Speed (Knot) economical	Endurance (nautical mile)	Self-sustaining Capability	Laboratory (m^2)	Year of Production	Subordinate to
Oceans-1	3324	104.21	13.74	4.9	20		6500	40		1972	Ministry of Geology and Mineralogy
Science-1	3324	104	13	4.9	20		4000	30		1979	Academia Sinica
Prospect 01	8240	99.2	38	4.85	12		8640	30		1974	Ministry of Geology and Mineralogy
Orient	1600	62.5	10.8	4.5	14	13	10000			1979	National Bureau of Aquatic Products
Fendou 03	1142	69	10	3.5	14.5		3000			1975	Ministry of Geology and Mineralogy
Experiment 03	3324	104	13	4.9	10		4000			1962	Academia Sinica
Haibin 512	2503	74	14.43	4.6	16		10000			1979	Ministry of Petroleum
Nabfeng 704	1750	62.5	10.5	4.0	14.5		10000			1978	National Bureau of Aquatic Products
South China Sea 503	2877	76	15	4.6	15.4		4000			1979	Ministry of Petroleum
Yellow Sea 104	375	41	7.2	3.3	12		5760			1979	National Bureau of Aquatic Products

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Table II

Level of Utilization of Some of the Marine Research Vessels in 1983

Name of Vessels	Number of Days Annually	Days for Going to Sea	Transition Days	Vessel Utilization Coefficient		
				Relative Coefficient	Actual Coefficient	Loss Coefficient
Practice	365	80	26	0.22	0.15	0.33
Xiangyianghong 16	365	90	30	0.25	0.17	0.33
Xiangyianghong 10	365	90	43	0.25	0.13	0.48
Shuguang 4	365	130	92	0.36	0.10	0.69
Shuguang 5	365	135	68	0.37	0.18	0.50

I N F O R M A T I O N   P A P E R S

THE SELECTION AND FUNDING STRATEGIES FOR RESEARCH VESSELS IN DEVELOPING COUNTRIES WITH SPECIAL REFERENCE TO LATIN AMERICA

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CONTENTS

INTRODUCTION

The availability of a sea-going surface vessel for general marine research represents an esential need for the knowledge of the seas and ocean areas off the coasts of developing countries. In many instances, small craft for short excursions to the near-shore zone have been used successfully. Notwithstanding their modest capability and low degree of autonomy, these small vessels have the advantage that they are well integrated into the maritime capacity of the particular country. A product of the local conditions, their operation requires low skill and a moderate budget.

Experience has shown that, as a particular institution dedicated to marine research grows to a certain size, the lack of a larger craft becomes a limiting factor in further development and may even result in a stagnation if an adequate research facility is not provided. When it comes to scientific work on the high seas and far away from shore, simple boats are insufficient, and a well-equipped all-weather vessel is needed. Such vessels are usually beyond the reach of any single institution or research group owing to their higher initial costs and the complex mechanism required for their proper operation.

The following notes will deal with some of the problems that arise in the selection and financing of multipurpose research vessels in the length range between 35 and 55 meters, approximately. An attempt is made to point out the funding strategies necessary for the successful operation of such medium-size vessels, since they already are, and will be in the next decade or so, the mainstay of research in the marine areas off the coasts of many developing countries.

Although the considerations presented here are mainly based on some thirty years experience with the type selection, acquisition, operation and financial provisions of medium-size research vessels in Latin America, it is believed that they may, at least to some extent, apply to other developing countries around the world.

Before going further, one should be aware that the administration of a research vessels cannot go beyond the general administration practices prevailing in the country that owns and operates such vessel. This is to say that any deficiency or virtue of the local system will be reflected, in one way or another, in matters related to the particular craft. For this reason, the central issue of any policy must be to adapt to the prevailing conditions and obtain the best possible deal within the local framework.

Research vessels may be different in many respects, design, purpose or degree of sophistication or versatility, etc., but they have one thing in common: they must be financed, manned, maintained, supplied and operated. The way this is done is a decisive factor for the operation and the results produced by the ship. Such vessels have also a common disadvantage in relation to commercial vessels, fishing, merchant, etc., in that they are funded and operated by non-commercial organizations where a long line of committees and individuals take decisions without really having to suffer the direct impact of their acts since the yield of the enterprise can at best be measured only on a relative scale.

How to establish such a scale can of course be discussed endlessly. One way to estimate the yield would be to compare the output in the form of scientific publications, technical reports and other visible evidence per unit time and cost, before and after the ship was taken into use, as follows: before the ship started to operate we put the input and the output both equal to 1(one). Now with the new ship the output has increased by a proportion, r, and the input by a proportion, i, that is to say, the yield is now $(1 + r)/(1 + i)$; if there is a real increase in the yield, this relation must be greater than one; if not, something must be done to improve the system as soon as possible, because, later on, the situation will have changed so that such before-and-after comparison will not hold by any means.

THE SELECTION OF RESEARCH VESSELS

Many problems of funding research vessels in developing countries arise from an inadequate or even a completely wrong selection of design, arrangements, machinery, etc., so that they do not fit into the local condition with respect to maintenance, operations and effective use by the interested institutions and individual scientists. Because of such shortcomings, a degradation process starts to snow-ball which, if timely measures are not taken, may ultimately lead to a level that is below recovery, and by which the once proud ship will be reduced to a heap of rust, or a shelter for harbour bums.

This self-sustaining degradation usually takes the following pathway: after the ship is put into effective service, the original enthusiasm fades away owing to factors such as limited work capacity, lack of versatility, unconfortable and inadequate living and working conditions, etc. The dwindling interest in her use will result in lack of support needed to obtain the necessary means for the vessel's maintenance and manning with well-paid and competent officers and crew. The lack of means to operate and maintain the vessel properly will cause further deterioration which in turn reduces the interest, and so on.

The process above has many negative consequences, among which two are outstanding:

i) a valuable tool for the progress of marine research has been made useless and,

ii) the deteriorated and abandoned ship will stand as a proof of the impossibility of operating a research vessel, which in turn cuts the possibility of recovering her or of acquiring a new one, especially if this new vessel is planned to be larger and better than the former. The argument goes: look what happened to our proud little R.V. "Sea Queen" and now you are proposing a still bigger ship that doubtless will deserve the name R.V. "White Elephant".

The reasons for mistakes or shortcomings in selection are many. Sometimes an old vessel is purchased with the purpose of adapting her little by little. In most cases the deterioration described above takes over and, instead of improving, the vessel is fast becoming a candidate for the scrap-heap.

Several Latin American countries have adapted old naval vessels for marine research. Built during the 2nd World War most of these vessels had been kept in to so called "moth-ball fleet" of the United States before they were reactivated and commissioned by the national navies which, after having rendered practically impotent by long use and/or deficient maintenance, have turned them into platforms for light-gear ocanographic operations such as plankton and water sampling. Since these vessels are a part of a larger military fleet organization, they manage to survive in spite of reduced interest by the marine scientists who have to use for lack of something more adquate.

Helping in the survival of these vessels in the circumstances that naval organizations are free from such problems as labour disputes, civilian safety and classification rules, etc. Further to their favour is the fact that they are supported by a military organization and operated by trained officers and crew. Therefore, in spite of their shortcomings, the naval research vessels are operational and not directly threatened by the progressive degradation process that affects civilian vessels in these countries. Thus it would seem that the solution of the civilian vessel problem would be simply to hand them over to the military. We shall see, however, that this is an acceptable solution only in a few cases and then under some special and temporary circumstances.

One of the mistakes most commonly made is to select a vessel that is too small and inefficient for her purpose. The choice of a smaller vessel is of course very tempting because of her lower acquisition and operating costs. Belatedly, one discovers, however, that the operational costs do not grow substantially for the larger vessel while the efficiency increases almost exponentially with size and so does the interest in using her. The result is that, in spite of somewhat higher oprational costs, the larger vessel is easier to fund than her smaller counterpart. This is true up to a certain size, beyond which the ship becomes impossible to manage under the particular local conditions.

There exists, therefore, for each situation, an optimal size depending upon the conditions under which the vessel is to be operated. Since such conditions vary from one country to the other, ideal size for one country does not necessarily match with those prevailing in another country. From these experiences one arrives at the paradoxical conclusion that, in many cases, a larger vessel is easier to fund and operate than a smaller one, under the same conditions.

Now, it is often easier said than done to select the right type of vessel with the optimal size, since many countries have no choice and must accept what comes their way. This is the case of the so-called gift vessel, i.e., vessels that have been donated by some well meaning industrialized country for marine resource research in the seas near the developing countries. Generally, such vessels do not fit into the local conditions and if they do it is just a fortunate coincidence. Much to the dismay of the donating country, more often than not, such vessels are quickly drawn into the self-sustaining degradation described above.

