AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT

RESEARCH INSTITUTE FOR MARINE FISHERIES

ORSTOM

COMMISSION OF THE EUROPEAN COMMUNITIES

JAVA SEA PELAGIC FISHERY ASSESSMENT PROJECT (ALA/INS/87/17)

FINAL REPORT

DURAND J.R. and WIDODO J.

Scientific and Technical Document No. 26
January 1997

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CONTENTS

Executive summary

NB : This PELFISH Final Report gives the main results, conclusions and recommendations. It is not a publication, and one will find in PELFISH publications and reports all relevant informations and data (Annex 5). After a general presentation of background and objectives (sections 1 and 2), we give the main results obtained in every field (3 to 5) and a synthesis approach (6). Conclusions and recommendations are presented in sections 7 and 8. The report ends with administrative sections on PELFISH organization, budget and staff (9 and 10). The handing over note between AARD and European Representation is given in Annex 1.

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1. PELFISH began in January 1991 and ended on 30 of June 1996 after an extension phase of eighteen months. The project was sponsored by C.E.C. DG 1 and implemented by AARD/RIMF for GOI and ORSTOM for France. The total budget amounted to 5.6 millions ECU with a 2.628.000 ECU grant from C.E.C. (equipment, technical assistance and general functioning), 1.902.000 ECU from ORSTOM (direction, scientific and technical assistance) and 1.000.000 ECU from AARD, mainly in kind.

2. The **overall objective** of PELFISH was to promote higher productivity and sustainable development of the offshore purse seine fishery for small pelagic fish in Java Sea. It included the provision of scientific advice on the management of this fishery; the improvement of the performance of this fishing system in terms of catch, conservation and distribution; the evaluation of the socio-economic impact of potential management measures and technical improvement; the enhancement of fishermen's income.

3. In order to launch a management scheme for offshore purse seine fishery in Java Sea, one have to understand **the functioning of the whole system** at the scale of the pelagic stocks, including their environment and their exploitation. The collection of data in nearly all relevant fields allows us to build a first synthesis of the system which will be the necessary frame/basis for management.

The system main features are :

- A **spatial extension** which is **much more eastwards** than thought at first. The influence of oceanic waters through the wide and deep eastern opening is much more important than exchanges with South China Sea.
- Two main types of **bioecological safeguards** : on the one hand, we have a combination of different life cycles and the vulnerability is only partial owing to repartition in coastal waters and also in eastern ones; on the other hand, the biomass is scattered and fish overdispersed which means a bioecological constraint limiting fishing effort.

The present **state of exploitation** is characterized by :

- maximum extension of fishing grounds with the present type of seiners;
- stagnation of the total catch for the past four years;

- stagnation or decrease in catch per unit effort implying that the total fishing effort has been increasing and/or the abundance has been depleting;
- possible decreasing tendency on the average length of the catch of the dominant species;
- this implies that the fishery is on the verge of an exploitation crisis - rather economical than biological - and that the management issue has to be faced very urgently.

The main **socioeconomic issues** are :

- the demand is not a limiting constraint at present and the fish prices seem to be still attractive;
- the turn-over rate for fishing companies investments is still high, but margins are narrowing;
- total employment is still high but some companies meet difficulties in recruiting fishermen whose standards of living are not satisfactory;
- the lack of credit facilities is a critical point as well for traders (short term and overdraft) as for owners (investment credit).

The **quality of these cheap fish products** offered for human consumption in Indonesia is not satisfactory. The authorities have to escape from the vicious circle, where fish remain relatively cheap, but do not satisfy the sanitation standards. In this matter, it is easy to improve quickly the quality by using simple solutions : ice crushers, better hold insulation, cleaning of baskets, quality of water, ...

4. The **resources management issue** has to be faced very urgently now.

- At present, the situation seems quite good with high catches, strong activities in post harvest, numerous employments for fishermen and good payback for owners. Nevertheless, a more detailed look at recent data is not so optimistic and, there should be more difficulties in the coming years. Even if the main problem is not biological surexploitation, a socioeconomic crisis is foreseeable.

From 1980, the resources management has been quite unobtrusive except for regulations on mesh size and distance from coast zonation. It did not matter so much during the development phase, as long as the stocks were reacting positively. At present, the concentration of the fleet in fewer hands is the probable scenario for the future. Would the authorities stop this evolution that they should strengthen the regulations and implement the law enforcement.

- From the knowledge accumulated on this fishery, the management issue seems relatively clear, at least if we stay with the same technological context and "natural" existing limitations on fishing effort. In order to deal with these natural constraints as well as for management purposes, it would seem sensible to limit the size of seiners. A maximum length of around 30 meters - that is to say about 120 tons - or even less, would be suitable.

- The fish quality will be a problem owing to the duration of the cruises, the poor handling on board, the use of polluted water in harbours and the waiting of seiners in Pekalongan and Juwana for several days before landing.

- In brief, the current dynamics remains precarious and has to be accompanied by an ambitious management policy, not only for regulating, but also for taking measures of educative, technical and financial support.

5. The management perspectives focus on small pelagic fisheries at first, but they could include later other on fishery resources. They present two main axis :

The first is more upstream and orientated towards research and some technical aspects under the general title «Towards systemic approaches of fisheries in Indonesia based upon Java Sea models». Here the two partners are AARD and ORSTOM and the corresponding agreements have already been signed between the two institutes for a two years period. The global objectives are oriented towards finalization, valorization, dissemination and transfer of PELFISH results and data along with the continuation of specific programs such as stocks extension, fish growth, fishing effort evaluation, ...

The second, whose provisional title is «PELFISH Extension Project» deals more directly with fishery management and related issues. It would involve both public administration and private operators.Training and transfer should be the main activities more specially in such fields as statistical data, fish quality, technological innovation. Prior to the implementation of the project itself, an exercise on control and survey should be performed and a workshop / brainstorming on management organized in order to give a better frame to the extension. The leading partners should be AARD, RIMF and Directorate General for Fisheries. In relation with the previous PELFISH project the main fundings could be asked first to European Union General Directorate I (DG I) and other international funding bodies.

These two sets of activities should be harmonized in order to get the best synergy, as many fields are adjacent or partly overlapping.

Ringkasan

Catatan : Laporan akhir PELFISH ini menyajikan beberapa hasil yang dianggap penting, selain beberapa kesimpulan dan sejumlah rekomendasi. Laporan ini bukan suatu publikasi, sebab semua informasi dan data yang berkaitan dapat dijumpai dalam sejumlah publikasi dan laporan PELFISH (Lampiran 5). Sesudah suatu penyajian latar belakang dan tujuan secara umum (seksi 1 dan 2), disajikan pula sejumlah hasil penting dari setiap bidang (3 s/d 5) kemudian diikuti suatu sintesis dari semuanya. Kesimpulan dan rekomendasi disajikan dalam seksi 7 dan 8. Laporan ini diakhiri dengan seksi yang bersifat administrasi, yakni tentang organisasi, anggaran biaya dan staf dari PELFISH (9 dan 10). Nota serah terima antara Badan Litbang Pertanian (AARD) dan Perwakilan Uni Eropa disajikan dalam Lampiran 1.

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1. PELFISH telah dimulai sejak bulan Januari 1991 dan berakhir pada 30 Juni 1996 sesudah mengalami suatu fase perpanjangan selama 18 bulan. Proyek disponsori oleh C.E.C. (DG I) dan dilaksanakan oleh Badan Litbang Pertanian (AARD)/Balai Penelitian Perikanan Laut (RIMF) bagi Pemerintah Republik Indonesia dan ORSTOM bagi Pemerintah Perancis. Biaya total mencapai 5.6 juta ECU dengan rincian 2.628.000 ECU hibah dari C.E.C (peralatan, bantuan teknis dan kegiatan umum penelitian dan pengembangan), 1.902.000 ECU dari ORSTOM (co-director, bantuan teknis dan saintifik), dan 1.000.000 ECU dari AARD (terutama dalam bentuk "in kind").

2. **Tujuan menyeluruh** dari PELFISH adalah meningkatkan produktivitas dalam mendukung pembangunan berkelanjutan dari perikanan pukat cincin (purse seine) lepas pantai bagi ikan-ikan pelagis kecil di Laut Jawa. Semuanya itu termasuk penyediaan berbagai pertimbangan ilmiah bagi manajemen perikanan yang bersangkutan, penyempurnaan keragaan sistem perikanan yang meliputi hasil tangkapan, konservasi dan distribusi, evaluasi sosial-ekonomi atas pengaruh sejumlah kebijaksanaan manajemen yang potential dapat dilaksanakan serta berbagai penyempurnaan teknologi, serta peningkatan pendapatan nelayan.

3. Agar dapat merumuskan suatu rencana sistimatis tentang manajemen perikanan purse seine lepas pantai di Laut Jawa, seseorang harus memahami **mekanisme keseluruhan sistem** yang mencakup sejumlah stok ikan-ikan pelagis, termasuk lingkungan serta eksploitasi mereka. Koleksi data dari hampir semua bidang yang relevan telah memungkinkan bagi kita untuk merumuskan suatu sintesa awal dari sistem tersebut yang dapat dijadikan sebagai kerangka dasar yang diperlukan bagi manajemen.

Beberapa keragaan penting dari sistem tersebut adalah :

- Suatu **perluasan spasial** daerah penangkapan **yang lebih mengarah ke timur** dari pada yang diperkirakan sebelumnya. Pengaruh dari massa air oseanik melalui bagian timur Laut Jawa yang lebih lebar dan dalam ternyata jauh lebih berarti dari pada pertukaran massa air dengan Laut Cina Selatan.

- Secara **biockologi** terdapat dua jenis **pengaman penting** : yakni, pertama, adanya suatu kombinasi antara sejumlah siklus hidup yang berbeda dengan kerentanan parsial yang berkaitan dengan penyebaran komunitas ikan-ikan pelagis kecil di perairan pantai dan di bagian timur Laut Jawa; kedua, biomassa yang terpencar serta

kawanan ikan yang menyebar berperan penting sebagai faktor pembatas bagi laju intensitas upaya penangkapan.

Status eksploitasi selama ini ditandai oleh :

- perluasan daerah penangkapan yang sangat jauh bila diukur dari kemampuan jenis purse seine yang ada;
- staknasi hasil tangkapan total untuk jangka waktu empat tahun terakhir;
- staknasi atau penurunan dalam hasil tangkapan per unit upaya yang berarti bahwa upaya penangkapan total selalu meningkat dan/atau kelimpahan yang mulai menipis;
- tendensi menurunnya ukuran rata-rata dari spesies ikan yang mendominasi hasil tangkapan;
- ini semua menunjukkan bahwa sumber daya ikan pelagis kecil berada di ambang eksploitasi yang kritis -yang lebih bersifat ekonomi dari pada biologi- dan oleh karena itu kita lebih dihadapkan pada isu pengelolaan yang sangat mendesak.

Isu utama sosial-ekonomi meliputi :

- permintaan akan ikan pelagis kecil saat ini tidak merupakan kendala pembatas selain harga ikan akan tetap atraktif;
- laju "turn-over" investasi perusahaan perikanan masih tinggi, tetapi margin mulai menyempit;
- jumlah total tenaga kerja masih tinggi tetapi sejumlah perusahaan mengalami kesulitan dalam melakukan rekrutmen nelayan dimana standar hidupnya kurang memadai;
- fasilitas kredit yang kurang memadai baik bagi para bakul (kredit jangka pendek) maupun bagi para pemilik kapal (kredit investasi).

Kualitas produk ikan pelagis yang murah yang diperuntukkan bagi konsumsi masyarakat lapisan bawah ini masih belum memadai. Pihak yang berwajib perlu mengusahakan harga ikan tetap murah, tetapi memenuhi berbagai standar sanitasi. Untuk maksud tersebut tersedia beberapa solusi guna meningkatkan kualitas produk, yakni penggunaan mesin penghancur es, insulasi palka ikan yang lebih baik, pencucian keranjang ikan, penggunaan air yang lebih bersih, dsb.

4. **Masalah manajemen sumber daya** ikan yang mendesak

- Pada saat sekarang situasi tampak cukup bagus yang ditandai dengan hasil tangkapan yang tinggi, berbagai kegiatan pengolahan yang pesat, nelayan dalam jumlah besar terlibat dalam perikanan purse seine serta "payback" yang bagus bagi para pemilik. Meskipun demikian, suatu pengamatan yang seksama terhadap berbagai data terakhhir ternyata tidak terlalu menggembirakan. Hampir semuanya berada dalam pertumbuhan yang statis, sehingga dikhawatirkan timbulnya kesulitan-kesulitan yang semakin besar beberapa tahun mendatang. Meskipun problem utama mungkin bukan bersifat biofisik karena eksploitasi, tetapi kesulitan yang bersifat sosial-ekonomi jelas dapat dilihat.

- Dari tahun 1980, pengolahan sumber daya ikan tidak terlalu tampak jelas kecuali peraturan yang mengatur ukuran mata-jaring dan zonasi, yakni pengaturan daerah penangkapan didasarkan atas jarak dari pantai. Dalam fase perikanan sedang berkembang dalam kurun waktu tersebut, tindakan pengolahan seperti itu tidak terlalu berpengaruh, sebab stok ikan masih menunjukkan

reaksi yang positif. Pada saat ini, pemilikan armada terpusat pada beberapa gelintir orang, mungkin merupakan skenario untuk masa mendatang. Seharusnya pihak yang berwajib menghentikan proses evolusi tersebut dan berusaha memperketat peraturan dan melaksanakannya dengan sebaik-baiknya.

- Dari pengetahuan yang kita peroleh dari perikanan ini, isu pengolahan mulai tampak jelas, paling tidak bila kita tetap berada pada kontek teknologi serta sejumlah faktor pembatas "alami" terhadap upaya penangkapan yang kini berlaku. Dengan mempertimbangkan kendala-kendala alami tersebut serta untuk tujuan manajemen, maka selayaknyalah bila dilakukan pembatasan terhadap ukuran kapal purse seini. Tampaknya, ukuran yang memadai adalah kapal-kapal dengan panjang maksimum sekitar 30m - yakni kira-kira 120 GT - atau kurang dari itu.

- Selain itu, kualitas ikan hasil tangkapan masih akan merupakan masalah yang disebabkan oleh durasi pelayaran, penanganan yang tidak memadai di atas kapal, penggunaan air yang tercemar di tempat-tempat pendaratan ikan (pelabuhan perikanan), dan waktu menunggu yang dapat berlangsung beberapa hari di Pekalongan dan Juwana sebelum dapat membongkar ikan untuk dilelang.

- Singkat kata, pengetahuan akan dinamika populasi ikan masih belum mantap dan harus di ikuti dengan kebijaksanaan pengelolaan yang menyeluruh, tidak saja yang berkaitan dengan regulasi, tetapi juga yang mengikutsertakan aspek pendidikan, teknik dan dukungan finansial.

5. Pada awalnya perspektif pengelolaan dititikberatkan pada perikanan pelagis kecil, tetapi untuk selanjutnya harus dimasukkan sumber daya hayati laut lainnya. Untuk itu semua terdapat dua poros kegiatan utama.

Pertama, kegiatan yang lebih bersifat hulu dan diarahkan kepada penelitian dan pengembangan sejumlah aspek teknis di bawah judul umum « Towards systemic approaches of fisheries in Indonesia based upon Java Sea models ». Dalam hal ini Badan Litbang Pertanian dan ORSTOM akan mengambil peran utama dan persetujuan untuk tujuan itu telah ditandatangani untuk jangka waktu dua tahun. Tujuan menyeluruh dari kerjasama tersebut diarahkan untuk finalisasi, valorisasi, diseminasi dan transfer hasil-hasil dan informasi dari PELFISH. Selain itu juga berupa tindak-lanjut sejumlah program yang bersifat khusus, seperti identifikasi stok ikan, pertumbuhan, evaluasi terhadap upaya penangkapan, dsb.