The reasons for the problems, in this case, are many. In the first place, the ship is built to the norms and standards of the donating country, having machinery and outfitting that may be common fare in that part of the world, with some special additions, like more efficient ventilation or even air cooling. Secondly, competent scientists and technicians from neither the donating nor the receiving countries were involved in the design and outfitting of the vessel. Thirdly, the ship may not be of the optimal size to fit into the local conditions as regards use and funding. Last but not least, it could happen that the local research capacity was not sufficiently developed to take advantage of the generous donation.

THE FUNDING OF RESEARCH VESSEL OPERATIONS

In the former section we have dealt with the relation that exists between the characteristics of a research vessel and the possibilities to finance her maintenance and operation. Evidently, however, the ideal ship is also subject to financial problems and to the self-sustaining degradation should the funding fail, for whatever reason. The main causes of such an event, all equally important, are:

i) Deficient or inadequate management.

ii) Lack of capacity and/or interest in the use of the vessel on behalf of the national institutions in charge of marine exploration and research.

iii) Isolation within the national system for structural or political reasons.

iv) Inadequate national maritime traditions and capabilities.

It is a standard idea that research vessels are very expensive to maintain and operate. Obviously, the cost is neither high nor low because it is, in a sense, unique and a comparison with other enterprises is hardly possible. The main issue here is that, while the input to the research vessel operations is highly visible, the output cannot be measured on a pecuniary scale since the results are usually not immediately applicable to the economic progress of the country. In the public mind, military vessels, for example, are not so expensive, although they operate at comparatively much higher cost than, say, a medium-size civilian research vessel. This is so because military ships have been integrated into the budgetary scheme as a necessity, and care is taken, for national security reasons, not to reveal their real operational costs.

On the other hand, civilian research vessels are neophytes on the national budget and those who are in charge of distributing the public funds tend to give priorities to items that can be expected to have an immediate impact an the economic or social progress of the nation. In view of this, the funding of a research vessel should be integrated, along with other expenditures for research, into the national budget as a basic item for long-term development of the resources of the seas. To achieve this difficult goal, a broad supporting platform within the scientific, economic and political communities needs to be formed.

This platform should be backed by international organizations through moral support and technical assistance but not by direct funding of the vessel's operation and maintenance. In the case of a gift vessel, the donating country should provide support through technical assistance for the operation of the vessel and, if necessary, for the scientific use of her as well.

The national platform can, however, only stay firm and stable as long as the ship is living up to its expectations by satisfying the needs of the interested users. Should it fail, the degradation process sets in and, in order to save the ship from the ultimate consequences of this trend the solution has been in many cases to hand the responsibility for the vessel's operation to the national navy and not to some private enterprise as is now a quite common procedure in the developed countries.

As stated earlier, an operation by the navy is free of many problems that burden the civilian regime. On the other hand, this solution has serious disadvantages for the effective use of a multipurpose research vessel, among which a few may be brought out here:

i) Naval complements tend to be much inflated compared to civilian crews, with the result that the accommodation originally reserved for the research group will be partly or even totally occupied by th naval personnel.

ii) The captain, officers and other crew members under military orders are on a continuous move up the hierarchical ladder, so that, even before they have learned the special needs of the research vessel as regards maneuvering on stations, operations of special equipment, the presence and activities of the scientific group, etc., they are promoted to some higher post and must leave. Only in very few cases has a captain or an officer been able to stay in this post after promotion.

iii) The blend of civilian and military personnel on the ship tends to create problems of discipline, since the civilians feel that they should not be submitted to the orders of the military regime. There is therfore a very high demand on the skill of the cruise leader to keep a harmonious air on board, especially on long cruises with intensive and tedious activities. In countries where marine researchers have had little opportunity to work at sea, well-trained cruise leaders are few and far between.

In view of these and other arguments of a civilian research vessel to a naval regime must be considered a provisional solution to be applied only in case of emergency, and the ship should revert to civilian order as soon as the conditions for its operation and funding are again satifactory.

A common practice in many developed countries is that the different users of research vessels pay for their ship time a "pro rata" system based on the total annual cost of operation and maintenance of an individual vessel. This system has the advantage that a strong platform of supporters if formed who have vested interests in the efficient operation of the vessel and are eager to obtain funds from whatever sources to be able to reserve for themselves the ship time needed for their research projects. Another positive aspect is that the users become conscious of the real cost and problems of the vessel and consider themselves partners in the enterprise; not just passive receivers of services which in the opinion of most are never satisfactory.

Such a system is difficult to apply in developing countries for the simple reason that most marine research institutions operate on a shoe-string budget that just covers basic needs like salaries, leaving nothing for such extras as time on a sea-going research vessel. However, as the interest in marine affairs increases, more and more public and private instances are willing to finance individual projects that include the paying of ship time.

The paid ship-time also provides the possibility to make the research vessel easily available to other countries for research in their own or international waters and to international organizations for specific purposes such as training courses, co-operative research operations, etc.

No doubt, in view of its sound economic realism, flexibility and stimulation of partnership, the paid ship-time modality represents one of the most promising funding policies for research vessels in developing countries and the one that assures the widest possible platform for the successful operation of a multipurpose research vessel.

This mechanism, however, cannot be the sole source of the financing of the vessel, because, if for some reason the interest in her declines, her continuous upkeep may be at stake. A permanent funding source, covering at least 50% of the total annual cost is therefore always mandatory. The income obtained through the paid ship-time should be the complementary source, for example, through a rotating fund mechanism.

CONCLUSIONS AND RECOMMENDATIONS

When the marine research infrastructure in a developing country has reached a considerable strength in the form of manpower and means, and only then, the use and operation of a medium-size multipurpose research vessel can be expected to be successful.

Before selecting the type of vessel to be employed, a very careful and ample study of all pertinent aims and circumstances must be undertaken.

Selection mistakes may result in a self-sustaining deterioration that may ultimately render the vessel useless and block the way for further use of research vessels in the particular country.

A vessel donated to a developing country should be designed and built taking into consideration her purpose and the particular conditions under which she will be maintained and operated.

Generally, a larger vessel is easier to finance and operate than a smaller vessel. The optimal size depends on purpose and local conditions.

Only as a measure of emergency should a civilian research vessel be operated under a military regime and it should revert to civil operation as soon as the conditions become again satisfactory.

In order to secure the financial provisions for the vessel's operations, she should be firmly integrated into the national budget and a wide platform of interested users should be formed at the national level.

Donors of research vessels should provide tchnical assistance for the operation of the vessel and scientific support if needed.

International organizations should provide moral support and technical assistance but they should abstain from direct funding of the vessel's operation and upkeep.

As a complement to the permanent financial support of the vessel, the introduction of a paid-time mechanism in the form of a rotating fund is proposed.

UNDP/FAO FISHERIES VESSEL POOL

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CONTENTS

A. BACKGROUND

1. FAO had a large new building programme between 1966 and 1971 and all of the vessels were assigned to projects. However, before the last vessel was delivered, the operational results indicated a low level of utilization in most of the projects.

2. The reasons given for the poor sea-going performance were, in many cases:

   i) poor maintenance;
   ii) inadequate funding to meet the operational needs;
   iii) inflexible and complex administrative procedures, and
   iv) poor conditions of employment for local crews.

3. Inadequate insurance cover was noted in certain cases; a serious oversight in view of the risks encountered and Project Managers were at times justifiably reluctant to order vessels to sea.

4. The need to improve the situation was obvious since, in some cases, an operational project had to wait up to two years for delivery of a vessel, only to be faced with lack of funds or authority to operate it. Thus project objectives were difficult to meet and the cost effectiveness questionable.

5. UNDP (the actual owner of the vessels) and FAO met in September to analyse the problems and make recommendations. From this meeting, the UNDP/FAO "vessels pool" concept emerged, later to be incorporated in a formal agreement between UNDP and FAO.

B. THE FISHERIES VESSELS POOL AGREEMENT

6. The Fisheries Vessels Pool Agreement was signed in May 1974 (retroactive to 1 January 1973) and FAO had an inventory of 68 vessels at that time.

   i) Long-range Objectives

   To provide national, regional, inter-regional and global UNDP-assisted fisheries projects with necessary vessel services.

   ii) Immediate Objectives

      a) To establish a vessel "pool" to which vessels from terminating projects would be transferred.

      b) To make available to new fisheries projects, when needed, under the control of an international captain and/or international engineer and/or other delegated authority, the services of operational vessels and selected equipment for the required period.

      c) To continue to maintain and operate the fleet of fisheries project vessels at minimum costs consistent with operational efficiency.

7. UNDP arranged to transfer selected vessels from terminated or terminating projects to the vessels pool for management by FAO. On the other hand, FAO arranged to set up the management team provided for in the agreement and to delegate operational authority to the Fleet Manager. The vessels owned by UNDP, which, for one reason or another, could not be moved from one country to another, were placed in a different category within the vessels pool. Many of these vessels continued to serve in the countries for which they were built and eventually the titles were transferred to the governments.

8. The main difference, regarding the assignment of the pool vessels to projects, from the previous arrangement, was the setting of a "service fee" for the use of the vessel. This fee was charged against the UNDP component of the project budget and was specially developed to generate funds to cover:

   i) Maintenance
   ii) Refit
   iii) Transfer between projects
   iv) Lay up
   v) Management
   vi) Replacement of capital equipment

9. The elements of the service fees were expressed as a percentage of the current replacement value of each vessel and arrived at from experience and certain assumptions. Other operational costs, set out in para 10 below, were expressed in the same manner in order to estimate budgetary requirements. At this stage it should be mentioned that the service fee was not intended to generate sufficient funds to purchase new vessels and the significance of this will be seen later in this paper; that element referred to as "replacement of capital equipment" was meant to cover such items as winches, electronics and other machinery.

10. The responsibility for bearing the costs of the local crew, food, fuel, oil, ice, etc., lay with the government counterpart authority and standard costs were developed for inclusion in project budgets; the idea being to set the level of the "Government Cash Counterpart Contribution".

11. Insurance remained a government responsibility for the majority of vessels. Generally, however, the arrangement fell into three main categories:

   i) government self-insurance;
   ii) commercial coverage arranged and paid for by governments, and
   iii) commercial coverage arranged by FAO and paid for either by governments or FAO.

12. Therefore, with the main responsibilities defined, and the budgets established, vessels were assigned to projects under agreements signed by the participating parties.

C. SUBSTANTIVE EXPERIENCE GAINED FORM THE OPERATION OF THE VESSELS POOL SINCE 1973

13. The flexibility of the pool concept has been clearly demonstrated by the movement of vessels from one project to another or to governments and indeed some vessels have been moved on a number of occasions. To the end of 1983 a total of 40 countries was serviced; vessels were transferred on 45 occasions to and from projects and were available for service for longer periods than had previously been the case.

14. At its peak, the pool had 26 vessels, varying in size from 13 m to 46 m, from small fishing vessels to units well-equipped for research using acoustic techniques, and a further 21 small vessels were added to the general UNDP inventory. By the end of 1983, the pool consisted of 11 vessels, the other being disposed of for reasons given later under para 23.

15. Better insurance was arranged through London brokers and the market was "tested" on a regular basis to ensure that the cover was both adequate and competitive. Gradually FAO assumed responsibility for placing the insurance of all pool vessels and other vessels owned by UNDP which were built specially for projects. There are now "Trawler All Risk Clauses for FAO Fishery Survey/ Training Vessels" - one of the benefits of a fleet policy. The actual policies include:

i) All Risks Hull and Machinery
ii) War and Strikes
iii) Protection and Indemnity (Schedule I and II)
iv) Excess Liability

16. Maintenance improved, leading to a significant increase in the availability of the vessels for service. This was mainly due to speedy delivery of spare parts, better technical supervision by HQ and field staff and by making use of the "Technical Services" offered by classification societies. The best combination experienced was having an internationally recruited engineer on board, backed by visits from a surveyor from a classification society under a "Technical Services" agreement. In such cases, authority was delegated to the surveyor, since he acted as owner's representative, to take action and not only to recommend.

17. Vessels were better eqipped than before. Refitting, particularly related to electronic equipment which depreciates more rapidly than the hull and machinery, was carried out regularly and was linked to

the special survey requirements of the classification societies. Vessels were also prepared and equipped for new projects prior to transfer and often during an assignement to meet a new requirement of a project, brought about by resetting project priorities.

18. Financially, the pool was meant to be self-supporting, as set out in para 8 above, the fees being revised on the basis of experience gained to meet inflation and for the sole purpose of establishing the level of the fees, the replacement values used were never less than the insured value in any given year. In fact, the pool account balanced at the end of 1982.

19. What was more important, however, were the savings to UNDP in not having to invest in new capital equipment every time a new project document was signed, which was conservatively estimated at US$ 39 million to the end of 1983. Also of note was the fact that the previous waiting time for a vessel, the building of which could not start until a project document had been signed, was eliminated.

20. It should be noted that the use to be made of a vessel was the responsibility of the project, government or other agency to which it was assigned. Therefore, actual seatime depended to a great extent on project activities. It also depended on the ability of the responsible party to provide fuel, etc.

21. In all cases, the "vessel assignment agreement" provided for the income from sales of catch to be used wholly or in part by the government (or user) to offset its expenditures related to fuel, food, local crew, bonus payments and so on. Thus, the desire to fish commercially has been a factor in many projects. One such project struck an acceptable working balance between research and fishing (from which data were collected) and the vessel put in 272 days at sea in 12 months.

22. Nevertheless, rising costs and the general world economic climate have lead to major problems recently. There was still a need for research, development and training but less and less funding to support the activities.

D. FUTURE TRENDS

23. The benefits of having a vessels pool are undoubtedly substantial but a number of factors have forced UNDP and FAO to consider the future of the pool. Old ships are costly to run, require updating periodically and often become obsolete because the basic hull form does not allow the flexibility to warrant extensive refitting and replacement costs are high. It is interesting to note in this context that a 29 m vessel bought in 1968 cost US$ 220,000 whereas in 1983 the rebuilding cost on the same specification ranged from US$ 2,800,000 to US$ 3,400,000; in the same period the standard cost for an FAO expert doubled. Therefore, the importance of that piece of essential equipment, related to the project staff, assumes greater proportion and, as a consequence of the capital

cost, the operational costs increase. Indeed, it is often lack of due consideration to the actual costs of operation which leads to low levels of utilization and it is important to note the following:

i) a fully crewed 500 GT research vessel with scientists costs about US$ 8,500 for each day at sea if used regularly;
ii) assuming all elements of operation, including depreciation, are charged to the vessel's budget, the average annual costs vary from 30% of the replacement value of a 50 m plus research vessel to 40-45% for a 30 m vessel; smaller vessels become proportionally more expensive at up to 55% of the replacemnt value.

24. Awareness of the high capital replacemnt and operational costs caused FAO to give careful consideration to its future needs for vessels' services. It was found that to maintain the same level of services, new vessels would be needed, at a cost of US$ 14,000,000 between 1984 and 1988. The attendant operational costs, however, would have led to proportionally higher service fees, from which the capital costs of the vessel would also have to be recovered over a number of years; this was not the case when the pool was formed since UNDP transferred the vessels to the pool at no cost. Although funds might have been made available to build some vessels, long term commitments could not be made by FAO to guarantee recovery of the capital investment from service fees due to the limited resources within regional, interregional and country IPF's (indicative planning figures of the UNDP system).

25. Therefore FAO studied the alternatives to owning (through UNDP) all of the vessels in the pool and, in doing so, found that a substantial number of research vessels in the world was under-utilized for a number of reasons. From this exercise a case was put before the UNDP Governing Council in June 1982 to support a "Study on the cooperative use of vessels for fisheries research and development" and this is described in Annex 1.

26. The UNDP Governing Council agreed to this study, which had the following objectives:

i) <u>Development Objective</u>

The long term objective was to assist developing countries in the management and development of available fish resources by making available to them the services of vessels for fisheries research and development at an affordable cost under a cooperative programme.

ii) <u>Immediate Objectives</u>

To conduct a feasibility study on the cooperative use of vessels owned by governments and individuals for the benefit of developing countries either lacking or being unable to use their own resources to carry out needed research, monitoring of stocks and exploratory fishing.

27. FAO has, together with NORAD and UNDP, long experience in the use of the Norwegian flag research vessel DR. FRIDTJOF NANSEN. This vessel has been assigned at various times to UNDP-funded national and global projects under the very favourable cost sharing arrangements made by NORAD. Such arrangements have met the most exacting requirements of the cooperative use programme in that a vessel has been made available, together with scientists and crew, and all operatonal costs met by the donor agencies.

28. Suitable vessels owned by some countries have been given to projects as an "in kind" contribution and, in very special instances, UNDP has made arrangements to meet some of the operational costs of such vessels. In each case the arrangements were in the spirit of the cooperative use programme, proving, as with the DR. FRIDTJOF NANSEN, that the programme was workable.