Kedua, dengan judul « PELFISH Extension Project » (provisional) akan berhubungan langsung dengan managemen perikanan dan berbagai masalah yang terkait. Kegiatan ini akan melibatkan baik pihak administrator maupun swasta. Pelatihan dan pengalihan teknologi dan ilmu pengetahuan akan merupakan kegiatan utamanya, terutama dalam bidang-bidang statistik, kualitas ikan, dan inovasi teknologi. Sebelum proyek itu diimplementasikan, harus dipersiapkan suatu keahlian dalam hal survei dan pengawasan dan dilaksanakan suatu lokakarya (tukar pendapat) tentang manajemen supaya dapat menghasilkan kerangka yang lebih baik bagi langkah-langkah selanjutnya. Kerjasama ini harus melibatkan Badan Litbang Pertanian, dalam hal ini Balai Penelitian Perikanan Laut dan Direktorat Jenderal Perikanan. Dalam hubungannya dengan proyek PELFISH sebelumnya, pendanaan akan diajukan pertama kepada Directorate General (DG I) Uni Eropa, dan kedua badan internasional lainnya.

1. BACKGROUND

1.1 Basic data

Project No :

ALA/INS/87/17

Project Title :

Java Sea Pelagic Fishery Assessment Project
(PELFISH)

Implementing Agency :

Agency for Agriculture Research and Development (**AARD**)

Country :

Indonesia

Source of Funding :

European Union Directorate General for External Affairs (**DG I**)

Amount of Grant :

1st term	2.200.000 ECU
2nd term	375.000 ECU
Total	2.575.000 ECU

Technical Assistance Companies :

ORSTOM (Scientific Research Institute for Development through Cooperation)
L M L (Landell Mills Limited)

Period of Contract :

Main Project : October 1990 - December 1994
Extension phase : January 1995 - June 1996

1.2 History

The Government of the Republic of Indonesia (GOI) has accorded high priority to the development of the country's fisheries resources under its successive Five Year Development Plans (REPELITA). The present project, proposed by GOI, to promote higher productivity and sustainable development of the offshore purse seine fishery for small pelagic fish in the Java Sea, constituted an integral part of the national priority program for fisheries expansion.

The offshore purse seine fishery, in the Java Sea, has expanded rapidly since 1979/1980, following the State ban on trawling operations in inshore and offshore areas. This ban was prompted by evidence of rapidly declining demersal fish yields. It threatens the ecological balance necessary to support the livelihoods of the small-scale inshore fishermen who have traditionally supplied most of the animal protein consumed by the Javanese population. Subsequently, the total pelagic fish harvest increased to about 220,000 t (in 1985). Almost all of the pelagic fish catch increment came from the introduction of large purse seine vessels, fishing offshore, whose total landings increased by some 30% each year.

Initially, an analysis of the Java Sea pelagic fishery was initiated during 1984/1987 within the framework of Franco-Indonesian agreement in oceanology. The works were performed by ORSTOM and RIMF. In connection with this study, a cruise was performed by PECHINDON with French R/V Coriolis and followed by a second cruise with Indonesian R/V Bawal Putih I. Two fisheries' biologists of ORSTOM were appointed to carry out the works along with researchers from RIMF. Additionally, an inquiry network was put in place in Tegal and Pekalongan harbours (fig. 1). Due to budget limitation and engine failure of the R/V Bawal Putih, the program was suspended in May 1987. However RIMF has tried to maintain the activities and has kept on the surveyors working as long as possible. Some scientists of RIMF, were sent to France for short and long-term trainings : biology and population dynamics, fisheries acoustics and fishing gear. These previous works were precious as they gave the first basis in fisheries statistics. It was also an experiment for the collaboration between scientists of the two countries. It can be said that, owing to the complexity and ambitions of PELFISH, the project team would not have performed its main objectives without these preliminary restrictions (the main abbreviations and acronyms are developped in Annex 2).

PELFISH was first planned for four years, and should have begun in August 1990. Owing to delays in tendering for various equipments, owing also to R/V Bawal Putih I repairs, the end was postponed to December 1994. In accordance with the conclusions of the Mid-Term Evaluation team, an 18-month extension phase was proposed for which a complementary budget was given through DG I. One will find more details on PELFISH chronology in Annex 3.

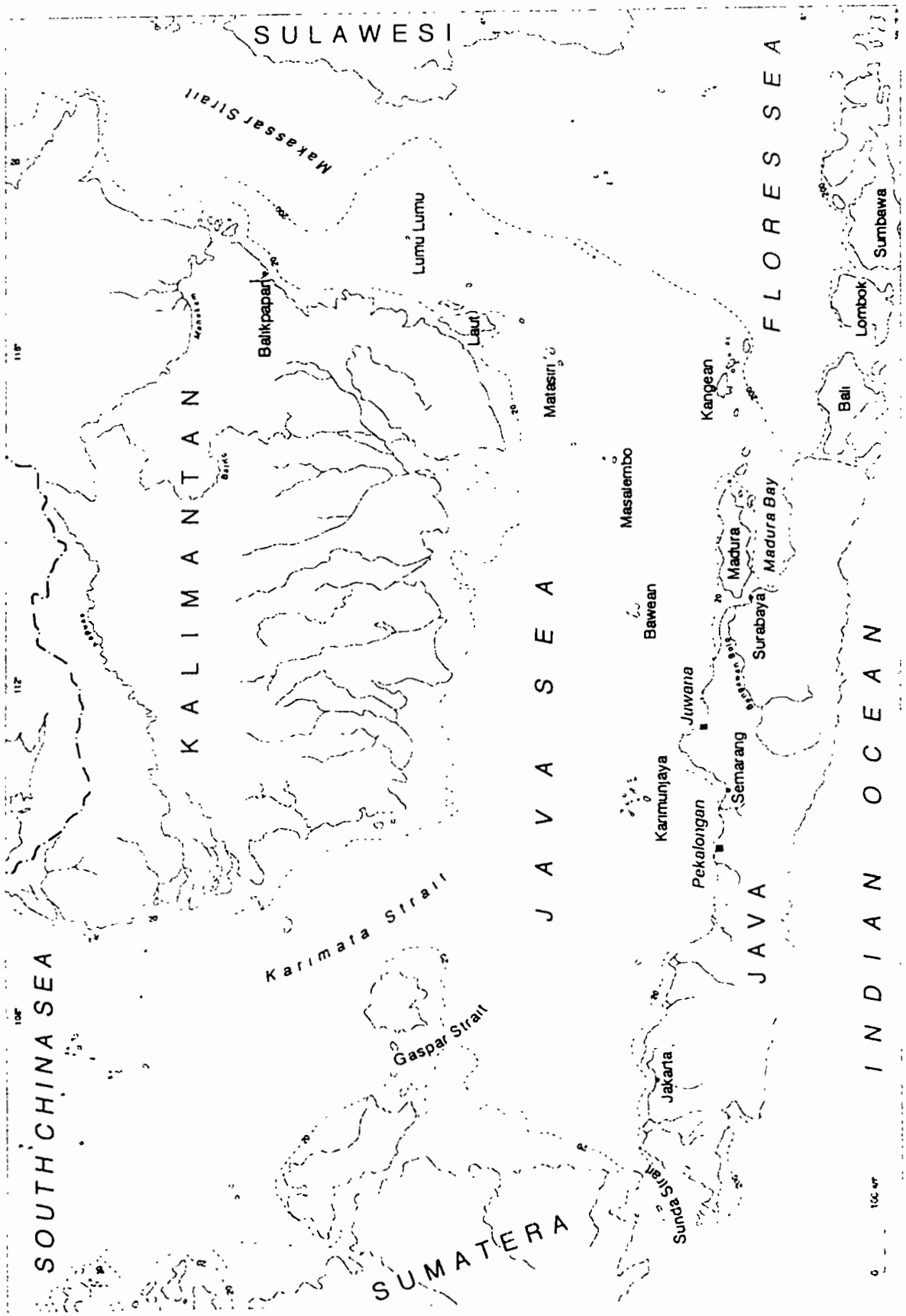

Figure 1 : Java Sea map

2. OBJECTIVES and SCOPE

Among Indonesia fisheries, Java Sea fisheries show very specific features : high global production, small scale and semi-industrial fisheries in coastal and open waters, quick evolution and proximity of the large Java market representing some 100 million people. It was decided to focus on seiner fisheries in open waters mainly because they catch a large amount of fish sold at relatively low prices, meaning that low revenue consumers are interested.

The choice also relied on scientific arguments :

- the evolution seemed very dynamic, mainly due to the shift from trawlers to seiners after the trawl ban which took place in early eighties;
- at first glance there did not seem to have much interaction between open water small pelagic stocks and coastal exploitation;
- the study was apparently feasible through landings taking place mainly in two harbours - Pekalongan and Juwana - and the existence of a statistical basis for these landings.

In the Memorandum, the first description of the general objectives was broad :

"... to study and improve the exploitation and the organization of off shore pelagic fisheries in the Java Sea, in order to increase the supply of the population in quality products and proteins, and to improve the revenue of the fishermen, who make up one of the poorest rural groups. in particular, the project aims at promoting the development of off shore pelagic resources in the long term, thanks to a better knowledge of the stocks (...), but also by suggesting better fishing methods as well as better conservation, handling and transformation methods capable of optimizing the profits of both consumers and fishermen, ...".

In the revised 1990-1994 Work Plan, these objectives were simplified and clarified in :

- the provision of scientific advice on the management of this fishery;
- the improvement of the performance of this fishing system in terms of catch, conservation and distribution;
- the evaluation of the socio-economic impact of potential management measures and technical improvement;
- the enhancement of fishermen's income.

The overall objective of PELFISH being to promote higher productivity and sustainable development of the offshore purse seine fishery for small pelagic fish in the Java Sea.

Section 7 shows the presentation of the main results and achievements, some comments on the definition of these objectives.

The presentation given below about PELFISH implementation and results (sections 3 to 6) will be organized in three successive steps : first, the basic knowledge of Java Sea and Java Sea pelagic fishes (environment, bioecology and acoustics), then the human aspects (exploitation and socio-economics), with a specific focus on technological issues (harvesting and fish quality) and some issues in fisheries management.

3. BASIC KNOWLEDGES

The management of natural aquatic resources assumes knowledges in various fields and the corresponding studies have to be more or less connected in a multidisciplinary approach. Multidisciplinarity, as defined here, means that all disciplines aim to analyze and understand the same object. It means too, that they have at least some common constraints, time and space scales and observation units. Managing the fisheries in Java Sea context requires the understanding of the whole system. Fish repartition and its variability depend on the physical and climatic environment on one hand, on the other hand, we have to deal with human societies and their cultures. Being able to operate a synthesis of the whole requires a multidisciplinary approach, including technological issues and institutions.

In this chapter, we will give a brief presentation of the main results, and some comments on difficulties and constraints. First, the global features of pelagic resources and their environment : physical environment, bioecology, behaviour and biomass (through acoustics); then the exploitation system : fishery and socioeconomics; in third place, a special attention is given to harvesting and fish quality; finally we will try to highlight the most important facts and hypothesis for the management issues.

Transfer of results and training have been operated through three main Seminars and many Workshops (Annex 4). Data and results interpretation have been disseminated through the publication of PELFISH scientific and technical documents, as well as many other publications (cf. Annex 5 for the main references). This work is still being implemented in the frame of a bilateral agreement between AARD and ORSTOM.

3.1 Environment

A thorough understanding of the ecosystems functioning is necessary to conduct the management of renewable living resources. It means that, beyond the description of an average scheme, the variabilities which occur at every level, from climatic variations and primary productivity to species recruitment and fish availability for fishermen must be taken into account.

The need for concomitant data on environment is obvious and the corresponding studies have been identified, but such programs required specific means and skills and could not be conducted in the frame of the present project. The solution was to extrapolate ancient results - mainly gathered before World War Two - and to use scarce and scattered recent data (Durand and Petit, 1995). A more specific utilization was done also for relations between climatic factors and seine fishing (Potier and Boely, 1990). In addition, we performed salinities and temperatures measurements during acoustic cruises in Java Sea, from 1991 to 1994 (Petit *et al*, 1995), cf. Annex 6. The acoustic team has acquires this data, using a thermosalinometer and a quantameter. A profiler probe measured the salinity and the temperature at each hydrological

station made repeatedly along the transects. The water turbidity was also analysed. Many stations have been probed from June 1993 until May 1995 (about 40 stations per survey).

The most important points of the environmental issues are thus :

- The Java Sea is a huge collection of waters : some 450,000 sq. kilometers. Morphologically, it is well delimited on three sides, namely Sumatra, Java and Kalimantan islands. The eastern boundary is wide open towards deep Indonesia seas. Its average depth is about 40 meters with its bottom sloping from west to east, 20 to 100 meters.

- The general climatic scheme is clear. Winds are seasonally reversing and so are the currents in the Java Sea : westward flow during the south-east monsoon (dry season), eastward during the north-west monsoon (rainy season).

- The general importance of fresh water impacts through rivers' discharge and rain at sea is distinctly demonstrated, even if a long term quantification remains impossible, owing to the lack of pertinent data.

- The year to year variability of the system is mainly explained through the changing balance of oceanic eastern waters with coastal and neritic waters from the Java Sea. There is a lack of description of environmental conditions for rainy season and subsurface waters.

Work at sea constraints

There were constraints for all PELFISH tasks dealing with work at sea, namely environment studies and acoustics, but also bioecology and fisheries. These difficulties can be summed up as follows :

1. The ship was in bad condition and the crew had lack of navigation knowledge.

2. The procurement of the equipment : for many reasons, the procurement of the needed equipment was late and progressive.

3. The autonomy of the research vessel R/V Bawal Putih I, formerly given for eighteen days, was actually twelve days, no more. The distance of the working fields has shortened our study durations.

4. Planification of surveys : in order to realize surveys and light experiments, the right period has to be previously planned (usually with no moon). It occurred that surveys were postponed.

5. Postprocessing problems were at first the time between two surveys, too short to start any analyze. Priority was given to the data acquisition and their filing. Playback, reports, maintenance, the preparations of survey were big time comsuming. The delivery delay of the computers and printers was long and step by step.

6. Contact with the professionals : difficulties to sample purseiners on fishing grounds; fishermen, often disturbed by the coast guards, were suspicious, even of the Project team. It has never been possible to communicate with them even using VHF radio.

7. The important dispersion of fish along with the low catch rate of sampling gears make difficult the attribution of specific biomasses. For the same reasons, it was

difficult to make a sound evaluation of the potential commercial stock in the total biomass.

3.2 Bioecology

Seine fisheries in open waters mainly catch six pelagic species : *Decapterus russelli* and *D. macrosoma* (scads), *Selar crumenophthalmus* (big eye scad), *Rastrelliger kanagurta* (pacific mackerel), *Sardinella gibbosa* (sardine) and *Amblygaster sirm* (spotted sardine). The fish caught are mostly immature or in recovery stage (Atmaja *et al.*, 1995). Most of the fish seem to reach sexual maturity from April to June, at the end of the rainy monsoon. The small number of encountered ripe and spent individuals in the catch sample may indicate that their spawning grounds are beyond the fishing areas, or they are not available for purse seine fishing.

From preliminary observations of growth parameters, it appears that most of the catch consist of young fishes (Suwarso *et al.*, 1995). As a rough estimation, we could say that the average age of fish caught is less than one year. Several cohorts were detected for some species, especially those of Carangids. Each of the cohort has its own characteristics, consequently, for analytical approach, they should be treated separately.

An exploratory scheme has been given for recruitment and migration (Sadhotomo and Potier, 1995) mainly from reproduction data and catch length frequency. The general average length increase from West to East. Obviously, the spatial distributions of sizes are related to hydrographic conditions and three types of life cycle are distinguished : oceanic, coastal and neretic. It is worthy to note that whether those fish are originating from a unit stock is still questionable. The difference on average length could be due to environmental factors and/or to the existence of different unit stocks. A preliminary study on stock identification, using mitochondrial-DNA analysis is in progress and a proposal on a more intensive study is to be discussed between ORSTOM and RIMF.

3.3 Acoustics

The specificity of acoustic studies required specific tools and methods : use of dedicated equipment and oceanographic vessel. Usually they are applied to relative abundance estimations of large scale areas, newly exploited or unknown, and therefore, to find out new exploitable resources. The first objectives were to operate global surveys on the whole Java Sea. This initial prospecting strategy had then been modified due to the vastness of the whole area and the insufficient abilities of the research vessel R/V Bawal Putih I to carry out big surveys. Moreover, preliminary studies had pointed out the possible existence of an island effect on abundance. It was thought that the gradient in the east-west environmental characteristics was influencing on species. Finally the presence of important catches in the North East of the Java Sea was requiring an indepth study. Indeed, it was not necessary to seek any new fishing places in the Java Sea where all the fishing grounds are prospected today.

Thus, attention has been directed towards aspects of fish behaviour : their density, their distribution and their small scale variability. There have been related to studies of fishermen's

tactics in order to estimate an average optimal production - in other words sustainable - and this, through bioecological results and exploitation data.

To achieve all these purposes, multidisciplinary studies have been effectuated :

- environment studies, by the use of oceanic probes (cf. 3.1);
- fish stock assessments, by the use of the Echo-Integration and Target Strength methods and biological samplings;
- observations of the fishing system, through the study of the fishing grounds and the light attraction as the main device used by the fishermen.

The research vessel R/V Bawal Putih I has accomplished 19 cruises from late 1991 to early 1995 (Annex 6). Student trainings have been carried out during some surveys.

The whole Java Sea has been covered twice : one total survey in rainy season, one total survey in dry season. We performed these cruises in order to obtain a seasonal representation of the fish abundance and the repartition of the aquatic populations. The team has investigated more precisely the fishing grounds and the high concentration areas in order to evaluate their relative richness compared with the mean densities found outside these specific areas. These concentrations have been identified by various means, trammel nets, trawling and sampling purseiners. To monitor the fish abundance and the distribution, the Project team performed medium transects in the middle of the Java Sea, that were used as a geostatistical model.

The first results of these collected data have been postprocessed during two consecutive workshops AKUSTIKAN 1 and AKUSTIKAN 2. They have been presented during the seminar on Acoustics AKUSTIKAN 2, from the 27 to 29 May 1996, in Bandungan (Central Java).

They give valuable information on the functioning of the Java Sea system :

- They confirm the huge scattering of small pelagic fishes and the relative by low occurrence of shoals. This result has to be related with the need for concentrating fish tactics. The concentration takes place at night and is rather slow, it explains why fishing always occurs at the end of the night.
- They give a first stratification for biomass in the Java Sea, which fits well with what we know about fishery dynamics.
- They produce very useful information on general vertical distribution and circadian cycle; these results would not have been obtained without the input of echoprospection.
- They demonstrate that the seasonal variability of biomass is related to changes in environmental conditions. It explains the seiners migration to Makasar Strait first, then to South China Sea fishing grounds at the end of the dry monsoon.
- They show that there is a strong correlation between biomass densities and salinity as the confirmation of the bioecological hypothesis we made at the beginning.
- They point out the importance of juvenile and larvae, especially in the western half part of Java Sea. These area seem to play a special role in relation with some commercial stocks.

Sustainability

The whole equipment remains in good condition and can still be used. Some calibrations will be necessary and will have to be made at the manufacturer's.

The research vessel R/V Bawal Putih I is still on duty, but obviously she has to be replaced soon, at least for acoustic studies, as her maintenance is getting more and more expensive.

Follow-up activities

1. Training and Transfer : The use of acoustics for marine fisheries assessments is given a high priority by RIMF authorities. In order to use the acoustics methods and equipments, it is necessary to transmit the "how - to - do" and our knowledge to a brand-new Indonesian team. A training course will start in November 1996 for eight months. It should be followed by 10 BPPL scientists and 3 electronic engineers.

2. At the end of the Seminar on Acoustics AKUSTIKAN 2, it has been recommended to go on monitoring the Java Sea fish stocks. This could be done by means of various transects performed in the midst of the sea or large surveys with application of statistic's models issued from the workshops and the seminar AKUSTIKAN. This might be carried out at least twice a year : one in wet season, one in dry season.

3. In the continuity of PELFISH, acoustics could be used at two different levels :

- provide complementary data on pelagic biomasses which would be useful for the management of seiners fisheries inside Java Sea or in adjacent bodies, such as :
  - shallow waters along Java coast, in relation with the study of minipurseiners fishery (cf. below, section 4.1),
  - biomass evaluations in Makassar Strait (East Kalimantan);
- beyond the borders of Java Sea (South China Sea, Banda Sea, ...) in order to verify PELFISH hypothesis on oceanic stocks and also contribute to the prospection of new Indonesian marine resources.

4. THE EXPLOITATION SYSTEM

4.1 Resources and Fishery

This refers to fisheries functioning as well as to bioecology or fish population dynamics. Special attention is paid to the fish behaviour and biomass estimation through echo-prospecting and integration. Data have been taken every month from the two main harbours for the main biological parameters (catch composition, length structure, reproduction, ...). Catch statistics were exhaustive and obtained through harbour authorities and specific project inquiries. A first synthesis of these results has been given in BIODYNEX Seminar (BIOlogy, populations DYNamics and EXploitation) held near Jakarta during March 1994. The proceedings had been edited in 1995 (Potier and Nurhakim, eds.).

The evolution of small pelagic seiners fisheries can be summarized through the extension of fishing grounds, the fishing vessels and the dynamics of catches. Before 1985, the fishing grounds were restricted to the central part of Java Sea. There followed extension towards eastern waters, with a concentration of the fishing effort in the vicinity of the main islands. At that time the entire of Java Sea open waters has been explored by big and medium seiners, the wide parts ignored being only shallow waters in West Java Sea and near South Kalimantan. Nevertheless, another extension occurred from 1988 onwards with extension to East Kalimantan waters in Makassar Strait on the one hand and Indonesia South China Sea waters on the other. This last move had two meanings : all the fishing grounds suitable for seiners in Java Sea were exploited and, furthermore, the exploitation of South China Sea small pelagic stocks - which must be seen as a distinct system - gives a seasonal surplus production to seiners companies during bad fishing season in Java Sea.

At the beginning of seiners exploitation, in the late seventies, the vessels landed in five harbours of the province of Central Java. Pekalongan was already the main one while Juwana had no seiners activity. From 1984 onwards, the eastwards move for fishing grounds brought about the development of Juwana activities. At present, Pekalongan and Juwana are the two main harbours for small pelagic fish, with more than 90% of the total catch. For the last four years (1992/1995), their respective seiners mean landings have been around 90,000 and 45,000 tons.

This extension of the fishing grounds has brought about very significant changes in the vessel characteristics (Potier and Sadhotomo, 1995). Initially, the seiners were 20 to 22 meters long with 120 HP engine and 20 to 30 tons fish hold capacity. At present, there has been an evolution towards bigger vessels, which are able to perform longer cruises towards South China Sea and Makassar Strait but there was also a diversification with the increase of a new small vessel fleet, the so-called "mini-seiners". There are presently three flotillas :

- large seiners : from 30 to 36 meters, engine power more than 250 HP and fish hold capacities up to 120 tons; the cruises last 4 to 5 weeks and they fish mainly in the eastern part of Java Sea, Makassar Strait and South China Sea;

- medium seiners : from 20 to 25 meters, 100 to 250 HP, 30 to 50 tons fish hold capacity; they exploit the traditional fishing grounds inside Java Sea;

- miniseiners : 12 to 18 meters, about 40 HP fishing mainly in North Java coastal waters.

The miniseiners (MPS) flotilla deserves a special comment (Ecoutin *et al.*, in press). It was not identified initially as a target of PELFISH as the project was dealing with open waters small pelagic and so focused on medium and large seiners. It is only in 1994 that it became obvious that the interaction between these MPS flotilla should be evaluated as they were fishing partly on the same stocks.

These vessels are more coastal than the larger ones and never stay at sea more than 3 days. Consequently, fishermen obtain much better prices for their capture which is almost always of better quality. From three general 1995 censuses, the total number was estimated about 1600, 60 to 75% of them being active. It is not possible to assess yearly production for the main species, nevertheless a total estimation is proposed : with an average c.p.u.e. of 900 kg/trip, MPS land about 80 to 100,000 tons a year. Taking into account open waters pelagic species only, it means that MPS accounts to 35/50,000 tons. Even approximative, it represents 25 to 35% of the recent average total catch for medium and large seiners and has to be taken into account for the management of the resources.

This diversification and the trend for bigger boats has not been accompanied by noticeable improvements in equipment, except for radio which has spread widely in the early nineties. Only a few vessels have GPS and fish finders are unknown. The vessels speed is low (7 to 8 knots) owing to under motorization. The fish quality remains generally insufficient, due to bad insulation of fish holds, bad handling of fish and excessive duration of cruises (see section 5 : Harvesting and Fish Quality).

The evolution of the main parameters of exploitation has been given in several papers (Potier and Sadhotomo, 1995; Nurhakim *et al.*,1996) and is summarized on figure 2. On figure 2A, the evolution of the total catch (excluding South China Sea) is summarised and in figure 2B, the evolution of the total number of boats from 1979, the year which could be taken as the beginning of the seiners fishery development is shown. For catch per unit effort data (fig. 2C), there is data from 1985 only. A more in-depth study of the exploitation should take into account the internal dynamics of all these parameters : variation of specific catches, effort standardization, spatiotemporal variations of efforts and catches, ... This study is still in progress, but it is thought that the global phenomena are so obvious and the general trends so marked that it is possible to give general conclusions on the state of exploitation (section 6).

Globally speaking, there has been a sharp increase in total catches from 40,000 (1979/1981) to 150,000 tons (1992/1995). Nevertheless, this evolution is far from being a steady one and schematically we can consider four distinct periods :

- 1981/1985 : increase from 38,000 to 117,000 tons (+33 % / year),
- 1985/1988 : decrease from 117,000 to 67,000 tons (-17 % / year),
- 1988/1992 : increase from 67,000 to 155,000 tons (+23 % / year),
- 1992/1995 : total catch seem to be levelling off around 150,000 tons.

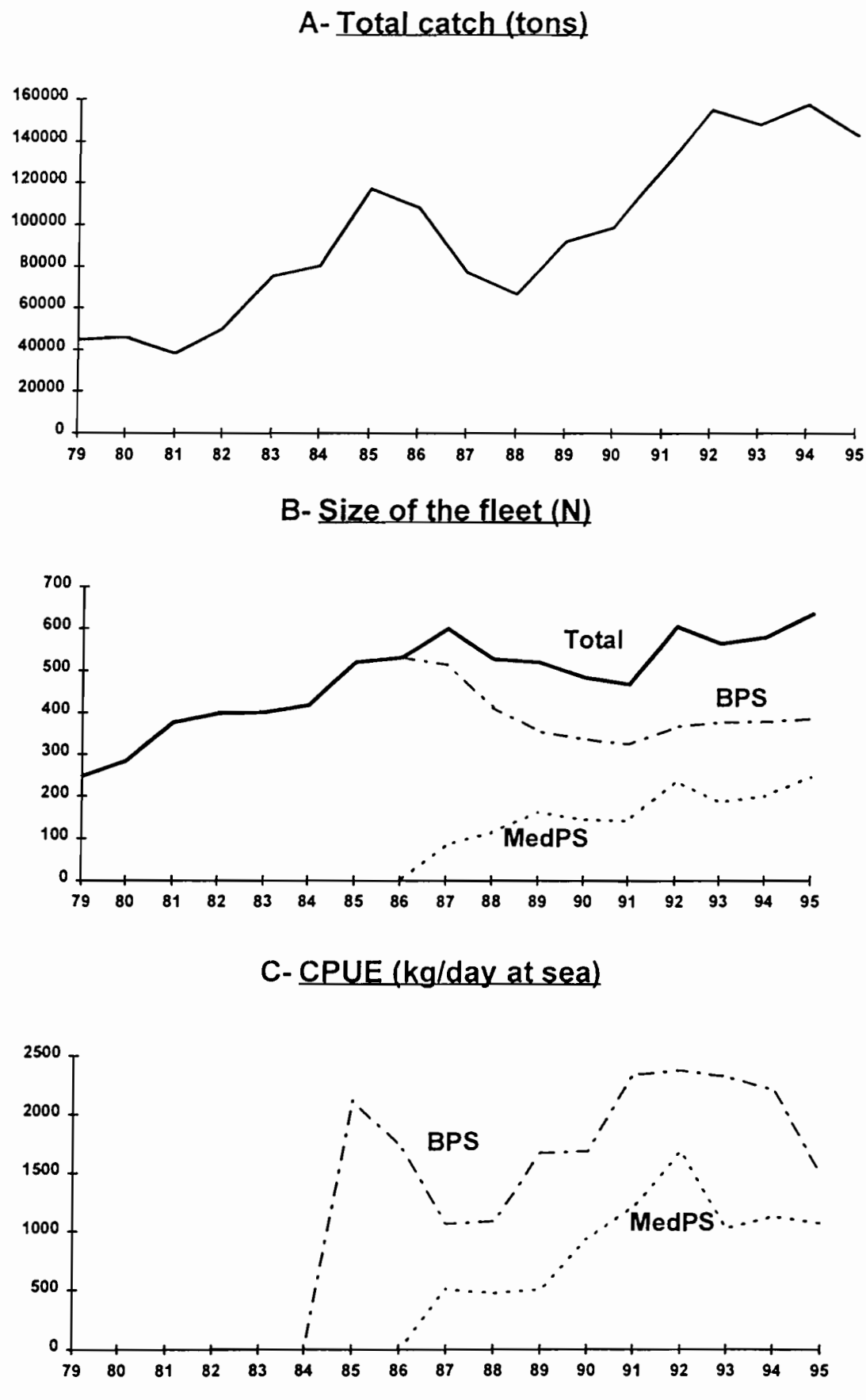

Figure 2 : Evolution of the main parameters of exploitation from 1979 to 1995 (BPS, Big Purse Seiner fleet, MedPS, Medium Purse Seiner fleet)

When looking at the evolution of the flotillas, it appears that the number of large seiners has been steadily increasing from 1979 to reach 531 in 1986. The medium seiners appeared probably during 1985 or 1986 and has been getting more and more numerous from 1987 (85) to 1995 (248). During the same period, the large seiners flotilla has been decreasing sharply from 531 (1986) to 326 (1991). The fishing capacity may have decreased from 1985 to 1988, then followed by an increase as old vessels has been replaced by bigger and more efficient ones. It can be said that there has been an increase in total fishing effort, owing to arrival of bigger seiners and new fishing tactics and strategies (Petit and Potier, 1996). Overall, the fishing effort has increased mainly during the last five years.

These evolutions of global characteristics of the seiners fisheries are partly reflected in the yearly values of catches per unit effort. With nearly the same number of boats from 1985 to 1987, large seiners c.p.u.e. has been divided by two. Afterwards, there is the reverse evolution from 1988 to 1991/92 and c.p.u.e. reaching their maximum value for medium (1.7 ton/day at sea) as well as for large seiners (2.4 t/d) in 1992. For the last three years, the degradation of these c.p.u.e. values is clearly demonstrated (fig. 2C).

4.2 Socioeconomics

When comparing with other exploitations among world fisheries, there seems to be a very specific characteristic in the use of fish caught. All fish caught are landed and nearly all fish landed are sold for human consumption, whereas the fish quality is often poor or bad. It means that, at present, the demand is not a limiting constraint. Even with small pelagic catches rising sharply in recent years, the market is far from being saturated. This source of protein remains relatively cheap, and within the huge population of Java, there are still important groups of consumers, at least along the North coast and in the large townsin Java. The improvement of fish quality being now the first priority - from both public health and economic points of view - could have consequencies on prices and could result in changes in demand.

The field of Java Sea fisheries socioeconomics had never been really studied indepth before. There are of course general statistic data and some papers dealing with general economic prospects but corresponding more or less to expertise reports than to research works, as it is the case for McElroy's publication (1991) which is nevertheless interesting as it examined previous data, the most recent being 1988-1989.

The main objectives were : evaluation of production costs, fish prices, incomes in the fishing sector and downstream. The research also targeted the fishermen conditions of work, the role of women in the production and the respective weight of the formal and informal sectors. But, as fisheries socio-economics lack of previous studies and data, it was nearly a virgin field at the start of the Project. Various papers were nevertheless dealing with prospects on management and fishermen societies on North Java Coast. They were too often built on ancient data and/on hyphotesis. The Project brought some new material and progressed in analysis in these matters. A tentative review has been given in December 1995 during the Seminar SOSEKIMA (SOSio-EKonomics, Innovation and MAnagement).