29. FAO anticipated a reasonable reponse to the first stage of the study, which was to obtain basic technical data related to research vessels, the level of utilization and an expression of the interest of countries in participating, both as users and/or donors.

30. To date the response has been fair regarding vessel data. Little or no data were obtained on utilization but a definite expression of interest was given in many of the returned questionnaires to receive vessels' services under such a cooperative programme.

31. The author, however, remains optimistic; the trend is clear - pooling of resources is essential and the UNDP/FAO vessels pool cannot meet all of the future needs for fisheries research, development and training from its current resources. This does not mean that the pool no longer has a role in the future. The Fisheries Vessels Pool Agreement provides the mechanism through which vessels from other sources can be managed to the benefit of developing countries and, in this context, donor agencies might do well to study the cooperative use programme. One thing is clear: too many donated fisheries research vessels are under-utilized, due more to the lack of operational funds than the lack of work programmes, which should cause the donor countries to give careful consideration to their political equipment as effective aid.

32. Oceanography is no less demanding than the fisheries sector with probably more reasons for research outside exclusive economic zones. Therefore, there can be few substantial arguments against pooling vessel resources. Cooperation, whether exercised regionally, sub-regionally, between countries or within countries, could yield benefits to developing countries. The research vessels exist: the funding and means should be provided.

ANNEX 1

	منظمة الأغذية والزراعة للأمم المتحدة 联合国粮食及农业组织 FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION	COFI/83/Inf.9 July 1983

COMMITTEE ON FISHERIES (COFI)

Fifteenth Session

Rome, 10-19 October 1983

COOPERATIVE USE OF VESSELS FOR FISHERIES RESEARCH AND DEVELOPMENT

SUMMARY

With the continued development of fisheries, the need to deploy vessels in support of research, development and training has increased. However, although the number of vessels in the world dedicated to such purposes has also increased, for a variety of reasons many are not fully utilized; nevertheless, the needs have not been satisfied. The paper describes the background to a proposal for the cooperative use of vessels for fisheries research and development and reports on a feasibility study to this end being undertaken by FAO and UNDP. The long term objective of this initiative is to assist the developing countries in the management and development of their fishery resources, by making available to them the services of vessels for fisheries research and development at an affordable cost under a cooperative programme.

BACKGROUND

1. Further growth in the world catch of marine fish will depend upon the more efficient exploitation and better management of traditional species and the utilization of the more unfamiliar species, such as mesopelagic fish. Such progress will require improvement in the scientific advice provided to managers. Good advice in turn depends upon research, including the provision of statistics and other information. There is also a growing need for technical development of methods of harvesting and utilization.

2. Training of fishermen is another priority need; it includes training in new fishing techniques as well as in improved traditional methods. Many training facilities have already been established in both developed and developing countries, to cope with the demands for more and better trained fishermen, a trend which is likely to continue.

3. Research, technical development and training all require the use of sea-going facilities including vessels specially designed for the purpose.

Future needs for vessel services

4. Investigation and exploitation of the living resources in exclusive economic zones will thus add to the need for:

i) continuous monitoring of known resources

ii) identification of exploitable species within the new limits

iii) development of techniques for catching and processing new species

iv) development and demonstration of low energy consuming fishing techniques

v) training of scientists, engineers and fishermen

5. On a national basis, the need for vessels varies with the state of development of the individual fishery and of the marine and fishery science of the country concerned. Initially, the main requirement is probably to carry out surveys of the fish resources and particularly to provide information on the likely magnitude of potential yields and catch rates as a guide to investment planning. In general, the vessels required must be well equipped, fitted with acoustic survey equipment and suitable for more than one method of capture. In some cases, the survey may be carried out in a few weeks; in others, the surveys may take a year or more, depending on the area to be covered. However, in either case, there may be a need to repeat the surveys at intervals to find out possible variations with the seasons and between years, and this need is likely to be a continuing one.

6. On a regional basis, there is an opportunity for cooperation between countries and, in many instances, vessels serving neighbouring countries could be used to meet the needs of a region. However, crews and scientists of one country may not be acceptable to another; the flag of one State may not be acceptable for operation in the exclusive economic zone of another. Nevertheless, vessels capable of operating on a regional basis are now seen as an essential component of future development, research and management. Such vessels may need to stay at sea for longer periods and have a greater range of operation than would be required for many national vessels.

7. Training at sea is needed in navigation, engineering and fishing techniques. Vessels range from units for artisanal fishermen to vessels for offshore fisheries. Since training is a continuous process, even in a developed fishery, the need for training, both ashore and afloat, is likely to increase if developing countries are to exploit their exclusive economic zones effectively. Vessels especially adapted for training will be required.

8. New technology may have to be developed to exploit, not only the resources in exclusive economic zones, but also also in other areas. It is also needed to upgrade the utilization of the catches in some existing fisheries. Vessels and new equipment will be needed to develop and demonstrate new technology.

Possible sources of vessels for research and training over the next 10 years

9. Some developing countries now own their own research and/or training vessels, many of which have been provided under bilateral agreements with developed countries. In many instances, these vessels are under-utilized. This is often due to lack of experience in fleet management methods as well as to funding problems. Such vessels might be made available at low cost to suitable development projects; project funds would be used to operate and manage them for the duration of the project.

10. Most developed countries with sizeable fisheries have fleets of research vessels; from time to time, vessels too are under-utilized. Some countries have cooperated with FAO in the past by providing vessels on charter for specific surveys. Arrangements of this nature can be used to utilize nationally-owned research vessels on a regional basis.

11. Vessels can also be chartered from the commercial sector. Although the costs may be high, there is generally no need to invest in capital equipment, apart from installing special scientific instrumentation. Such chartering could be particularly useful for coastal and inshore activities.

12. Special agreements with donor governments, such as in the case of the Norwegian research vessel, DR. FRIDTJOF NANSEN, will continue to be an important method of making vessels available for resource surveys on a global or inter-regional basis. Such arrangements are subject to adequate funds being made available.

13. Although the UNDP/FAO Vessels Pool is currently able to meet some of the needs, UNDP finds it inappropriate to embark on a construction programme for new vessels. Other sources of vessels have to be found as the existing vessels come to the end of their useful working lives. The most promising arrangement for the future would appear to be cooperative use of vessels, supplemented by the UNDP/FAO Vessels Pool.

Cooperative use of vessels

14. Since many developing countries do not own their own vessels for research and training or may not have sufficient vessels to meet their needs, one possible way in the future to overcome the lack of vessels, in particular for short-term work, would be to organize cooperative use on a world-wide basis.

15. One of the main sources of vessels could be developed countries with substantial research fleets and research programmes. Although it might be assumed that most of the available time of individual vessels is needed by the flag country, past experience is that there is often surplus vessel time. Individual vessels may be available for a few months in every two years; overall, considering the number of vessels involved, the total vessel time available could be substantial.

16. Vessels owned by developing countries, many of which have been supplied under bilateral agreements in recent years, are often under-utilized. It might be a valuable part of a general programme of technical cooperation between developing countries, for one country to own and manage a well-equipped acoustic survey vessel, another to own and manage one equipped for testing different types of fishing, and another for training. The operations of these vessels could then be programmed so that they serve each country region or geographical group, according to their particular needs.

17. The use in UNDP-funded projects of vessels provided bilaterally to developing countries might be considered, provided the vessels are suitable for the work to be done. However, the organization of a cooperative programme involving their use in other countries might be a lengthy operation since the agreement of various countries to participate would be needed and it would also be necessary to initiate long-term planning on the basis of matching specific needs with the availability of vessels. Nevertheless, there would appear to be a growing number of vessels throughout the world which could be brought under the umbrella of a coordinating agency.

18. Following a discussion of this matter at the 29th Session of the UNDP Governing Council (May, 1982), UNDP and FAO have therefore agreed to carry out a feasibility study on the cooperative use of vessels owned by governments and companies for the benefit of developing countries lacking their own resources to carry out research, monitoring of stocks, exploratory fishing and training.

19. The study is now in its preliminary phase and questionnaires have already been sent to governments and individuals to:

i) gather data on vessels, in order to up-date the FAO register of research vessels

ii) obtain information on the availability of vessels

iii) determine the needs for additional vessel time and supporting services over the next 10 years

iv) obtain an expression of the interest of the countries and individuals in participating in such a cooperative programme

20. The Inter-governmental Oceanographic Commission (IOC) of UNESCO is cooperating in the first phase of the study, and the questionnaires also cover marine sciences. The data collected are to be processed by FAO; IOC will have access to the data for consideration at a workshop on the use of research vessels scheduled for early 1984.