The first Project's studies focused on producers : fishermen and owners (Roch *et al.*, 1996; Roch and Sastrawidjaja, 1996). These preliminary results show that for fishermen the average incomes are not so low. The range between the unskilled crew and the specialists, as

skippers and mechanics, is broad and tends to be broader still for the large seiners. For the deck hand fishermen income reach around 1 million Rupiah/year; 1.5 to 2 millions for the chief engineer, and up to 7 or 8 millions for the skippers. These figures are higher than average rural incomes and some skippers are able to invest in small scale fisheries like bottom gillnets.

Concerning the fishermen standard of living, the situation is not satisfactory in many domains : health, safety at sea, off season subsidies or in case of illness, ... Nevertheless, there are a lot of possibilities of improvements : better salaries policy, particularly through the granting of incentives and adjustements in the sharing system. Other field of improvements : the cooperatives benefit now by a large amount of money from the auctions taxes, which are clearly affected, an important part have to be redistributed to the fishermen ("savings" and improvement actions in welfare). Nevertheless, only part is redistributed to the fishermen. Clearly enough, the cooperatives should be respectful to their mission, and should allocate the funds to their normal destination

Fish prices and reactions of the consumers : different field observations tend to indicate that there could be a ceiling price for the small pelagic species, which are mainly consumed by rural and urban consumers with low purchasing power. Such a situation could explain why the fishermen hesitate to invest in the fish quality, because they fear a possible drop of the demand or a transfer towards other animal goods, such as chicken. Nonetheless, prices seem to be directly linked to the fish quality. According to a fish survey (December 1994 - February 1995) dealing with the main species, the price of fish salted on board is generally almost 60% lower than that of fresh fish. Besides, the price per kilo is almost four times higher for superior quality of fresh fish than for inferior quality. The ratio for fish salted on board is over three.

Concerning the elasticity price/quantity, the first observations in the main fish harbours of the Java sea indicate that, for a 100% landing increase, the auction price would be reduced by 20 to 30 % - according to the species - which is not very high.

As far as investments have been researched, it is confirmed that the turn over rate has been very high during recent years, with a paying off in 2 or 3 years. It seems that this very profitable situation is changing, and that the paying off nowadays is 4 years. Thought far from rentability threshold, margins are narrowing, due to higher investments in larger boats, to higher costs for functioning whereas catch per unit effort is not growing as quickly as it has done in recent years and fish prices have been decreasing in constant value.

There is a lack of data on employment on seiners, but the companies seem to meet some difficulties in recruitment of fishermen. On the one hand it appears that the deck hand fishermen prefer to get embarkment on tuna liners. They get better incomes, with a granted salary, whereas on seiners their income depends on the sharing system. They are replaced by countrymen without any skills in fishing, looking for seasonal jobs. On the other hand it is more and more difficult to find valuable skippers : they are not so numerous and are able to get more money in tuna fisheries.

Looking at the near future, it seems obvious that the quick increase of seiners' catches and the modifications in the flotillas structure have and shall have consequencies for fishing companies and for traders/processors of fish products. As far as the latter are considered through two PELFISH inquiries, in 1995 and 1996, the current situation is characterized by three main features :

- Great vitality and adaptation of professionals : extension of the activities upstream (geographical diversification of the sources of supplies), downstream with the

widening of the distribution channels (the whole national market and even export), and the development of new products, following the consumers preferences evolution.

- Ease of entry to the profession, the main criteria being the «knowledge of the fish», because the trade and traditional processing system is capital saving, with few investments and low fixed costs. The activity is in fact a simple extension of domestic transformation for fishermen wives, employees of the fisheries services or people working in the fish trade environment. The main obstacles are hidden : traders in place are often reluctant to give places to newcomers and like to test their nerves through prices rocketing to size their financial abilities.

- But high level of insecurity, due to the lack of short-term credit, for the payment of raw materials. The fish has to be paid for in cash immediately at the auction place and the small scale operators have difficulties to maintain permanent activities in this field. Such a situation means that a lot of small traders or processors have to suspend temporarily their activity and become intermediaries in buying fish at the auction for others adopting a «low survival profile».

In the present state of evolution, two preliminaries conclusions may be drawn :

- As far as vessel owners and fishing companies are concerned, the investment in large seiners of the new generation - most of them having been built very recently, from 1992 up to now - will have significant consequencies : high investment costs (from 500 to 600 millions rupiah for a fully equipped vessel), but also higher management costs. It means that the concentration of the fleet in fewer hands is the probable scenario for the future, unless the authorities do not agree with the laissez-faire policy.

In brief, the current situation needs attending measures, in order to help the shipowners to follow the evolution. Nevertheless, the setting up of a modern system of investment credit is of urgent priority.

- For the traders, the priority concerns short term credit facilities in order to purchase the raw materials. The quick increase in catches necessitates more liquidities as the lengthening of the chain of distribution leads to a longer trading cycle. The lack of short-term credit and overdraft facilities generates risks and uncertainty for most of operators.

5. INNOVATIONS in HARVESTING and FISH QUALITY

The objectives of PELFISH included diagnosis on various technical aspects and, consequently, improvments which could be done in the short term. It must be remembered that seiners catches are mainly composed of low and medium value species. It means that their price is more or less suitable with poor people revenues. It means also that this situation will influence investment capacities and, partly at least, technical innovation. At first glance, it appears an obvious contrast between a strong and dynamic seiners fisheries on the one hand and their poor onboard equipment and the poor quality of fish on the other.

This field mainly deals with seines design and its evolution, the implementation of electronic devices on the fishing boats, the evaluation of the fish quality and the methods of conservation. For more information see, among others, Durand (1994), Durand and Gueguen (1995), Clucas and Reilly (1993), Basmal and Wikanta (1995).

5.1 Harvesting

Seiners vessels are flat bottomed without noticable keel, in order to be able to enter shallow coastal waters and river mouths. These are the only suitable locations for fishing harbours and landings, as for example in Juwana and Pekalongan. The medium seiners are built locally in North Java Coast permanent dockyards but large seiners (30 to 36 m total length) are built at Bagan Siapi-api (Sumatra). They are delivered as bare hulls and the owners supervise the fitting out of machinery and holds.

The seiners performance could be improved in different ways : motorization, nets design and new electronic equipments.

* Seiners are relatively slow vessels : 6 to 7 knots. These low performances are easily explainable : the traditional shipyards use a great amount of heavy wood (usually solid teck); the hull shape is not the best suited for speed; the use of truck engines lead generally to an under-powered fleet, ... These negative aspects must be counterbalanced by convincing explanations leading to such choices : the traditional building gives good results and is by far the less expensive; the vessels draught has to be as small as possible; the truck engines represent a low cost investment compared to marine engines. On the whole, present vessels represent a good compromise. Taking into account the specific economic context of this fishery - low investments related to low prices - it is not obvious to propose a better solution obeying such schedule of conditions.

* Nets : Since the beginning of the XXst century, the encircling nets *lampara* and Danish seines *payang* were used around fish aggregating devices (*rumpon*). In order to have a more efficient

fishing tool, some owners introduced purse seine in Java Sea in 1968 and on a commercial scale in 1973. Allowing better catches and longer fishing times, the adoption of the purse seine spread quickly along the northern coast of Java. At present, this net is found in almost every province of Indonesia, but the Java Sea is still the more important area for purse seine fisheries.

This so-called purse seine is actually a ring net. Hauling in the catch requires a great deal of manpower : an average of 45 and up to 60 deckhand fishermen onboard larger seiners. At the scale of the whole fishery, it represents thousands of jobs. The most probable evolution of the net shouds be towards actual purse seines and correlated mechanization with the use of winches. Such an evolution would mean important social changes and would not necessary be the best solution with scattered fish and fishing effort limited to 1 or 2 hauls per night (cf. section 6).

For this reason, it is proposed that an improvement of the traditional net rather than a new one is effected. The modified design is still a ring net, but, with some innovations in mounting this net requires less material than traditional ones and is 25 to 30% less expensive. This saving is all the more noticeable since the net account for an average 25% of the total investment. The trials has been quite satisfactory with catches similar to traditional nets. Nevertheless, it seems that, even if some owners agree with this saving money evolution, many captains and fishermen are distrustful and prefer to use their traditional tools.

* Electronic equipments : the electronic equipments were very poor, and at the beginning of the Project, the only and recent innovation concerned the Short Sinuswave Bandwidth radios (SSB). They are used to keeping in contact with other vessels of the same ownership at sea and with the owner ashore. The diagnosis was that, for security and efficiency reasons, the seiners lacked equipments able to give locations of boats and locations of fishes : Global Positioning Systems (GPS) and fish finders.

Heading towards fishing grounds, finding back the chosen ones, and, moreover, pinpointing the fish aggregating devices, is usually performed in the traditional way through the captain's knowledge of currents and winds, using, when it is possible, landmarks ashore. Even if the results were not so bad, it is obvious that the use of GPS represent a decisive advance as it allows appreciable reductions of the cruises duration and gives the possibility to explore new areas, outside the traditional ones. The cost of this investment is relatively very low, as the purchase of one GPS represents about 0.5% of the total investment. During 1994 and 1995, the masterfisherman has been training more than 30 captains or chief engineer. It was not so easy as they had to learn the use of charts and position plotings, the majority of them being illiterate. A majority of them understood the interest of GPS, learned to use them and asked owners for this equipment. At present, the use of GPS is spreading, and it is estimated that GPS will be soon a basic equipment of all Java Sea medium and large seiners.

Fishfinders are also very useful to locate fish underneath the boat and together with GPS they constitute a basic equipment of every modern fishing vessel even much smaller than Java Sea seiners. Here again the cost is not a major difficulty, as the price is quite the same as GPS's. Nevertheless, it seems that the sensibilization phase is more difficult, and progress in this matter will be slower than for GPS.

5.2 Fish Quality issues

Seiners catches are mainly small fishes with low commercial value. At present operating habits consist in long fishing cruises. During the first two weeks catches are salted, then the subsequent catches are kept under ice. Handling has to be done for hundreds at the same time, and it is rather careless. The final products are usually low quality ones and the so-called fresh fish reach very rarely the first grade quality. It must be remembered that the low value of these products does not allow very large investments on handling and preservation.

These strong constraints are not avoidable and it makes no sense to propose drastical changes such as deep freezing onboard and ashore. Nevertheless, it does not mean that practices must stay as they are. It is possible to propose many specific improvements. Their implementations would lead to noticeable global changes in quality.

*** Fishing cruises duration**

This is one of the most crucial factors. The fishing grounds for the small pelagic fish are far from the main marketing and landing centres on the North Java coast where the fishing fleets are based. Nowadays, the larger purse seiners in the fleet can spend up to 40 days at sea. Under ice the maximum duration for conservation is 14 days. The last days catches from these vessels are normally 5 to 6 days from capture before landing. Many captains give priority to the filling of their holds regardless of quality. Furthermore the main harbours are usually congested, and very often the shipload loose its quality while waiting 2 or 3 days before landing !

The introduction of Global Positioning Systems (GPS) by PELFISH, in the first instance, and then through private investment by a number of boat owners in the fleet mean that journey times may be reduced to some extent. More importantly, from the fishing point of view however, is that captains of vessels fitted with GPS can now pinpoint their position whilst fishing and return to known fishing grounds with certainty. This obviously has economic advantages in reducing time and fuel spent searching for fish. Along with the use of GPS, the keeping of log books by the fishing captains of exact positions of good fishing areas will in future make it possible for boats to target small pelagic fish more efficiently and reduce time and fuel consumption.

A decreasing of the seiners cruise duration, together with immediate landings in the harbours, would be a good indication of new tendency towards a better quality.

*** Handling on board/Use of ice crushers**

Observations of fish proposed in Juwana and Pekalongan auction halls show that a large proportion of them are in bad physical state, often broken, even crumbled. This physical degradation is directly linked to handling and conservation at all stages of production line. This is a general statement : whereas fish represents fishermen wealth, most of fishermen do not take care of it from fishing to landing. Several improvements have been proposed :

- empty the net little by little, the fish being sent directly to the fish holds with the help of sliding channels instead of puting the bulk of the catch on the deck;

- crush the ice instead of using large blocks (cf. below for summary of ice crushers experiment);

- give a better insulation to fish holds, together with a better coating than rough wood planks. The project has performed two experiments. The first one, with epoxy paint was not conclusive; the second one based on the use of fiberglass for fish holds gave excellent results but was by far too expensive;

- drain regularly ice melt waters mixed with fish «juices» from the bottom of fish holds; PELFISH has demonstrated that the installation of drainage pipes - very simple and costless devices - without disturbing the bulk of the fish give very positive results;

- improve vessels stability through the use of stabilizing "wings" fixed to the hull of the boats on both sides just below the water line. This might be effective in reducing side to side movement of the boat and therefore damage to fish in the hold.

*** Ice crushers experiment**

Large purse seine vessels traditionally ice fish in the holds with large blocks of ice with only a small proportion being broken into smaller pieces to be mixed with the fish. It results in various problems which affect the quality of the fish :

- the fish is inadequately chilled,

- the large pieces of ice, cause considerable damage to the fish,

- the weight of the ice blocks (up to 50 kg each) cause fish damage.

The bottom of the hold is left unprotected by ice. Ice and ice melt water are able to move around in the hold causing damage.

As a result the fish quality from the large purse seine vessels at unloading is rarely better than second quality. The main suppliers of top quality fish for distant fresh fish markets are the mini purse seiners which spend shorter periods of time at sea and are able to land their fish within 5 days of capture.

For all these reasons, PELFISH decided that it would be worth making trials on the use of on-board mechanical ice crushers.

The results from the first observations are extremely encouraging :

- there is no reduction in volume in the ice/fish mass during storage making reicing unnecessary;

- the fish holds can accomodate more fish than with traditional ice breaking methods;

- this reduces movement of the fish in the hold and pressure on the fish;

- speed of icing is increased considerably so that fish is placed under ice and reduced to ice temperature faster than normally.

The result of the factors listed above is that the fish at landing is of better quality. Obviously, the experiment proved to be a very positive one. Other owners are planning to install similar ice crushers and it will be very interesting to follow this evolution.

*** Hygiene and Sanitation**

At last, it is always the consumer who is affected by the effects of bad quality. The appearance of the fish plays a major role, and the prices classification within four categories - from the best to the worst - gives an accurate illustration of this situation. Furthermore, nutritional value is more or less correlated with the appearance.

Hygiene and sanitation which are directly correlated to handling and conservation conditions. In 1995 preliminary studies revealed that fish was contaminated before being unloaded from the holds; that pathogenic organisms were found in the river water used to wash the fish during sorting and unloading; that the contamination was increased by the present handling systems. It was proposed therefore to undertake other studies at Pekalongan of the incidence of pathogenic bacteria at all points during the unloading and sale of fish. Analysis for pathogens of sea water at catching points, ice and salt used for preservation, surface, meat and eviscera of fish taken straight from fish holds at landings, water used for fish washing and for hosing down fish landings were recommended. The first results at Pekalongan, even if they are preliminary, are worrying. The contamination of baskets is confirmed and this problem should be taken into account by the authorities. Ice supplies and ground water supplies show in some cases pathogenic bacteria, further samples should be taken in order to ascertain these results. Bacteriological studies have shown that Pekalongan river water should not be used as it is heavily polluted. Even if some of these results have to be confirmed, they strengthen for the authorities the supply of clean water for the fishing industry at the Pekalongan fish landing. The analysis should be extented to include other landing places, Juwana being the first priority.

It was found that the public health administration people were conscious of the importance of the hygiene issue for fish consumers. But, except these specialists, it seems that there is not such a concern in the fisheries context. For both administration and private operators hygiene and sanitation are not first rank priorities. This is now a major issue. Nevertheless, the necessary technical recommendations are totally ineffective if they are not supported by administration and private operators. It seems that they still are not really sensitive to the sanitary aspects which will become economical aspects.

*** Conclusions**

Among others, three specific conclusions are highlighted :

- The reduction of fishing time and fuel consumption experienced following the introduction of GPS into purse seine vessels has shown positive advantages for the purse seine vessels operating in the Java Sea from the North Java coast and there is every sign that within a few years GPS will be standard equipment on most vessels.

- The use of ice crushers on board purse seine vessels shows very positive advantages in maintaining fish quality and increasing the value of fish landed. The further publicity and extension of this technology to other fishing groups is recommended.

- It was proposed that further PELFISH research should concentrate on pin-pointing the source of contamination of fish at the fish landings to produce evidence for the decision makers as to the actions required to overcome the problems.