21. It is expected that the preliminary evaluation of the questionnaires will be completed before the end of 1983. It should then be possible to determine the numbers and types of vessels technically suitable for the proposed programme, the general needs of the developing countries and the possibility of matching the needs from other sources. It is also intended to investigate how developing countries might be assisted in the management of vessels and thus obtain a higher rate of utilization.

22. The key issue most likely to emerge from the study is that of funding of vessel operations. Many developing countries might not be able to meet the operation and maintenance costs which can be considerable, varying from US$ 350,000 annually for a small vessel to over US$ 2,000,000 annually for a well-equipped and manned vessel of about 46 m. Therefore, in many cases, traditional donor agencies, both multilateral and bilateral, might contribute most valuably to the exercise through the financing of support costs rather than the supply of new vessels.

23. Should a cooperative programme prove to be feasible, it may well become possible to provide high quality services to meet the new needs of developing countries at reasonable costs. Such international collaboration might be seen as a logical element of the proposal for a special technical assistance action programme referred to in document COFI/83/12.

INTERIM RESULTS FROM FAO/IOC QUESTIONNAIRES ON RESEARCH VESSELS AND REQUIREMENTS

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CONTENTS

A. INTRODUCTION

1. At its 29th Session in May 1982, the Governing Council of the UNDP gave consideration to a proposal for the "cooperative use of vessels for fisheries research, development and training" and agreed to a feasibility study on the subject to be carried out by the FAO. The study included the collection of data on vessels, the possible free time of these vessels and the actual needs of a country for fishieries research, development and training, as well as an expression of the interest of countries to participate in a long term cooperative programme.

2. In February 1983, the IOC agreed with NORAD to hold an international "Workshop on Improved Uses of Research Vessels" to discuss, among other aspects, the operation of research vessels at a national level, particularly in developing countries and within the context of regional and subregional co-operative marine science investigations. For this purpose, the IOC required data to be collected on existing vessels engaged in marine science studies.

3. Therefore, the FAO and IOC, which are co-operating closely on matters of common interest in the framework of the Inter-Secretariat Committee on Scientific Programmes relating to Oceanography (ICSPRO), agreed on a common questionnaire as a first step in gathering the basic data for evaluation as well as, at a later date, to compile a register of research vessels. There will probably be a need to obtain further and more detailed information at a later date on some of the vessels or countries' needs arising from the outcome of the Workshop and the study.

B. LIST OF COUNTRIES BY REGIONS

4. Far East:

China; Japan; Korea, People's Democratic Republic of; Korea, Republic of.

5. Asia:

Bangladesh; Brunei; Burma; India; Indonesia; Kampuchea; Malaysia; Maldives; Pakistan; Philippines; Singapore; Sri Lanka; Thailand and Viet Nam.

6. Middle East, Turkey and North Africa:

Algeria; Bahrain; Egypt; Iran; Iraq; Israel; Jordan; Kuwait; Lebanon; Libya; Morocco; Oman; Qatar; Saudi Arabia; Syria; Tunisia; Turkey; United Arab Emirates; Yemen Arab Republic and Yemen, People's Republic of.

7. Africa:

Angola; Benin: Cameroon; Cape Verde; Comoros; Congo; Djibouti; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Ivory Coast; Kenya; Liberia; Madagascar; Mauritania; Mauritius; Mozambique; Namibia; Nigeria; Reunion; St. Helena; Sao Tome & Principe; Senegal; Seychelles; Sierra Leone; Somalia; Sudan; Tanzania; Togo and Zaire.

8. Europe:

Albania; Austria; Belgium; Bulgaria; Cyprus; Denmark; Finland; France; Germany, Democratic Republic of; Germany, Federal Republic of; Greece; Iceland; Ireland; Italy; Malta; Monaco; Netherlands; Norway; Poland; Portugal; Romania; Spain; Sweden; Switzerland; United Kingdom and Yugoslavia.

9. USSR

10. North America:

Canada and United States of America.

11. Central America and the Caribbean:

Bahamas; Barbados; Belize; Bermuda; Costa Rica; Cuba; Dominica; Dominican Republic; El Salvador; Grenada; Guatemala; Haiti; Honduras; Jamaica; Mexico; Nicaragua; Panama; Puerto Rico; St. Christopher and Nevis; St. Lucia; St. Vincent and the Grenadines and Trinidad and Tobago.

12. South America:

Argentina; Brazil; Chile; Colombia; Ecuador; Guyana; Peru; Suriname; Uruguay and Venezuela.

13. Oceania:

Australia; Fiji; Kiribati; New Zealand; Papua New Guinea; Samoa; Tonga and Vanuatu.

N.B. Subgroupings may be introduced later, such as East and West Africa, Gulf States and Arabian Sea or East and West Atlantic. Such subgroupings would be essential at an "operational" stage but are of less importance in this report.

C. QUESTIONNAIRES ON RESEARCH VESSELS AND NEEDS FOR ADDITIONAL SERVICES

14. In order to determine the present and future needs of developing countries for research vessels' services, it is important to know the numbers and types of vessels actually available, as well as the actual needs. It is also important to know the age or expected life span of the available vessel.

15. The FAO/IOC questionnaires (attached as Annex 1 and Annex 2) sought to identify vessels by length, power, age and principal use and, at the same time, to obtain information on whether or not suitable vessels could be released by their owners for work elsewhere.

16. The response to the questionnaires has been reasonably favourable from the point of view of collecting technical data; less favourable in identifying a suitable number of vessels available for use by other than the owner, and has highlighted the needs of a number of countries for additional research vessels' services.

17. However, many of the questionnaires have yet to be returned and, for this reason, the attached tables reflect the data collected to the end of April 1984. Eventually, after a reasonable cut off date, the data from the questionnaires will be entered into a computer programme designed by FAO. This will form the basis for an update of the research vessels of the world record.

18. As a second stage activity, further information will be requested from owners of suitable vessels, donors and governments with pressing needs.

19. FAO will also report to UNDP on the result of the "Study on the Cooperative Use of Vessels for Fisheries Research, Development and Training" (INT/82/701), which is described in the paper by John Fitzpatrick "UNDP/FAO Fisheries Vessels Pool".

20. The actual number of research vessels in the world is certainly greater than the numbers listed in Table 1. Many returns have yet to be received, some of which should come from countries known to have research vessels.

21. Comments on the availability of vessels for service elsewhere have been cautious but in some cases the owners would invite requests from foreign governments. One country noted that funding of such an exercise would be the most important factor.

22. Although the requirements for additional assistance would appear to be greater than the available services, it is too early to draw conclusions. This is partly due to some of the potential donors wishing to discuss the needs of others directly and, in some cases, there is obviously a reluctance on the part of the authority which submitted the questionnaire to make what might be seen as a commitment. Nevertheless, the Workshop should attempt to obtain a consensus of opinion in relation to the cooperative use of research vessels.

TABLE 1

REGIONAL DISTRIBUTION OF RESEARCH VESSELS

REGION	15 m - 24 m			25 m - 34 m			35 m - >			Region Total	REMARKS
	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries		
Far East	1	2	-	8	-	-	3	4	-	18	
Asia	1	9	5	-	5	12	5	4	5	46	
Middle East	1	3	4	2	7	5	2	1	1	26	
Africa	2	5	1	-	3	6	-	2	1	20	
Europe	9	12	2	4	11	2	26	30	2	98	
USSR	-	-	-	-	-	-	41	20	-	61	
North America	-	-	-	1	-	-	6	1	-	8	
Central America	-	2	13	-	1	1	3	2	1	23	
South America	1	5	2	-	2	6	3	1	4	24	
Oceania	2	1	8	1	-	2	2	2	-	18	
UNDP/FAO	-	-	5	-	-	4	-	-	1	10	
World Total	17	39	40	16	29	38	91	67	15	352	

TABLE 1
ADDENDUM 1

REGIONAL DISTRIBUTION OF RESEARCH VESSELS FROM DATA COLLECTED BY QUESTIONNAIRE AND OTHER SOURCES

REGION	15 m - 24 m			25 m - 34 m			35 m			Region Total	REMARKS
	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries		
Far East	3	1	-	9	-	23	22	1	27	86	
Asia	4	7	5	9	4	14	15 *	3	6	67	* 1 - Seismographic
Middle East	7	2	4	2	4	8	7 *	1	-	35	* 1 - Seismographic
Africa	4	5	2	1	1	6	-	1	-	20	
Europe	13	10	5	24	7	13	98 *	9	24	203	* 19 - Seismographic
USSR	-	-	-	10	-	-	119	21	15	165	
North America	2	-	3	24 1/	-	10	75 2/	-	12	126	1/ - 6 - Seismographic 2/ - 17 - Seismographic
Central America	-	2	14	8 3/	1	1	31 4/	2	4	63	3/ - 2 - Seismographic 4/ - 5 - Seismographic
South America	1	5	2	-	2	7	7	3	4	31	
Oceania	3	2	13	1 *	-	2	4	4	1	30	* 1 - Seismographic
UNDP/FAO	-	-	5	-	-	4	-	-	1	10	
World Total	37	34	53	88	19	88	378	45	94	836	

Note: The purpose of this addendum is to set out the regional distribution of research vessels from data collected from various sources. Such vessels included cover various aspects of research, i.e., oceanography, fisheries, marine surveys, geology and geophysics.

TABLE 2

REGIONAL DISTRIBUTION OF RESEARCH VESSELS AVAILABLE FOR DEPLOYMENT ELSEWHERE

REGION	15 m - 24 m			25 m - 34 m			35 m - >			Region Total	REMARKS
	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries		
Far East	-	-	-	-	-	-	-	-	-	-	
Asia	-	1	3	-	2	-	-	3	1	10	
Middle East	4	-	-	-	-	-	-	1	-	5	
Africa	-	-	-	-	1	-	-	-	-	1	
Europe	2	-	-	-	1	-	9	1	-	13	
USSR	-	-	-	-	-	-	-	-	-	-	
North America	-	-	-	-	-	-	-	-	-	-	
Central America	-	-	-	-	-	-	-	-	-	-	
South America	1	1	-	-	-	-	-	1	-	3	
Oceania	-	-	-	-	-	-	1	-	-	1	
UNDP/FAO	-	-	5	-	-	4	-	-	1	10	
World Total	7	2	8	-	4	4	10	6	2	43	

TABLE 3

REGIONAL DISTRIBUTION OF RESEARCH VESSELS UNDER CONSTRUCTION OR PLANNED FOR CONSTRUCTION

REGION	15 m - 24 m			25 m - 34 m			35 m ->			Region Total	REMARKS
	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries		
Far East	-	-	-	-	-	-	-	1	-	1	
Asia	-	-	-	1	-	1	1	-	-	3	
Middle East	-	-	-	-	-	-	-	2	-	2	
Africa	-	-	-	-	-	-	-				
Europe	-	2	-	-	4	-	-	1	-	7	
USSR	-	-	-	-	-	-	3	-	-	3	
North America	-	-	-	-	-	-	-	-	-	-	
Central America	-	-	-	-	-	-	-	-	-	-	
South America	-	-	-	-	-	3	-	-	-	3	
Oceania	-	-	-	-	-	-	-	-	-	-	
UNDP/FAO	-	-	-	-	-	-	-	-	-	-	
World Total	-	2	-	1	4	4	4	4	-	19	

TABLE 4

REGIONAL DISTRIBUTION OF RESEARCH VESSELS LESS THAN 15 YEARS OLD

REGION	15 m - 24 m			25 m - 34 m			35 m - >			Region Total	REMARKS
	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries	Oceano-graphy	Combined	Fisheries		
Far East	-	1	4	-	-	1	-	3	7	16	
Asia	1	5	5	-	5	6	2	4	2	30	
Middle East	1	2	2	-	4	1	2	2	1	15.	
Africa	-	5	2	-	2	1	-	2	1	13	
Europe	11	11	-	-	3	7	16	23	-	71	
USSR	-	-	-	-	-	-	27	18	-	45	
North America	-	-	-	-	-	-	4	1	-	5	
Central America	-	5	4	-	1	1	-	1	-	12	
South America	-	4	-	-	-	-	1	6		11	
Oceania	1	2	7	1	1	-	2	1	-	15	
UNDP/FAO	-	-	1	-	-	2	-	-	1	4	
World Total	14	35	25	1	16	19	54	61	12	237	

TABLE 5

REGIONAL DISTRIBUTION OF REQUESTS FOR ADDITIONAL RESEARCH VESSELS' SERVICES

REGION	Short Term		Long Term		Region Totals	Number of countries within regions making requests	REMARKS
	Near Shore	Off Shore	Near Shore	Off Shore			
Far East	3	1	2	2	8	4	
Asia	5	6	7	5	23	8	
Middle East	6	5	3	2	16	7	
Africa	9	10	9	9	37	12	
Europe	3	4	2	2	11	5	
USSR	-	-	-	-	-	-	
North America	1	1	1	1	4	1	
Central America	8	9	7	7	31	9	
South America	5	6	2	3	16	7	
Oceania	4	6	4	5	19	6	
World Total	44	48	37	36	165	59	

TABLE [illegible]

Sheet No. 1

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m - >			REMARKS
	Oceano-graphy	Com-bined	Fishe-ries	Oceano-graphy	Com-bined	Fishe-ries	Oceano-graphy	Com-bined	Fishe-ries	
Albania	-	-	-	-	-	-	-	-	-	
Algeria	-	-	-	-	1	-	-	-	-	x
Angola	-	-	-	-	-	-	-	1	-	
Argentina	-	1	-	-	-	-	2	-	3	x
Austria	-	-	-	-	-	-	-	-	-	
Australia	2	1	2	1	-	1	2	1	-	x
Bahamas	-	-	-	-	-	-	-	-	-	
Bahrain	-	-	-	-	-	1	-	-	-	
Bangladesh	-	-	1	-	-	1	-	-	-	x
Barbados	-	-	-	-	-	-	-	-	-	x
Belgium	-	-	-	-	-	-	-	1	-	x
Belize	-	-	-	-	-	-	-	-	-	
Benin	-	-	-	-	-	-	-	-	-	
Bermuda	-	-	-	-	-	-	-	-	-	
Brazil	-	1	-	-	2	3	-	-	-	x
Brunei	-	1	-	-	-	-	-	-	-	x
Bulgaria	-	-	-	-	-	-	-	-	-	
Burma	-	-	-	-	-	-	-	-	1	
Burundi	-	-	-	-	-	-	-	-	-	x
Cameroon	-	-	-	-	-	-	-	-	-	x
Canada										
Cape Verde	-	-	-	-	-	1	-	-	-	
Chile	1	1	1	-	-	1	1	-	1	x

x = Questionnaire received

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m - >			REMARKS
	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	
China										
Colombia	-	-	-	-	-	-	-	-	-	x
Comoros	-	-	-	-	-	-	-	-	-	
Congo	-	-	1	-	-	1	-	-	-	
Costa Rica	-	-	-	-	-	-	-	-	-	x
Cuba	-	-	-	-	-	-	-	-	1	
Cyprus	-	1	-	-	-	-	-	-	-	x
Denmark	-	-	-	-	-	-	1	-	-	
Djibouti	-	-	-	-	-	-	-	-	-	
Dominica	-	-	-	-	-	-	-	-	-	
Dominican Republic	-	-	-	-	-	-	-	-	-	
Ecuador	-	-	-	-	-	1	-	-	-	
Egypt	-	-	-	-	-	-	-	-	-	
El Salvador										
Ethiopia	-	-	-	-	-	-	-	-	-	x
Fiji	-	-	2	-	-	-	-	-	-	x
Finland	-	-	-	-	-	-	-	-	-	
France	-	1	1	-	1	-	5	8	1	x
Gabon	-	-	-	-	-	-	-	-	-	x
Gambia	-	-	-	-	-	-	-	-	-	
Germany (DR)	-	-	-	-	-	-	2	-	-	x
Germany (FR)	-	-	-	1	3	-	6	3	-	x
Ghana	-	-	-	-	1	-	-	-	-	x

x = Questionnai received

TABLE 6

Sheet No. 3

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m - >			REMARKS
	Oceano-graphy	Com-bined	Fishe-ries	Oceano-graphy	Com-bined	Fishe-ries	Oceano-graphy	Com-bined	Fishe-ries	
Greece	-	-	-	-	-	-	-	-	-	
Grenada	-	-	-	-	-	-	-	-	-	
Guatemala	-	-	-	-	-	-	-	-	-	x
Guinea	-	-	-	-	-	-	-	-	-	
Guinea-Bissau	-	-	-	-	-	-	-	-	-	x
Guyana	-	-	1	-	-	-	-	-	-	x
Haiti	-	-	-	-	-	-	-	-	-	
Honduras	-	1	-	-	-	-	-	-	-	x
Iceland	-	-	-	-	-	1	-	3	-	x
India	-	-	-	-	-	6	2	-	-	x
Indonesia	-	-	2	-	-	1	1	-	2	x
Iran	-	-	2	1	-	2	-	-	-	x
Iraq	-	-	-	-	-	-	-	-	-	
Ireland	-	-	-	-	-	-	-	-	-	
Israel	-	-	-	1	-	-	-	-	-	x
Italy	1	1	-	-	1	-	2	-	-	x
Ivory Coast	-	-	-	-	-	1	-	-	-	
Jamaica	-	-	-	-	-	-	-	-	-	
Japan	-	1	-	-	-	-	1	3	-	x
Jordan	-	-	-	-	-	-	-	-	-	x
Kampuchea	-	-	-	-	-	-	-	-	-	
Kenya	-	2	-	-	-	-	-	-	1	x