In both fields of harvesting and post harvesting, recommendations have been given and improvements suggested. The analysis of harvesting and fish quality issues led to two different standpoints. It was considered that the exploitation system represent a fair compromise between traditional ones and more modern fisheries. Should it be turned upside down classical difficulties could arise : unemployment and/or economic losses and/or biological surexploitation. The case is totally different for fish quality and the authorities in charge should not hesitate to give a high priority to the improvments concerning that sector.

6. SYNTHESIS APPROACH

One of the major results of the Project is in depth collection of existing informations on Java Sea pelagic open water fisheries and their physical and human environments. Along with the description of the exploitation scheme and the commercialization issues they allow us to give a first synthesis on the system and its functioning. Even if it has to be completed and reinforced it gives the preliminary basis on which the fisheries management should be built.

*** Spatial extension**

The geomorphological concept of Java Sea has been useful but no longer fits in with the system which supports the medium and big seiners exploitation. It is clearer that the bioecological links with South China Sea should not be overestimated. Some exchanges exist, as stated by Hardenberg (1938), but it would mainly imply coastal species. There are seasonal exchanges through the Sunda Strait, but they have an influence only on the South-West waters of Java Sea. The influence of oceanic waters through the wide and deep eastern opening - even if it is modulated owing to interannual climatic variability - is much more important. It can be said that, for some of the small pelagic species, the Flores Sea to South Sulawesi and Makassar Strait up to Banda Sea are probably parts of the system.

This emphasis given to the eastern part is demonstrated also when one considers the exploitation data. The bulk of the catch comes now from the surroundings of the islands situated north of East Java and Madura and south of South-East Kalimantan (fig. 1). This eastern shift has reached the East Kalimantan fishing grounds and explains the growing importance of Juwana and, on another scale and for various reasons of Brondong, main harbour on north coast of East Java province.

*** Bioecological safeguards**

The examination of the open waters pelagic stocks exploitation in its present state, shows that there are specific characteristics which lead to some safeguards to surexploitation :

- The combination of <u>different life cycles</u> for the main target species mean that their vulnerability is only partial, coastal and neritic species being protected in shallow waters (but their catches by small scale fisheries is not well known) and oceanic species being out of reach, at least for their adult components in eastern waters.

- Owing to acoustic studies results, the <u>biomass repartition</u> seems to be scattered and fish overdispersed when comparing with others pelagic ecosystems in the world. This original feature has to be related to Java Sea specific environment characteristics which lead to specific fish behaviour. Usually, small pelagic fishes are found in shoals which represent natural concentrations easier to find and to fish. It could explain why the fishing occurs mainly at night and why the operations of concentration (with aggregating device and/or light) are quite long, enabling generally only one seine haul, sometimes two, during the night. Even with nets and

lights improvements it means that the individual effort for a given boat should not rise very much. It seems to be a natural constraint limiting fishing effort.

- Safeguards have been placed on the size of vessels.There are two limits to the size of the vessels : on the one hand, coastal waters along Java Coast are shallow and the harbours are built round river estuaries in Central Java. The draught is low and already larger seiners have problem to enter the harbour when coming back from fishing cruises. On the other hand, the traditional keels building with one wood piece does not seem able to adapt to bigger boats. From this two points of view, the present seiners seem to have reached their maximum size (at present, 36 to 37 meters total length).

In order to deal with these natural constraints as well as for management purposes, it would seem sensible to limit the size of seiners. It seems that a maximum length round 30 meters - that is to say about 120 tons - would be quite suitable.

*** Present state of exploitation**

The purse seine fishery has been developing at a steady pace during the past fifteen years. The increase in total catch - from 30,000 to 150,000 tons (fig. 2) - was accompanied by changes in number of boats, size of vessels, growing fish holds capacities and increasing engine power. There was also a marked eastward trend for fishing grounds which brought about an eastern development of activities ashore in Center and East Java provinces.

At present, the situation seems good with high catches, strong activities in post harvest, numerous employments for fishermen and good payback for owners. Nevertheless, a more detailed look at recent data is not so optimistic. During the last four years, the total catch has not been increasing and remains at 150,000 tons. The catches per unit effort present maximum values for 1992 and have been decreasing since (fig. 2) : 37% less for both medium and large seiners. It means that, as the fish prices have not changed very much, the income per vessel has been decreasing.

To understand the future development of this fishery, it is possible to learn from its recent history, and, more precisely, from its evolution between 1985 to 1988. It was the first crisis with a sharp decrease in total catch, together with a parallel drop for large seiners catch per unit effort. It was probably due to the combination of factors among which the most obvious were unfavourable climatic conditions, overcrowded fishing grounds and perhaps increasing of fuel taxes. Consequently, the number of large seiners has decreased rapidly, less 40% between 1986 and 1991; and the medium seiner fishery has been developing even faster : from 85 (1987) to 238 (1992).

After three difficult years, the situation was reversed thanks to much more intensive prospection of fishing grounds eastward. Then the same process started again : total catch increase, sharp increase of the number of boats in 1991/1992, vessel size increase, together with cruise range.

At present, the fishery is on the verge of a new crisis which should be different from the previous one. The present situation has globally three main characteristics :

- With the present vessels,the prospection of Java Sea fishing grounds seem to have reached the maximum extension. The western-part of Java Sea does not seem to mean a rich future for seiners : shallow waters, bottom often muddy or rocky and occurrence of small pelagic fishes rather poor. The whole continental shelf in the

eastern part of Java Sea and northward in the Makassar Strait is exploited. South China Sea is already exploited and gives only a complementary production when Java Sea fishing conditions are bad.

- The stagnation of total catches for the past four years has two meanings. Firstly confirms that all fishing grounds are exploited : everything being equal, we have reached a kind of «maximum sustainable yield»; secondly, it illustrates the safeguard for surexploitation, as seiners are not able to fish on all species stages.

- The decrease in catch per unit effort means that the total fishing effort has been increasing. This is due to more vessels, more effective (light power, size of nets, ...), rather than an increase in the number of seine hauls per vessel, the latter being limited by the scattered biomass.

From 1980, the resources management has been unobtrusive except for regulations on mesh size and distance from coast zonation, which are not really followed. It did not matter so much during the development phase, as long as the stocks were reacting positively. Everything being equal, the next crisis should be different : the main problem would not be biological surexploitation, but obviously economic surexploitation. The management issue has to be faced very urgently now.

*** Socioeconomic issues**

Even if total catches seem to have reached now a maximum level, this recent fast growth has been changing all the cards, with significant technical and social evolutions, among all operators categories in Central Java. The challenge is difficult, considering that the new trend in the fishery is just beginning. The great vitality and capacity of adaptation, among vessel owners, fishermen, processors, traders, is remarkable, but, it is necessary to highlight the strong constraints stemming from the extension of their activities.

- Vessel owners : They have to find the financing for lauching the large seiners of the new generation. Moreover, they have to be able to follow the technical evolution towards sophisticated gears of communication, navigation, catch, ... They have also to improve their management capability. It means that, in the current conditions, only few people could take dominant positions in the near future sustained diversification of the activities, access to the credit, education and technical skills and, of course, a solid lobbying ability. In such a context, the main problem concerns the middle size companies. Until now, their main advantages were their skills in fishing and good integration into the community, most of them originating from the fishermen milieu. It will not necessarily be sufficient to survive in this new context, unless specific measures to be taken by the administration.

- Crews : They have taken advantage of the fishery growth in the last years, in terms of employment, income, and - for the better specialists (skippers and mechanics) - significative improvements in their financial and social status. Therefore, the tendency is to a radical break between the elit of the crew and the big majority of the unskilled deck hand fishermen, who remain very vulnerable. They have few opportunities of rise, no social security, and depend on the owners paternalistic system. The hypothesis of mechanization of the catch (net hauling with the help of hydraulic winches) would deprive many unskilled deck-hand fishermen of their jobs, as they are mainly occupied with hauling the seine nets manually.

- Processors and traders : Following the growth of the catches and the excellent prospects from a largely unsatisfied demand, this sector has seen a strong expansion in the recent period. Its main characteristic is capital saving and is consequently able to offer many jobs opportunities

near the production areas. The possibility of social ascension is largely opened for people with low level of education, but coming from (or working with) the world of fish (employees of fisheries services, transporters, unskilled workers, brokers, ...). This is true also for women of the fishermen milieu, and their importance in trading and processing is far from being insignificant. But, one must not forget that the enlargement of scale exposes to bigger risks, particularly in matter of products preservation, and short term credit facilities

- Consumers : There are good reasons to anticipate a broad margin of growth for the local fish consumption. People's diet is lacking in protein contents, particularly in animal proteins. This diet is still far from the FAO standard (16 kilos of fish per year and capita for a standard of 25-30 kilos, 1993). The long term growth of the demand of fish is secured by the strong economic growth rate, currently 6% per year. The large scale of the market, with a population of 200 millions of people, will give for a long time a gap between landings and needs. New possibilities to provide the inland populations, particularly in Java, are given by better communications and better preservation (ice, frozen fish and refrigerated seawater, ...).

In this context, two main questions have to be taken into consideration :

- The quality of the cheapest fish products offered for human consumption in Indonesia is not satisfactory. The authorities have to escape from the vicious circle, where fish remains relatively cheap, but doesn't meet sanitation standards. In this matter, it is easy to improve quickly the quality by using simple solutions : ice crushers, better holds insulation, cleaning of baskets, quality of water, ... Until now, professionals have neglected this aspect. It is necessary to improve conditions in order to reach standards of hygiene and sanitation because of the presence of human pathogenic bacteria in the environment, particularly sensitive in the tropical context.

- The second problem concerns the access to fish for low income people. By now, the fish prices seem to be still attractive, compared to the substitutes animal staple food, as chicken. But, as we don't really know the patterns of consumption in Indonesia, it remains difficult to foresee at which level the modifications could occur. Anyway, the authorities have to protect the poorest by avoiding a general rocketing in prices

From current knowledge on this fishery, the management issue seems clear, if the same technological context and «natural» existing limitations on fishing effort remain. The fish quality will be a problem owing to the duration of the cruises, the poor handling on board, the use of polluted water in harbours and the waiting of seiners in Pekalongan and Juwana for several days before landing. In brief, the current dynamics remains precarious and has to be accompanied by an ambitious management policy, not only for regulating, but also for taking measures of educative, technical and financial support.

7. LESSONS TO BE DRAWN

At the end of this very short presentation of our multidisciplinary results we have to point out strong and weak points of our studies, in the sight of the management objectives which could better be analyzed as definition of biological constraints and social objectives.

A basic understanding of the functioning of the system which is represented by small pelagic stocks in Java Sea open waters, their exploitation by seiners fisheries and distribution and commercialization through North Coast harbours. The main results deal with bioecology, acoustics, exploitation system, socioeconomics. In order to reach the general objectives initially fixed, we had to build a multidisciplinary team able to describe the functioning of the whole system.

As we have already been presenting our results within sections 3 to 6, we will rather underline here weaknesses and failures, if any, in order to draw some perspectives which are developed in section 8.

*** Multidisciplinary approach**

Classically fisheries biologists focus on population dynamics and exploitation and their major interconnection with social sciences occurs at the end of the production process with landings in harbours; the economist then takes in charge the quantitative and qualitative issues through transformation and commercialization channels. From this point of view we think that the objectives have been reached. Nevertheless we still find weaknesses in our general knowledge, from two points of view, at least.

The environment case is a special one, as information and data collection are under the authority of other state agencies and were mainly out of reach of such a project as PELFISH. For all living marine resources monitoring and survey as well as for oceanographic studies (productivity, pollution, ...), Indonesia needs permanent means at several scales. More attention should be paid to satellite data (remote sensing) on the one hand, and on the other hand it has been suggested to install a permanent network of coastal stations, cheap and easy to manage, which would give very valuable informations on the quality and dynamics of marine waters. The inter annual variability issue should be analyzed and an index could be developped, accounting both for local variability and large scale variability (ENSO). During the project, we had to limit our studies and the environment functioning has been guessed through ancient data and partial recent ones.

For socio-economics, we have two different situations. In the economic field, the study of firm competitiveness is still in progress, and, generally speaking, a valuable information on costs is difficult to get as owners and fishermen are reluctant to give details on the financial side of their activities. In the social sciences field - but for innovation, adaptative processes and women part in fisheries - the sociological knowledge is too low as well for recent history, social life, employment. Here also, for other reasons, it is often difficult to get relevant data and information.

In brief, the aquatic resources management should rely on better ecological and socio anthropological data as they are integral components of the exploitation system.

*** Global scale**

The initial definition of this project's frame was given by the Java Sea open waters, the small pelagic stocks within this area, the so-called medium and big seiners catching these fishes in these waters and the corresponding post-harvesting activities. The general postulate underneath this definition was that it was more or less an unity which could be described in itself. This assumption has proved to be a valuable working hypothesis, leading to proposals for next steps in management. Nevertheless, we have to underline that this general definition present at least two major weaknesses for a better understanding of the whole system.

The first one is related to the spatial repartition of the small pelagic stocks and the bioecology of the main species : more should be known about areas which could be important bioecological ones for some of the species caught : West Java Sea and South Kalimantan waters for neritic and coastal species, North of Makassar Strait, Sulawesi and may be further eastward for oceanic species. Understanding the Java Sea open waters small pelagic fisheries means studying also Java Sea coastal waters and links with adjacent water bodies, at least from two points of view : spatial repartition of species and populations (genetic studies) and quantitative estimates of the abundances (biomasses through acoustics but the disponibility of modern and adapted research vessels is a preliminary condition (cf. section 3.3).

The second one concerns the exploitation scheme. The importance of the mini seiners fishery is demonstrated (cf. section 4.1) and their contribution to the total captures of the main small pelagic open waters stocks should be taken into account. Beyond our first study, we need to better know this fishery for its overall quantitative impact, but also for its socio-economic specificities as it is an interlinking field towards coastal and littoral fisheries.

Thus, the Project brought up new questions, mainly outside its initial scope as it is not really satisfactory to deal with small pelagic only. Along our way, it became more and more obvious that strong interactions are found between fisheries, between fisheries products and with other next economic fields (aquaculture, transport, ...). Even more the coastal waters present a specific landscape with high competition on coastal resources, changes of the environment through human behaviour (infrastructures, pollutions, ...). It can be concluded that, beyond the next steps presented in section 8, the frame should be even larger, including all marine resources. It means a systemic approach of Java Sea aquatic resources exploitation and management. Such an approach will have to deal with complexity and imply involvement of co-management process. Thus the future should combine classical numerical knowledge and more modern approaches taking into account complexity linked to multispecific populations.

*** Comparison with initial objectives**

The scientific arguments for the choice of open waters seiners fisheries relied on three hypothesis : quick evolution, low interaction and statistical feasibility. On the whole these hypothesis were verified. The fishery dynamics has been evident throughout the whole period, from 1979 till now. It is this quick evolution which allowed us to interpretate the first crisis and give some warning about the present situation. Concerning interaction, we have to take into account miniseiners fisheries, but anyway medium and large seiners catches produce 75 to 80% of average catch. The statistical feasibility has been verified while comparing our sampling with administration data for Pekalongan and Juwana harbours. But here again, these data do not

include miniseiners activities, which case is much more complicated with numerous vessels, low individual catches and scattered landing places.

On this rather sound postulates, the general objectives were aimed at studying and improving the exploitation and the organization of off shore pelagic fisheries and promoting their development in the long term. Studying and giving advices for improvements have been done through several channels : on the field trainings and demonstrations, as well as technical workshops, scientific seminars and panels with administration, private operators and fishermen. From this point of view, it has been fully answered to the terms of reference, the question remaining on the willingness of fishery administration and private companies to follow recommendations and proposals.

A special attention has to be given to technological innovation. Through various technical expertises, PELFISH was able to perform a sound evaluation of the possible improvements compatible with the general development context. To give recommendations is not sufficient and we have been trying to give as far as possible on the field demonstrations. For the most obvious improvements (Global Positioning Systems, ice crushers, ...) we could feel some change in the behaviour of some captains, owners, fishermen, ... Nevertheless, it is also obvious that the project had not enough time and means to go further in this direction. One of the priority of the suggested Extension Project will be to have a strong action in transferring and training innovations and improvements at the fishery scale through permanent actions in the two main places at least, Pekalongan and Juwana. This should involve post harvesting as well as fishing means, better handling as well as better navigation, ...