x = Questionnaire received

TABLE 6

Sheet No. 4

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m -			REMARKS
	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	
Kiribati	-	-	1	-	-	-	-	-	-	x
Korea (North)	-	-	-	-	-	-	-	-	-	
Korea (South)	1	-	-	8	-	-	1	-	-	x
Kuwait	-	-	-	-	-	1	-	-	-	x
Lebanon	-	-	-	-	-	-	-	-	-	
Liberia	-	-	-	-	-	-	-	-	-	
Libya	-	-	-	-	2	-	-	-	-	x
Macau	-	-	-	-	-	-	-	-	-	
Madagascar	1	1	-	-	-	-	-	-	-	x
Malaysia	-	-	-	-	1	-	-	-	-	x
Maldives	-	-	-	-	-	-	-	-	-	
Malta	-	-	-	-	-	1	-	-	-	
Mauritania	-	1	-	-	1	-	-	-	-	x
Mauritius	-	1	-	-	-	1	-	-	-	x
Mexico	-	-	13	-	1	1	3	2	-	x
Monaco	-	-	-	-	-	-	-	-	-	
Morocco	-	-	-	-	-	-	-	-	1	x
Mozambique	-	-	-	-	-	-	-	-	-	
Namibia	-	-	-	-	-	-	-	-	-	
Netherlands	-	1	-	1	1	-	9	-	-	x
New Zealand	-	-	-	-	-	1	-	1	-	x
Nicaragua	-	1	-	-	1	-	-	1	-	x
Nigeria	-	1	-	-	1	-	-	1	-	x

x = Questionnaire received

TABLE 6

Sheet No. 5

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m - >			REMARKS
	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	
Norway	1	-	-	-	-	-	-	6	-	x
Oman	-	-	-	-	-	-	-	-	-	
Pakistan	-	-	-	-	1	1	1	-	-	x
Panama	-	-	-	-	-	-	-	-	-	x
Papua New Guinea	-	-	2	-	-	-	-	-	-	
Peru	-	2	-	-	-	1	-	1	-	x
Philippines	-	-	1	-	-	3	1	2	2	x
Poland	-	-	-	-	-	-	-	1	-	x
Puerto Rico	-	-	-	-	-	-	-	-	-	
Portugal	3	2	-	2	1	-	1	1	-	x
Qatar	-	-	-	-	1	-	-	-	-	x
Reunion	-	-	-	-	-	-	-	-	-	
Romania	-	-	-	-	-	-	-	-	-	
St. Christopher & Nevis	-	-	-	-	-	-	-	-	-	
St. Helena	-	-	-	-	-	-	-	-	-	
St. Lucia	-	-	-	-	-	-	-	-	-	x
St. Vincent and the Grenadines	-	-	-	-	-	-	-	-	-	
Samoa	-	-	1	-	-	-	-	-	-	x
Sao Tome & Principe	-	-	-	-	-	-	-	-	-	
Saudia Arabia	-	-	1	-	-	-	-	-	-	
Senegal	-	-	-	-	-	1	-	-	-	
Seychelles	-	-	-	-	-	-	-	-	-	x
Sierra Leone	-	-	-	-	-	1	-	-	-	x

x = Questionnaire

TABLE 6

Sheet No. 6

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m - >			REMARKS
	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	
Singapore	-	-	-	-	-	-	-	-	-	
Somalia	-	-	-	-	-	-	-	-	-	x
Spain	2	2	-	-	-	-	-	1	-	x
Sri Lanka	-	-	-	-	-	-	-	-	-	x
Sudan	-	-	-	-	-	-	-	-	-	
Suriname	-	-	-	-	-	-	-	-	-	
Sweden	2	-	-	-	1	-	-	-	-	x
Switzerland	-	-	-	-	-	-	-	-	-	
Syria	-	-	-	-	-	-	-	-	-	
Tanzania	1	-	-	-	-	1	-	-	-	x
Thailand	1	7	1	-	3	-	-	1	-	x
Togo	-	-	-	-	-	-	-	-	-	x
Tonga	-	-	-	-	-	-	-	-	-	x
Trinidad & Tobago	-	1	-	-	-	-	-	-	-	x
Tunisia	-	1	-	-	-	1	-	-	-	x
Turkey	1	2	-	-	2	-	2	1	-	x
United Arab Emirates	-	-	-	-	1	-	-	-	-	x
UK	-	4	1	-	3	-	-	6	1	x
USA	-	-	-	1	-	-	6	1	-	x
USSR	-	-	-	-	-	-	41	20	-	x
Uruguay	-	-	-	-	-	-	-	-	-	x
Vanautu	-	-	-	-	-	-	-	-	-	

x = Questionnaire received

TABLE 6

Sheet No. 7

DISTRIBUTION OF RESEARCH VESSELS BY COUNTRY

COUNTRY	15 m - 24 m			25 m - 34 m			35 m ->			REMARKS
	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	Oceanography	Combined	Fisheries	
Venezuela	-	-	-	-	-	-	-	-	-	
Viet Nam	-	1	-	-	-	-	-	1	-	x
Yemen Arab Rep.	-	-	-	-	-	-	-	-	-	
Yemen, PDR.	-	-	1	-	-	-	-	-	-	
Yugoslavia	-	-	-	-	-	-	-	-	-	
Zaire	-	-	-	-	-	-	-	-	-	

x = Questionnaire

DISTRIBUTION OF REQUESTS FOR ADDITIONAL RESEARCH VESSELS' SERVICES BY COUNTRY

TABLE 7

Sheet No. 1

COUNTRY	Short Term		Long Term		REMARKS
	Near Shore	Off Shore	Near Shore	Off Shore	
Argentina		x		x	
Australia	x	x	x	x	Tasmania
Bangladesh	x	x	x	x	
Barbados	x	x	x	x	also training
Brazil			x	x	
Brunei		x			
Burundi	x	x	x	x	also protection
Chile	x	x			
Colombia	x	x			
Costa Rica	x	x			also training and protection
Ethiopia	x	x	x	x	
Fiji	x	x			also training
Gabon		x	x	x	
Ghana	x	x			
Guatemala	x	x	x	x	also training and protection
Guinea-Bissau	x	x	x	x	
Guyana	x	x	x	x	
Honduras	x	x	x	x	also training and protection
Indonesia	x	x	x	x	
Iran	x				
Italy	x	x			Fano Laboratory
Japan	x	x	x	x	-
Jordan	x	x	x		
Kenya	x		x	x	

COUNTRY	Short Term		Long Term		REMARKS
	Near Shore	Off Shore	Near Shore	Off Shore	
Kiribati	x	x	x	x	also training and protect
Korea (South)	x				
Madagascar	x	x	x	x	
Malaysia		x	x	x	
Mauritania	x		x		
Mauritius		x		x	also protection
Mexico		x			
Morocco	x	x			
Netherlands			x		
Nicaragua	x	x	x	x	
Nigeria		x			very short cruises require
Pakistan	x		x	x	
Panama	x		x		
Peru	x	x			
Philippines	x	x	x		also protection
Portugal		x		x	Hydrographic Institute
Qatar	x	x			
St. Christopher & Nevis	x	x	x	x	also protection
St. Lucia	x	x	x	x	also training and protecti
Samoa		x		x	also training
Seychelles	x	x	x	x	
Sri Lanka	x	x	x	x	
Sweden	x	x			
Tonga	x	x	x	x	also training and protectic
Trinidad & Tobago	x	x	x	x	also training and protectio

DISTRIBUTION OF REQUESTS FOR ADDITIONAL RESEARCH VESSELS' SERVICES BY COUNTRY

TABLE 7

Sheet No.3

COUNTRY	Short Term		Long Term		REMARKS
	Near Shore	Off Shore	Near Shore	Off Shore	
Tunisia	x	x	x	x	
Turkey	x	x			
United Arab Emirates			x	x	
UK	x	x	x	x	Natural Environment Research Council
Viet Nam			x		Oceanography only

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Leave Blank

QUESTIONNAIRE ON RESEARCH, DEVELOPMENT AND TRAINING VESSELS

BASIC INSTRUCTIONS FOR COMPLETING THE QUESTIONNAIRE. Fill in one form for each vessel over 15 m in length OA

(i) **Planned Vessel** is a vessel under construction for delivery within 3 years.