*** Management**

The overall potential of the offshore stocks remains unknown but there are some indications of approaching full exploitation. In the absence of appropriate onboard fish preservation facilities, the bulk of the landing continues to be of inferior quality. The prices remain about half those paid for first quality fresh pelagic fish only; currently, most of the catch goes to traditional processing into products with a short shelf life, whilst established canning plants remain under-utilized. Nevertheless, the fishery now supports employment for a minimum of 100,000 persons, including fishermen (18,000), boat builders and maintenance engineers, harbour personnel, auctioners, fish wholesalers and retailers, traditional fish processors, and distribution. The socioeconomic importance of such strategic field on North Java Coast does not need to be emphasized.

In such a context, managing level of catches through regulations on maximum size of vessels (hence size of seine and unit fishing effort) and number of vessels would be efficient. It could be combined with output management through individual quotas (TAC) as the landings occur (90%) in two harbours (Widodo and Durand, 1996). Nevertheless it should be kept in mind that managing the quality is also a priority issue as well from economic point of view - the prices reflecting more or less the quality - as from the sociological ones as it would improve nutritive and sanitary standards.

Unfortunately enough, the resource management expertises planned during the extension phase (January 1995/June 1996) could not be fully implemented before the end of the project. A first provisional Work Plan and a mission on the feasability of bioeconomic modeling has been carried out. There is still the need for an expertise on Monitoring, Control and Surveillance and a general synthesis including a description of the institutions involved in management. Prior to a possible Extension Project, the management issue has to be completed as proposed below in section 8.

8. PERSPECTIVES and RECOMMENDATIONS

PELFISH objectives were given using different key-words : Java Sea open waters / small pelagic stocks / seiner fisheries. The results given in the preceeding sections show that these terms of reference do not define a closed system : from the bioecological point of view as we have to deal with the inaccessibility of Java Sea coastal and oceanic oriental components, as well as from the exploitation point of view as other fisheries interact (miniseiners and others) with big and medium seiner fisheries. Nevertheless, the main mechanisms are known and we have now a reasonably safe understanding of the system, that is to say «from environmental variability to processed products». It allows us to identify what should be done to reach the ultimate objective which is the implementation of, broadly speaking, the system management. It means taking into account very important socio-economic activities as illustrated by the main average figures : total catches round 150,000 tons; total employments about 100,000; total landings value about 90 billions rupiahs.

What we know and what we shall know led to numerous and various recommendations in every field. These recommendations are easily distributed in two consistent sets. On the one hand, the results and data have to be exploited in different ways, the hypothesis have to be checked and deepened, a better transfer has to be done, ... and it means a time table exceeding the first project planning. All these issues refer mainly to more upstream activities which belong naturally to the field of the scientific institutions involved. On the other hand, the more downstream issues - like resource management, fish quality, innovation, ... - have to be taken separately as they need urgent answers and specific means. As a result, PELFISH perspectives should take the form of two programs :

- REsearch and DEvelopment for MArine Resources (REDEMAR) gathering issues which have to be deepened and/or solved in order to have a better understanding and thus a better management;

- Pelfish Extension Project (PEP), dealing essentially with the management implementation.

Such a schematic presentation should not conceal the links and overlaps between the two domains. They are obviously wholly complementary. Furthermore, every activity upstream implies an asking from the development, and, reciprocally findings through research should be directly useful to development and management.

8.1 REDEMAR

AARD and ORSTOM have signed on the thirteenth of November 1996 a Memorandum of Understanding (M.O.U) in the general field of land and water resources exploitation improvement. The Rider 1 to this M.O.U. deals with Marine Resources Exploitation and refer to a two years plan of operations (July 1996 to June 1998) under the title «*Towards systemic approaches of fisheries in Indonesia based upon Java Sea Models*», the usual acronym still being PELFISH.

The main justifications are the following :

- From 1990 to 1996, AARD and ORSTOM have collaborated in the frame of a European Union funded Project (in short : PELFISH). At the end of the Project (June 1996), some of the main objectives have been achieved namely :

  - Data base in biology, acoustics, population dynamics, socioeconomics;
  - Diagnosis on possible improvements in matter of technological issues and fish quality;
  - Diagnosis on stocks rate exploitation and possible management schemes.

- Nevertheless the formalization and valorization of PELFISH results should go on in order to extend the expertise to other Java Sea fisheries and to be able to conduct comparative studies with other marine fisheries in Indonesia.

The main operations are the following :

* Specific Programs

  - Big and Medium Seiners : Statistical data Collection
  - Mini Seiners : activities and fishing efforts
    investments, cost and incomes
  - Fishing activities experiments through GPS (Global Positioning System) and data loggers
  - Marine fisheries development and village organization
  - Commercialization of Java Sea fisheries catches

*Data exploitation

  - Mini Seiners
  - Population Genetics
  - Otolithometry
  - Incomes and investment (Big and Medium Seiners)
  - Commercialization

* Data Base and Transfer

  - Exploitation statistics
  - Socioeconomics

- Acoustics

* Training

In Indonesia : Acoustics
Keyboarding and basic softwares

In France : Acoustics
Otolithometry
Fishery Resources Economy
Fishery Management

*Publication and Valorization

- SOSEKIMA proceedings (Seminar on Socio Economics, Innovation and Management)

- Special synthesis on innovation

- Diagnosis on exploitation state

- AKUSTIKAN proceedings (Seminar on Acoustic : Behaviour and Biomass Evaluation of pelagic fishes)

- General synthesis

- Video on small pelagic fisheries

This cooperation is a direct and very positive outcome of the PELFISH activities. For all these operations, the means and budget are mainly found in AARD and ORSTOM. The team is located in the same office as was PELFISH first team in Ancol.

8.2 PELFISH Extension Project (PEP)

In order to fulfill the general objectives initially drawn, it is proposed to enforce an extension project which would involve the management resources aspects, the general implementation of innovations in fishery and post-harvesting sectors, and a few complementary actions directly linked with these issues. Thus, management has to be understood here in a broad acception - and not the classical presentation on fisheries and stocks - as it involves the whole system. As an illustration, we could say that it could include : collecting relevant information (environment/biological parameters/harvesting and post-harvesting, ...); strengthening of institutions; providing scientific expertise; giving technical information, ... One has also to precise the meaning of the word extension here : use the results and conclusions of PELFISH - which was mainly a research/development program - to apply within the fishery and make the information/technology available, ...

During the prolongation of PELFISH the objectives have been reoriented towards management and further expertises on fish quality. On the whole we are able to sketch the general outline of the proposed extension project. But there are still lacks which do not allow us to get directly to this project, for example expertise on control and survey, synthesis report from the resources management experts, discussion with DGF, ... This is why we propose, prior to the launching of PEP proposal, to perform the complementary expertises, then to present all

recommendations and conclusions at a workshop held in Jakarta as soon as possible between AARD, DGF, PELFISH, management experts and European Union.

*** PEP General outline**

A) Data collection

In the course of our work we have identified deficiencies which could limit the implementation of management :

- further research on the spatial structure of the fish stocks and the possible effects of catch in other regions;

- better assessment of fishing efforts using standardization methods, dissemination of log books, direct observations through the installation of GPS and dataloggers, ...;

- better knowledge of miniseiner fisheries : collection of catch and effort data but also basic information on socioeconomics;

- the weakness of costs data makes necessary a detailed survey of all fishing costs, encompassing all sectors of the fishery;

- the analysis of the competitiveness of processing and trading firms, together with data on employment and informal sector has to be carried on;

- all data bases, concerning all subsets of the fishery system should be centralized in an unique location.

From the list of operations given above for REDEMAR, we notice that, more or less, the above data collection seems included in the AARD/ORSTOM agreement. Whether they should belong to both or not is a matter of priorities and means thus should be discussed prior to the installation of PEP.

B) Fish quality

Based on the work undertaken during PELFISH on fish quality and post harvest fisheries development, the following activities are recommended :

- Onboard handling systems : the fish quality onboard would be enhanced through the use of mechanical ice crushers and alternative drainage systems. Demonstration and training could be combined with more general training in fish handling, hygiene and sanitation.

- Quality assurance : the fact that fish caught in the pelagic fishery of the Java Sea are generally not destined for export markets should not mean that the standards of handling, hygiene and sanitation are lacking. A module of PEP should concentrate on good quality assurance practices at fish landing points and with fish processors.

- Clean water supplies : the provision of clean water is one of the main problems associated with fish hygiene and sanitation. The introduction of simple but effective means of purification and the extension of this technology to the authorities responsible for provision of water in the fish landings, to ice manufacturers and to fish processors should be a major focus.

- Alternative handling systems : fish baskets at landing centers are non durable, cannot be stacked properly and unable to protect fish from contamination. Trial of

alternative containers should be conducted and if feasible introduced to markets as an alternative.

- Improved fish processing practices : on the one hand, various examples have been identified of improved practices which could find application elsewhere (for example, reducing the «browning» for salted/dried; production of smoked fish, ...); on the other hand, investigations will lead to improvements like for the process of salting fish on-board. Transferring these improvements would be another extension aspect.

C) Resources management

The Work Plan for the prolongation phase of PELFISH ranked high the formulation of management proposals among project's general outputs and defined the main objectives as follows :

- measures to adjust the fleet capacity and activities to the stock potential yield;
- risks associated with different management schemes, including *status quo;*
- implementation system for monitoring the fishery and enforcing the regulations;
- the institutional adjustments to implement the management scheme, notably the coordination between research institutions and fishery administration.

The first mission of the two management experts took place in September 1995. We may summarize their conclusions and recommendations (Troadec and Cunningham, 1996) in five chronological steps :

- assessment of all management relevant data and, thus, identification of missing ones leading to assumptions or guesses, implications in terms of risk and error;
- description of the current management system;
- short-term expertise in order to build a bio-economic model of the fishery;
- short-term expertise on monitoring, control and surveillance;
- global analysis conducted by the two experts.

The two first tasks have been performed by PELFISH scientists and the bulk of existing data has been used for tentative bio-economic modeling by a specialist. It was not possible to implement the two last steps, owing to delays and disponibility of skilled experts. It means that, prior to a possible implementation of this new project, the two expertises have to be realized in first priority.

Owing to the situation described above, we should implement first a transition phasis to complete the preliminary expertises already begun and give the best design to this extension project. It should include :

- Monitoring, Control and Surveillance expertise (MCS, 2 months), its short-term objective being to assist Indonesian administration to formulate and implement a comprehensive MCS system (the terms of reference are the same as previously given);
- Analysis by the management experts of all informations and recommendations given in previous steps (1 to 2 months). They should issue a synthesis report presenting all needs and options;

- As soon as the analysis of management perspectives will be available, a workshop should be organized with national administrators, planners and scientists. The general discussion should include also all issues already listed previously under «data collection» and «fish quality» headlines. This should give the best possible contents to the implementation of management for Java Sea marine resources.

It is thanks to European Union Directorate General I (external affairs) that PELFISH got the main financial means for equipment and functioning. The short-term activities and the possible project presented in this conclusion are obviously linked with the priority given by DG I to management. Consequently it seems logical to ask the same sponsor to be involved for the extension period and participate to the financing necessary for the preliminary phasis, the workshop and the extension project itself.

9. Organization of PELFISH

The PELFISH project was built upon the cooperation between three main partners : Indonesia, through the Agency for Agricultural Research and Development (AARD); France, through Scientific Research Institute for Development through Cooperation (ORSTOM); European Union, through Directorate General 1, external affairs (DG I). (See figure 3 organigram for general relations with other institutions).

The Institutions involved

INDONESIA

(1). Agency for Agriculture Research and Development (AARD). This agency is responsible for planning, organizing, incitating and controlling the national research and development in agriculture (including fisheries). All of the research management of the subordinate institutions should be in accordance with the national plans.

(2). Central Research Institute for Fisheries (CRIFI). This institute plays a coordinating role in fisheries research (including marine fisheries).

(3). Research Institute for Marine Fisheries (RIMF). RIMF provides a number of counterpart scientists and contributes in kind facilities for the project.

COMMISSION OF THE EUROPEAN COMMUNITIES

The C.E.C. has played a central role in co-financing the Project operating costs which cover the entire foreign exchange costs of equipment, scientific and technical supplies, vehicles and training along with local technical assistance, operating and maintenance costs for Project activities, including vessels, and expatriate consultancy inputs for the fishery study.

FRANCE

ORSTOM is a public establishment which is devoted to Research for Development in tropical areas. It provided mainly the long-term expatriate technical assistance which included fisheries biologists, acoustics scientists and engineer, one socio-economist and some short-term specialized expatriate inputs.

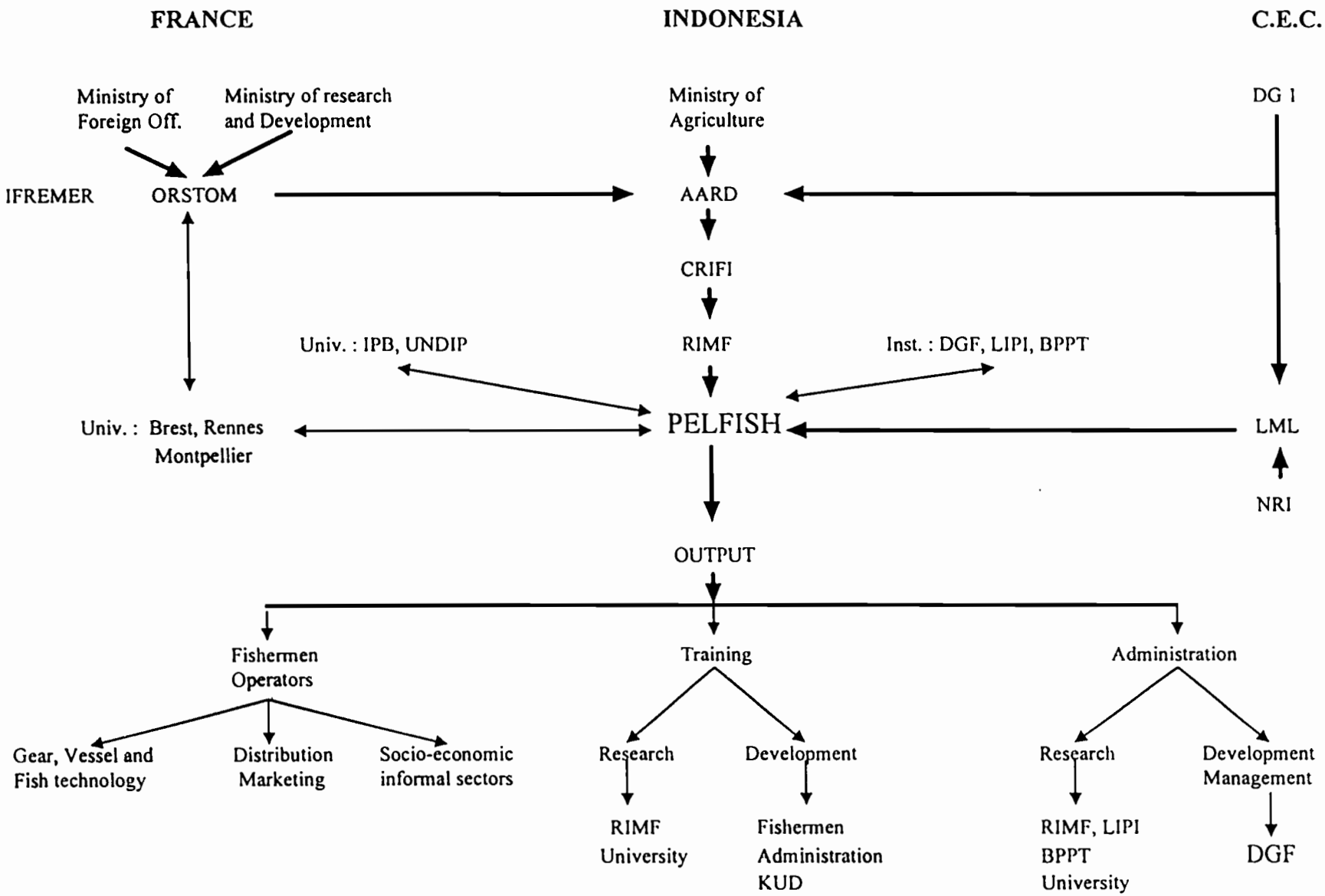

Figure 3 : PELFISH external relations (modified from Work Plan, 1991).