(ii) **No Vessel:** If the country has no research, development or training vessel cross the appropriate box, complete 0111 and 0112 and return the questionnaire as indicated below.

(iii) 0111 **Area** means geographical area in which the country is located.

(iv) If other units than indicated are used they must be clearly stated (e.g. if feet instead of metres are used delete the " m " and put " ft " instead).

(v) Boxes to be crossed where appropriate.

(vi) If data not available leave the appropriate line blank. If the item does not exist on the vessel (e.g. Ballast Water) delete the item. This does not apply to items provided with boxes.

(vii) **09 Past years** mean calendar years preceding the date of completion of the questionnaire.
Next years mean calendar years immediately following the date of completion of the questionnaire.

☐ Existing Vessel ☐ Planned Vessel ☐ No Vessel

Origin
- 11 Area . . . .
- 12 Country . . . .
- 13 Owner . . . .
- 14 Operator . . . .
- 15 Funding Agency (if different from 13 or 14) . . . .
- 16 Vessel's Name . . . .
- 17 Where Built . . . .
- 18 Year Built . . . .

02 Main Dimensions
- 11 Length OA . . . . m
- 12 Length BP . . . . m
- 13 Breadth . . . . m
- 14 Depth MLD . . . . m
- 15 Max. Draft . . . . m

03 Capacities and Areas
- 11 Gross Tonnage . . . . GRT
- 12 Hold No. 1 . . . . m^3
- 13 Hold No. 2 . . . . m^3
- 14 Fuel . . . . m^3
- 15 Fresh Water . . . . m^3
- 16 Ballast Water . . . . m^3
- 17 Laboratories, Total Area . . . . m^2

04 Range and Speed
- 11 Cruising Range . . . . n mi
- 12 Cruising Speed . . . . kn

05 Accommodation
- 11 Officers . . . .
- 12 Crew . . . .
- 13 Scientists . . . .
- 14 Trainees . . . .

06 Design Particulars

10 Hull Materials
- 11 ☐ Wood
- 12 ☐ Steel
- 13 ☐ FRP
- 14 ☐ Aluminium

20 Energy Sources
- 21 Main Engine Type . . . .
- 22 Main Engine Power . . . . kW
- 23 Propeller . . . . rpm
- 24 Generating Sets . . . . Total kW
- 25 Total Electrical Power . . . . (AC) kVA
- . . . . (DC) kW

30 Storage
- 31 ☐ Fish in Bulk
- 32 ☐ Boxed Fish on Ice
- 33 ☐ Chilled Sea Water
- 34 ☐ Refrigerated Sea Water
- 35 ☐ Freezing
- 36 ☐ Water Samples
- 37 ☐ Geological Samples
- 38 ☐ Biological Samples
- 39 ☐ Space for Portable Instruments

40 Special Fittings
- 41 ☐ C.P. Propeller
- 42 ☐ Side Thruster
- 43 ☐ Propeller Nozzle

07 Fixed Equipment

10 Navigational
- 11 ☐ Radar
- 12 ☐ Loran
- 13 ☐ Decca
- 14 ☐ Omega
- 15 ☐ Satellite Nav. System
- 16 ☐ Facsimile Receiver
- 17 ☐ Gyrocompass

20 Echosounders/Sonars
- 21 ☐ Echosounders for Fishing
- 22 ☐ Echosounders for Scientific Research
- 23 ☐ Echointegrator
- 24 ☐ Sonar
- 25 ☐ Netsonde
- 26 ☐ Pinger

30 Deck
- 31 ☐ Trawl Winch
- 32 ☐ Seine Winch
- 33 ☐ Power Block
- 34 ☐ Net Drum
- 35 ☐ Line Hauler
- 36 ☐ Gillnet Hauler

40 Oceanographic Equipment
- 41 ☐ Oceanographic Winch
- 42 ☐ Winch for Bottom Sampling
- 43 ☐ Seismic Winch
- 44 ☐ Gantry
- 45 ☐ Cranes
- 46 ☐ Other Winches for instruments or sampling

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50 Electronic Data Processing

☐ Available on Board

Comments on other Data such as Portable Scientific Equipment:

30 Marine Sciences

31 ☐ Physical Oceanography
32 ☐ Chemical Oceanography
33 ☐ Biological Oceanography
34 ☐ Meteorology
35 ☐ Geology
36 ☐ Geophysics
37 ☐ Pollution

08 Use of Vessel

10 Fishing Methods

11 ☐ Trawling
12 ☐ Seining
13 ☐ Gillnetting
14 ☐ Trolling
15 ☐ Handlining
16 ☐ Longlining
17 ☐ Pole and Line
18 ☐ Pots and Traps

20 Fisheries Research, Development and Training

21 ☐ Fishery Research
22 ☐ Exploratory Fishing
23 ☐ Experimental Fishing
24 ☐ Fisheries Training
25 ☐ Fisheries Protection

09 Vessels Activities

10 For the past 2 years

11 No. of Cruises . . . .
12 Overall Seatime . . . . Days

20 Planned for the next 2 years

21 No. of Cruises . . . .
22 Overall Seatime . . . . Days

30 Presumable availability of vessel for deployment elsewhere

31 Over the next 2 years . . . . Months . . . Days
32 Over the next 3 years following 0931 . . Months . . . Days

Other comments:

Date:	Completing Body or Institution and Address

After completion, please return form(s) to the address below and keep a copy for your own record.

Fleet Manager
Fisheries Department
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla
00100 Rome, Italy

Annex 2

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Leave Blank

QUESTIONNAIRE ON COUNTRY'S NEEDS IN RESEARCH, DEVELOPMENT AND TRAINING FOR WHICH ADDITIONAL VESSEL SERVICES ARE REQUIRED

Basic instructions for completing the questionnaire. This form is to be completed once *only* even if questionnaires have been completed for more than one vessel.

(i) **1111 Area** - means geographical area in which country is located.
(ii) **12 Next 5 years** - means calendar years immediately following the date of completion of the questionnaire.
(iii) **Short Term** - means vessel's availability for cruises over a period of 1 to 3 months duration (cross the appropriate boxes).
(iv) **Long Term** - means vessel's availability for cruises over a period of 6 to 12 months duration (cross the appropriate boxes).
(v) **Near Shore** - means cruises within 12 n mi distance from the shore and up to about 60 n mi from shelter (port, safe anchorage, etc.) (cross the appropriate boxes).

11 Origin

11 Area
12 Country
13 Institution and Address

12 Needs for the next 5 years

	Short Term Needs: Near Shore	Short Term Needs: Off Shore	Long Term Needs: Near Shore	Long Term Needs: Off Shore	
	1	2	3	4	
1	☐	☐	☐	☐	— Fishery Research
2	☐	☐	☐	☐	— Exploratory Fishing
1	☐	☐	☐	☐	— Experimental Fishing
4	☐	☐	☐	☐	— Oceanographic Observation (incl. Oceanographic Biology)
5	☐	☐	☐	☐	— Meteorological Observation
6	☐	☐	☐	☐	— Fisheries Training
7	☐	☐	☐	☐	— Fisheries Protection

13 Proposed type of vessel services required (*if available* from elsewhere)

11 ☐ Vessel with Equipment, Crew, Cruise Director, Scientists and/or Experts
12 ☐ Vessel with Equipment and Crew but Cruise Director, Scientists and/or Experts from own country
13 Does the country have back-up facilities to evaluate data collected?

☐ Yes ☐ No

Other comments:

Date:	Completing Body or Institution and Address

After completion, please return this *form to the address* below and keep one copy for your own record

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Fisheries Department
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla
00100 Roma, Italy

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No.	Title	Publishing Body	Languages
32 Suppl.	Papers submitted to the UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime Paris, 27 September-1 October 1982	IOC, Unesco Place de Fontenoy Paris, France	English
33	Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR) Halifax, 26-30 September 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
34	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa) Tenerife, 12-17 December 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish

No.	Title	Publishing Body	Languages
35	CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific Suva, Fiji, 3-7 October 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36	IOC/FAO Workshop on the Improved Uses of Research Vessels Lisbon, 28 May - 2 June 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36 Suppl.	Papers submitted to the IOC-FAO Workshop on Improved Uses of Research Vessels	IOC, Unesco Place de Fontenoy 75700 Paris, France	English