Human Resources and Staff

RIMF and ORSTOM provided respectively the co-director and the director. These two senior scientists shared the responsibility of the PELFISH Management Unit (PMU).

The permanent staff consisted of full time researchers and administratives appointed by ORSTOM, RIMF and CRIFI for the whole duration of the project. The list of personnel is presented in Annex 7a. The distribution and evolution of local manpower is given in table 1. It consisted mainly of secretaries and drivers in Jakarta and surveyors in the main fish landing places on the North Coast of Java.

Table 1 : Local Staff (months/years)

	1990	1991	1992	1993	1994	1995	1996	**Total**
Local Permanent Staff								
Drivers		28	48	48	48	48	24	244
Adm. Secretaries		6	15	24	26	24	6	101
Accounting					6	24	9	39
Technician						9	11	20
Wardens		24	24	24	24	24	12	132
Local Temporary Staff								
Investigators	16	90	145	216	251	412	100	1230
Total	16	148	232	312	355	541	162	1766

Short-term consultancy have been allocated to the Project by DG I through tendering which was carried off by Landell Mills Limited (LML). The first contract amounted to 41.3 man months and the additional one to 20.5 man months (cf. section 10 and Annex 7b).

France provided also some consultants from IFREMER (purse seine technology) and ORSTOM (to evaluate the Project implementation and results, assuring its scientific and technical value; specific scientific inputs, ...). On the whole, all consultants were coming from European institutions (state and private). As far as possible, each of them got an indonesian counterpart, in most cases from RIMF, in accordance with the subject.

Demobilization of permanent staff took place on the 30 of June 1996. The RIMF/ORSTOM scientific team has been maintained in Ancol in the frame of direct agreement between the two institutes. Some of local staff has been rerecruited for this two years program. On the whole, most of the staff involved during PELFISH has found immediate new job opportunities with other projects.

PMU functioning

The internal organization of PELFISH is given in figure 4.

The project's main office was situated in Ancol RIMF Sub-Center. Various data and informations were collected on the north coast of Java central Province, with three main locations : Semarang, R/V Bawal Putih I registry port; Pekalongan and Juwana, main fisheries harbours (fig. 1).

The ongoing activities were described every two months in bimestrial reports and preliminary results were given in semestrial reports. They were given a restricted distribution. A Steering Committee, gathering all parties involved, had a meeting at least once a year, in order to give advices on the proposed orientations.

The dissemination and valorization of PELFISH results were mainly undertaken by the way of Technical and Scientific Documents (Annex 5) and through the implementation of many workshops and seminars (Annex 4).

Initially, PELFISH has been divided in fourteen «Research and Development operations» :

1. Statistics, sampling and measurements
2. Board ship inquiries, fishing efforts
3. Processing of collected data
4. Biology of the major species
5. Echoprospection and cruises evaluation
6. Fish behaviour
7. Environment
8. Purse seine Technology
9. Fish Aggregating Devices (FAD)
10. Fishing boat Technology
11. Sociology and Economics
12. Marketing
13. The informal sector
14. Fish post harvesting

Such a presentation has proved convenient at the beginning but was no longer useful as the project moved ahead with results and new perspectives. It was agreed with the MTE's appreciation that "*the very complexity of the fishery and its importance as a food source, makes the economic and social factors as relevant as the biology, ...*" it means that, operation 11 (Sociology and Economics) and 13 (The informal sector) had to be looked upon as complete programs constituting one of the main priorities during the consolidation phase.

In order to achieve these objectives, three main fields activities, gathering these operations were defined :

- Biology, Fisheries and Stock Assessment;
- Socio-economic studies;
- Technologies : boats, nets and post-harvest.

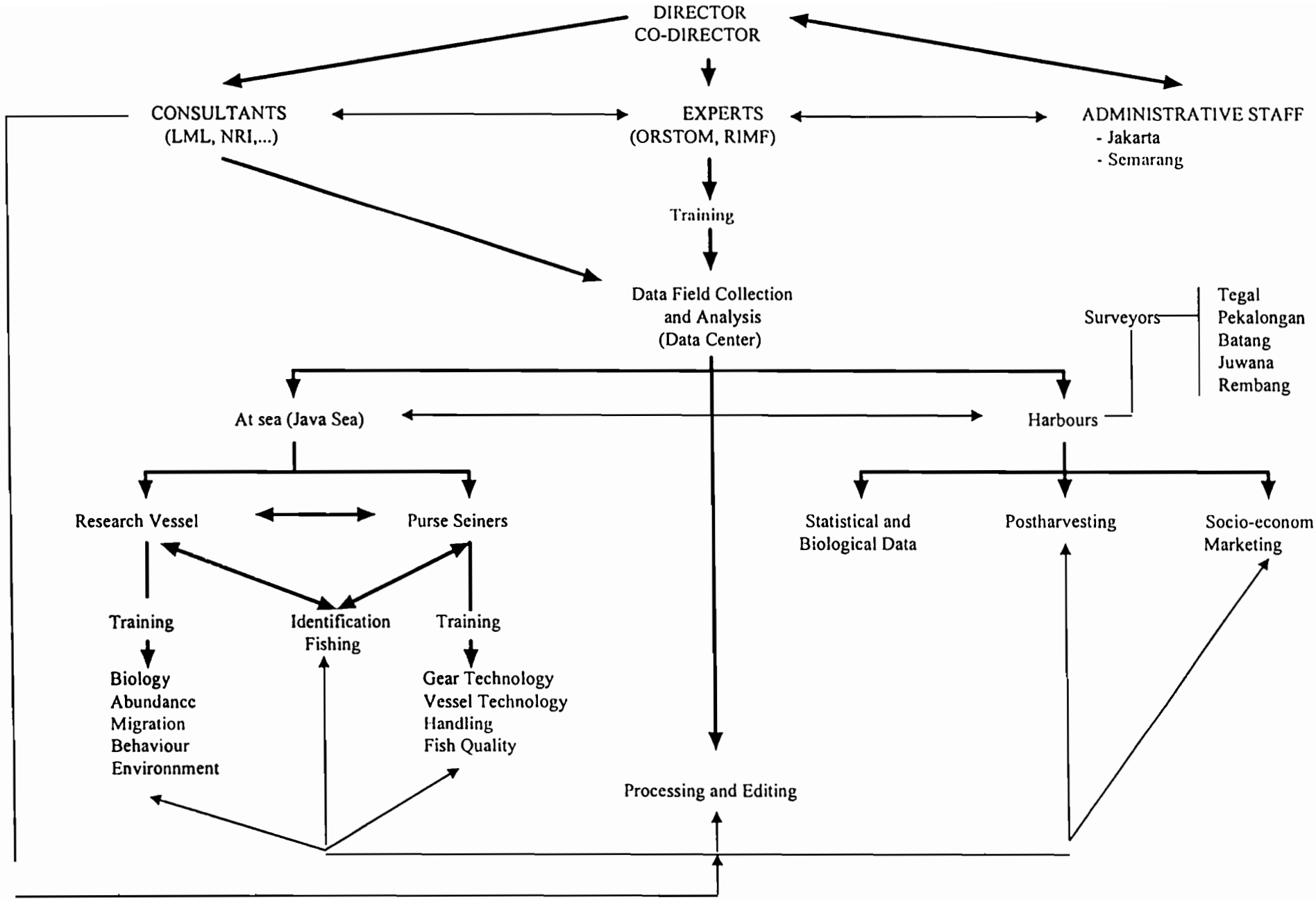

Figure 4 : PELFISH internal organization (Work Plan, 1991)

* Handing Over of Equipments

As indicated below (section 10, table 3), on the whole 700.000 ECU were used for purchasing various equipments, vehicles and supplies. Their exhaustive list is given in Annex 8, under three main headings : equipments installed on R/V Bawal Putih I (restoration, electronic equipment and spare parts); equipments installed on commercial purse seiners in order to demonstrate the utility of some innovations and perform the related on the job trainings (Global Positioning Systems, fish finders echo sounders, ice crushers and material for fish holds insulation); others equipments in Ancol with three main items : scientific equipments (hydro-acoustics and environment); computers and related devices (every scientific team and administration); vehicles (used in Jakarta and for Java North Coast field studies). As stated in the handing-over note (Annex 1) every equipment purchased through the C.E.C. grant has been given back to AARD.

As already said in section 3.3, the use of acoustics for marine assessments is given a high priority in Indonesia. All equipments and softwares are allready in use for a training course ORSTOM organize in Ancol.

10. BUDGET and EXPENDITURES

General financing

The financing memorandum between the Commission of the European Communities and the Republic of Indonesia was signed on the 5th of November 1988. The commitment of the community was fixed at 2.200.000 ECU covering :

"entire foreign cost of all project equipment, scientific and technical supplies, vehicules and training together with local technical assistance, operating and maintenance costs for project activities, including vessels, as well as expatriate consultancy inputs for the fishery study."

For the two other partners :

The French technical cooperation grant [had to] *provide the expatriate technical assistance (1.200.000 ECU).*
The government of Indonesia [had to] *provide the administrative and technical facilities and supplies, as well as local administration and services, and all salaries for project counterpart staff. It will also provide an existing suitable research vessel which will be rehabilitated and fitted out by the project to be at its disposal for about 280 days (450.000 ECU)* (*in* Annex to the Financing memorandum's special provision).

In order to extend the project up to 30/6/1996, the Rider No.1 was signed on 16/5/1995 reallocating 97.000 ECU from the original budget and approving an additional 428.000 ECU commitment of the Community.

The table 2 gives the repartition of the global contributions during the two phases, as cost estimates given in the Rider No.1.

Table 2 : Cost Estimates (ECU) for the Project and its extension

	Fin. Mem	Extension	Total
1. C.E.C. Grant			
Equipment and supplies	800.000	-97.000*	703.000
Training	400.000	49.000	449.000
Technical Assistance	300.000	409.000	709.000
Operation and Maintenance	700.000	67.000	767.000
	2.200.000	*428.000*	*2.628.000*
2. French Grant			
Technical Assistance	*1.200.000*	*702.000*	*1.902.000*
3. Indonesian Contribution			
Equipment and Supplies		60.000	60.000
Professional staff	250.000	320.000	570.000
Admin. and Recur. Costs	200.000	170.000	370.000
	450.000	*550.000*	*1.000.000*
TOTAL	**3.850.000**	**1.680.000**	**5.530.000**

* Transfer of resources from Equipment and Supplies to other budget lines.

The total cost of the Project was estimated at 5.530.000 ECU, the C.E.C. Grant covering 47,5 % (2.628.000 ECU), the French technical cooperation 34,4 % (1.902.000 ECU) and the Government of Indonesia 18,1 % (1.000.000 ECU).

PMU operations

The Project Management Unit was fully in charge with all local costs :

- Training (in Indonesia, abroad, local short term experts);
- Operation and maintenance (all field costs, R/V. Bawal Putih I expenses, seminars and workshops, general operational costs);
- The purchase of equipments was shared between Brussels (tendering on scientific equipments, including the initial purchase of computers) and PMU for all other equipments and supplies (Annex 8);
- PMU was not directly involved in the management of Landell Mills contract for Technical Assistance (cf. infra).

The Project accounting procedures were complicated as they have to follow differing accounting requirements from the two major donors, C.E.C. and ORSTOM. Furthermore, till 1994 they were hand-prepared. By adopting a new computer-based system the problem was solved for both C.E.C. and ORSTOM accounting requirements and it provided a better management control. The Annex 9 gives the yearly repartition of the PELFISH expenses from 1990 to June 1996. The day to day expenses were managed through deposits made on two bank accounts in Jakarta, respectively in French Francs and Rupiahs. These banks account have been closed at the end of the project (Annex 10).

The balances for extension phase and total for the Project are given in table 3.

Table 3 : PELFISH expenses and balances
(Rounded figures in thousands ECU, for more details see Annex 9)

	Financing Memorandum			**Rider 1**		**Total**	
		PELFIS Expenses	Balance		Cost Estimat.	PELFIS Expenses	Balance
Equipment &	800	663	+137	-97	703	700	+3
Training & loc TA	400	319	+81	+49	449	639	-190
Technical	300	420	-120	+409	709	(619)	(+90)
Operation & Maint	700	507	+193	+67	767	670	+97
Total	2200	1909	+291	+428	2628	2628	0

The *main phase* expenses balance need some comments :

- Equipment and supplies, Operation and Maintenance : the positive balance was mainly due to a lower utilization than initially planned of R.V. Bawal Putih. As the general biomass mapping of the whole Java Sea was impossible to perform, we decided to work on the basis of transects through the fishing grounds. Thus the need for days at sea was reduced from 280 to 180.

- Training and local T.A. : the explanation for the positive balance is found in the delay in implementing PELFISH. Training activities have been enlarging every year, with the completion of results and data.

- Technical Assistance : the original contract for technical experts did not include the master fisherman. Very early after the beginning of the project it appeared that the permanent presence on the field of a professional was necessary. The negative balance represents twelve months contract and related costs for masterfisherman. This presence was so positive that we asked to another twelve months contract during the extension phase, in order to reinforce communication between fishermen and PELFISH.

For the *extension phase,* we estimated at 720.000 ECU our needs for 18 months, with a stray input for Technical Assistance and merely no new equipment. Taking into account the 291.000 positive balance from the first phase we requested for a 428.000 ECU additional financing which was agreed through the Rider No.1.

The large negative balance for training and local T.A. has two explanations : some Seminars, Workshops, training abroad had to be delayed to 1995/1996 on the one hand, on the other the masterfisherman activities had a local cost higher than estimated at first : fields per diem were not taken into account in the Landell Mills contract and PMU had to finance 4,5 months contract in 1995.

Technical Assistance summary

Through a tendering in early 1991, Landell Mills Limited (LML) has been chosen as consultant for technical assistance. During the first four years, 41.3 man months were performed (Annex 11) dedicated mainly to master fisherman (14.5 months), Fish processing and vessel technologists (12.5 months) and Fisheries economist (7 months). The total cost has been 419.852 ECU; the C.E.C. grant provided initially 300.000 ECU which were extended in order to cover the master fisherman contract.

An additional amount for Technical Assistance has been planned during the extension phase : 20.5 man months (amounting to 230.000 ECU). It was mainly focused on an extension of the master fisherman contract (7.5 months) and various management expertises (9 months). Unfortunately, the latter could not be fully implemented : due to delays in the signature of Rider 3 (12 of June 1995), due also to difficulties in finding the right experts at the right time, due at last to the deadline on the 30 of June 1996, which seemed impossible to overpass. As already developped in sections 7 and 8, the lack of these expertises in the management field did not allow to give a full diagnosis on the management issues and related perspectives.

11. ANNEXES

1. Handing over note
2. Initials and Acronyms
3. Chronological Landmarks
4. Workshops and Seminars
5. Main reports and Publications
6. R/V Bawal Putih Cruises
7. Summary of Experts and Counterparts workink in the Projet
8. List of equipments
9. Project expenses 1990-1996 (in ECU)
10. Bank accounts closure
11. Technical Assistance Summary

Annex 1 : HANDING OVER NOTE

JAVA SEA PELAGIC FISHERY ASSESSMENT PROJECT (ALA/INS/87/17)

Today, 1997, marks the formal completion of the

JAVA SEA PELAGIC FISHERY ASSESSMENT PROJECT (NO. ALA/INS/87/17)

Both parties, the European Commission and the Government of Indonesia record their mutual satisfaction at the successful completion of this important project and wish to commemorate the occasion by signing this document which is done in two originals.

This project was undertaken by the Government of Indonesia with the assistance from the European Commission and the Government of France. The contribution of the Government of Indonesia was ECU 1,000,000, the European Commission was ECU 2,628,000 and the Government of France was ECU 1,902,000.

For the Government of Indonesia	For the Representation of the European Commission
Dr. Faisal Kasryno	**Mr. Klauspeter Schmallenbach**
Director General of AARD	*Head of Representation*

TEMPORARY HANDING OVER NOTE
JAVA SEA PELAGIC FISHERY ASSESSMENT PROJECT (ALA/INS/87/17)

On the day Monday the First day of July nineteen hundred and ninety six (1 July 1996) the undersigned :

1. Dr. J. R. Durand : Directory of Java Sea Pelagic Fishery Assessment Project, on behalf of the Head of the Representation of the Commission of the European Communities (EC), hereafter called the First Party.

2. Dr Fuad Cholik : Direction of Central Research Institute of Fisheries, on behalf of the Director General of Agency for Agricultural Research and Development (AARD), hereafter called the Second Party.

Prior to the formal handing over of Java Sea Pelagic Fishery Assessment project from the Head of the Representation of the Commission of the European Communities (EC) to the Director General of Agency for Agricultural Research and Development (AARD).

Based on Financing Memorandum between the Government of the Republic of Indonesia and the Commission of the European Communities (C.E.C.) No.ALA/INS/87/17 dated 15 November 1988.

Both parties agree to the hand over the Java Sea Pelagic Fishery Project facilities, financed by European Communities Grand and now completed.

The First Party hands over the Java Sea Pelagic Fishery Assessment project facilities to the Second Party and the Second Party agrees to receive the project facilities from the First Party.

The handing over mention is the Java Sea Pelagic Fishery Assessment Project facilities comprising equipment/supplies funded by the EC under the project.

The handing over marks the completion of EC financial assistance for the Java Sea Pelagic Fishery Assessment Project.

Matters which still require finalization will be agreed jointly between the First Party and the Second Party.

This handing over note is made in 2 (two) sets and signed on sufficient seal by both parties on the day and date mentioned above.

Second Party Direction of Central Research Institute for Fisheries	First Party Director of Java Sea Pelagic Fishery Assessment Project
Dr. Fuad Cholik	**Dr. J. R. Durand**

Annex 2 : INITIALS and ACRONYMS

AARD	:	Agency for Agriculture Research and Developpment
BPPL	:	Balai Penelitian Perikanan Laut (RIMF)
BPPT	:	Badan Pengkajian dan Penerapan Technologi (Agency for Assessment and Application of Technology)
C.E.C.	:	Commission of the European Communities
CRIFI	:	Central Research Institute for Fisheries
DGF	:	General Directorate of Fisheries
ECU	:	European Currency Unit
EU	:	European Union
GOF	:	Government of France
GOI	:	Government of Indonesia
IFREMER	:	French Institute of Research for Sea Exploitation
PELFISH	:	Java Sea Pelagic Fishery Assessment Project
IPB	:	Institut Pertanian Bogor (Bogor Agriculture University)
KE	:	Kilo ECU (ECU 1000)
LIPI	:	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Science)
LML	:	Landell Mills Limited
KUD	:	Koperasi Unit Desa (Village Cooperative Unit)
MTE	:	Midterm Evaluation
MPS	:	Mini Purse Seiners
BPS	:	Big Purse Seiners
Mrp	:	Million of Rupiahs
NRI	:	Natural Resources Institute
ORSTOM	:	French Scientific Research Institute for Development Through Cooperation
PMU	:	Project Management Unit
RIMF	:	Research Institute for Marine Fisheries (BPPL)
TPI	:	Tempat Pelelangan Ikan (Fish Auction Centre)
UNDIP	:	University of Diponegoro (Universitas Diponegoro)
VSN	:	Voluntary Service National

Annex 3 : CHRONOLOGICAL LANDMARKS
Annex 3a : General Agenda

N.B.: one will find more detailed informations on expert activities in annex 3b and R/V Bawal Putih cruises in annex 6.

May 1990	Beginning of the Project (Theoritically)
August 1990	Effective beginning of the Project
October 1990	Tendering for technical assistance. Landell Mills Ltd won the tender
December 1990	Arrival of T. BOELY as Director of the Project and long-term expatriate and Mrs. FORICHER, Head of Administration
January 1991	Tendering for materials and equipment in Europe (S. MARRIOTT)
February 1991	Mission of J.R DURAND (ORSTOM) for a Project evaluation
March 1991	Appointment of M. POTIER as a long-term fishery expatriate biologist expert of ORSTOM
April 1991	Restricted tendering for materials in Jakarta (S. MARRIOTT)
June 1991	Entered the Project premises in Ancol
July 1991	Arrival of D. PETIT in the Project as a Fisheries acoustician
September 1991	E.M AMIN and P. COTEL took part in advanced echo signal processing in London, UK
October 1991	Delivery of Biosonic echo-sounder followed by a sea trial on board of R/V Bawal Putih I; calibration test in November 1991
	Arrival of P. COTEL in the Project as an acoustic engineer
December 1991	First cruise of R/V Bawal Putih (12-20/12/91)
January 1992	Sea trial of Bawal Putih by B. CAMPILLO of ORSTOM. Problem of the main engine
February 1992	Approval of the Project revised Work Plan by AARD after having been approved by C.E.C and French Embassy
May 1992	Delivery of fishing gear and oceanographic equipment
August 1992	Fit a new insulation of fish holds on board BINATUR F in Pekalongan
October 1992	Evaluation of the Project by J.R DURAND (ORSTOM)
April 1993	S. WIDJAJA goes to ORSTOM France, for a short-term training with J. ROCH
	Dr. BOELY went back to France for serious health reason
	Manpower development by a specialized training course on the isolation and identification of pathogenic bacteria, attended by seven participants in RIMF Slipi 15-21 May

May 1993	Training course on Fresh Fish Handling, Hygiene and Sanitation in Tegal, Pekalongan and Juwana (160 participants)
July 1993	Arrival of J. ROCH in the Project as an Economist
	P. GUEGUEN, master fisherman, starts his works as a long-term expatriate expert in the Project
	J.R DURAND starts his works as the Director of the Project. He replaces T. BOELY
August 1993	J. BASMAL starts his long-term training on fish postharvest in University of Humberside, UK
September 1993	WIJOPRIONO started his short term training on vessel and gear technology in University of Humberside, UK
	Mid-Term Evaluation Team Mission
October 1993	Seminar on gear Technology of purse seine fishery, in Pekalongan and Juwana
	Signature of an agreement on a new seine trial with two owner : A. MARTOPO (Pekalongan) and J. BUDIHARTO (Juwana).
November 1993	F. GERLOTTO, an ORSTOM fishery acoustician, evaluated the programs on acoustics
	S. NURHAKIM joined the Project after his Ph.D graduation
	J.R DURAND and SUHERMAN took part in the 4th Indo-pacific Fish Conference in Bangkok, Thailand
December 1993	Steering Committee meeting on Mid-Term Evaluation results and recommendations
February 1994	N. LUONG, a VSN bio-statistician, started working for the Project
March 1994	Workshop on Biology, Population Dynamics, and Exploitation ofthe Java Sea pelagic fishery (BIODYNEX), 21-25 may 1994
	A Collaboration between Project and J. BUDIHARTO, Margo Fleet owner, on experimental fishing and some technological innovations
October 1994	A.T.GRAMONT, a technical support for the 18 months consolidation phase of the Project
	Second contract for P. GUEGUEN, a fishing master, for one year period
	First census on mini purse seiner fleet
	Arrival of I. ANTUNNES, cultural geographer
January 1995	Extension of the Project for 18 months, until June 30, 1996
May 1995	Last cruise of Bawal Putih (03-09/05)
	Arrival of L. VUICHARD, CSN working as an economist

June 1995	J. BASMAL succeded in his master program in the University of Humberside, UK
	Arrival of J.M. ECOUTIN, fishery biologist
August 1995	A. SARI entered his 2nd year master program in University of Humberside, UK
September 1995	J.P. TROADEC and S. CUNNINGHAM, fishery management experts, were in the Project to set up a work plan for a further studies for management
October 1995	Participation at Fourth Asian Fisheries Forum (16-20 October) in Pekin with 13 communications
December 1995	A seminar on socio-economics, innovation and management of the pelagic fishery of the Java Sea, namely SOSEKIMA, was carried out in Semarang (Central Java)
May 1996	Workshop and Seminar on Fishery Acoustics were performed in Jakarta and Semarang, respectively 20-24 and 26-29 May : AKUSTIKAN 2
June 1996	Project was terminated on June 30

Annex 3b : Visit of Experts and Consultants

Period	Expert/Consultant	Organism	Aims
9-22/05/90	BOELY, CAMPILLO, POTIER	ORSTOM	Starting of the Project and visit R/V BP I
21-30/09/90	BOELY, CAMPILLO	ORSTOM	Organization of the Project & Agreement between ORSTOM and AARD
7-15/01/91	S. MARIOTT	Consultant of EU	Preparation of the tenderings for material
15-22/02/91	J.R. DURAND	ORSTOM	First evaluation of the Project
07-22/03/91	J.Y. DREMIERE, J.P. GEORGE	Gear Technologists, IFREMER	
02-10/04/91	S. MARIOTT	Consultant EU	Evaluation material bought on place for the Project during a tendering
01/05/91	LEVALLOIS	President of ORSTOM	Meeting with AARD Staff
15/06-06/07/91	S. Mc ELROY J. ROGERS C. TEMPLE	Economist, LML Post-harvest, LML Naval architect	First mission
16-18/10/91	S. Mc ELROY	Economist, LML	Discussion on consultancy programme
25/10/91	S. Mc ELROY	Economist, LML	Discussion on national counterparty of macro economy
08/11-02/12/91	J. ROCH	Economist, ORSTOM	Define a working programme on social and economic espects of the purse seine fishery
15/11-04/12/91	P. NEALSON	Acoustician BIOSONICS	Control of Biosonics apparatuses and training
21/11-02/12/91	E. MARCHAL	Fishery and acoustician scientist ORSTOM	Evaluation of the population dynamic and acoustic programme of the Project
17/01/92	S. Mc ELROY	Economist, LML	Discussion on his last mission report
20/01/92	S. Mc ELROY N. PEACOCK	LML	Discussion on the Quarterly Report 2 and 3 and on the programming mission of the post-harvest, naval architect and socio-economics
23/01/92	S. Mc ELROY N. PEACOCK	LML	Finalize the programming mission for the LML's team in February to March.
27/01-03/02/92	CAMPILLO	ORSTOM	Perform sea trial for the evaluation of the R/V Bawal Putih I
06/02-17/03/92	I. CLUCAS A. REILLY	NRI	LML consultants in Post-harvest
18/02-17/03/92	S. Mc ELROY C. TEMPLE	LML Vessel technologist, LML	
10/06/92	F. GUILLERM	Private	Realization of the Project documentary film
03/07//92	G. SERRE	Private	Fish postharvest, especially for new products
10/09-16/10/92	J.P. GEORGE	IFREMER	Fitting out of the bottom trawl and of the purse seine
22/09-26/10/92	C. TEMPLE	Consultant LML	
22/09-23/10/92	I. CLUCAS	Consultant LML	

25/09-23/10/92	P.Y. DREMIERE	IFREMER	Improvement of the present purse seine used by the fishermen
10-25/10/92	J.R. DURAND	ORSTOM	Scientific evaluation of the Project
31/10-08/11/92	I. CLUCAS	Consultant LML	
05/11-21/12/92	J. ROCH	ORSTOM	Economic survey of the purse seine fishery
24/01-05/02/93	J.P. GEORGE	IFREMER	To set up a mid-water trawl, conduct fishing trial and discuss the use of new designed purse seiner with A Martopo in Pekalongan
01-09/04/93	J.P. GEORGE	IFREMER	Trial fishing on midwater trawl on bord the R/V Bawal Putih I in Karimun Java waters
20/04-16/05/93	I. CLUCAS	Consultant LML	Carried out a two days training course in eac harbor and participate in the workshop on LML consultancy results
12-14/05/93	S. Mc ELROY	idem	idem
27/04-18/05/93	C. TEMPLE	idem	Perform the last mission on vessel gear technology consultancy and present the results in workshop held in Semarang on 13/05/93
27/04-27/05/93	A. REILLY	idem	idem
15/06/93	P. GUEGUEN	Consultant LML	Master Fisherman
11-28/07/93	J.R. DURAND	ORSTOM	New Director of the Project appointed by ORSTOM
27/09-08/10/93	MARRIOTT H. KENNEDY	EU Team	Midterm review
28/09-11/10/93	J.P. GEORGE	IFREMER	To deliver a half day seminar on gear technology in Pekalongan as well as in Juwana and modify the experimental purse seine net in Binatur Company at Pekalongan
10/94	J.M. ECOUTIN	ORSTOM	First census of Mini purse seiners
16/11-04/12/93	F. GERLOTTO	ORSTOM, Fishery acoustics expert	Visit R/V Bawal Putih I, especially of her acoustics, and visit fisheries harbors of big purse seiners
17-27/03/94	P. FREON	ORSTOM	Give consultancy on Biology and population dynamics of the Project and take part in Biodynex workshop
19-26/03/94	SAILA GAYANILO MANSOR CALVELO CHEUNPAN	Univ. Rhode Island, USA ICLARM, Manila SEAFDEC, Malaysia BFAR, Manila Bangkok Marine Fish Dev. Center, Bangkok	Take part in the Biodynex workshop
03-17/07/94	R. CLIGNET	ORSTOM, Sociologist	Conducted a field observation along central Java North coast together with J. Roch and Sastrawidjaya to see the possibility on further studies sociology in the Project
15-17/07/94	J. CATANZANO	Economist, ORSTOM	Visited the Project on the way to Taiwan

16-23/07/94	J.Y. WEIGEL	Economist, ORSTOM	Perform a field mission to Pekalongan. To discuss on the possibility of further studies during the consolidation period of the Project
26/08/94	Luca FERUZI	EU Brussels	General review of the EU's Project in Indonesia
19-30/09/94	A.T. de GRAMONT	Consultant of EU	To formulate proposal of the the Project consolidation phase
23/11-18/12/94	R. CLIGNET	ORSTOM	Study on formation patrimony and risk of fishermen of the big purse seiners
21/11/94-28/11/95	P. GUEGUEN	Consultant LML	2nd term consultancy : 2.5 months contract which should be extended to 12 months till november 1995
26/11-13/12/94	F. GERLOTTO, P. PETITGAS	Fishery acoust., ORSTOM Geo-statistician	Joint in the Workshop of Fishery acoustics (AKUSTIKAN 1) held in Jakarta on 5-12/12/94
27/11-18/12/94	J.Y. WEIGEL	ORSTOM	Study on commercialization of big purse seiner's catch
01/11-07/12/94	I. ANTUNES	Human geographer	Worked for her DEA supported by ORSTOM
13/02-01/03/95	G. SERRE	Private, fish quality expert	Carry out further studies as the continuation of the first one performed in July 1992
07-21/03/95	J.M. ECOUTIN	Fishery biologist, ORSTOM	Carry out the second census on mini purse seiner fleet; the first one was performed in October 1994
17-19/04/95	J. LE FUR	Bio-economist, ORSTOM	To perform a comparative study on bio-economic model between small pelagic fishery of West Africa and the Java Sea
02-22/09/95	J.P. TROADEC, S. CUNNINGHAM	Fishery manag. ORSTOM Economist , Univ.of the Portsmouth, UK	Management of the Java Sea fisheries
11-26/10/95	M. POTIER	ORSTOM	To prepare and participate in 4th Asian Fish Forum
13-27/10/95	J.Y. WEIGEL	ORSTOM	Mission on commercialization of the fisheries
23/11-13/12/95	I. CLUCAS	LML Consultant	Study on the quality of fisheries
27/11-10/12/95	F. AKINDES	Univ. of Ivory Coast	SOSEKIMA 's Seminar
01-10/12/95	M. KEBE C. CHABOUD J. HAGE J.Y. WEIGEL R. CLIGNET Nik M. ABDULLAH C. PESTANO J. BUTCHER L. WESTLUND O. SISOVANN T.S. TANA N.A. TUAN C.T. CHUANG TAI SHZEE YEW	CRODT/ISRA Senegal ORSTOM Univ. of Maryland, USA ORSTOM ORSTOM Univ. Pertanian Malaysia Univ. Visayas, Manila Griffith Univ. Brisbane FAO Rome, Italy Ministry of Env. Cambodia Ministry of agri. Cambodia Cantho Univ. Vietnam National Taiwan Univ Univ. Pertanian Malaysia	SOSEKIMA 's Seminar (Bandungan, Central Java,4-7 december 1995)

02/96	M. GUILLAUME	ORSTOM	Making film in Central Java
15/04-16/05/96	R. CLIGNET	ORSTOM	SOSEKIMA Proceedings and meeting with UNDIP
27/04-14/06/96	M. POTIER	ORSTOM	Preparation of AKUSTIKAN 2's Seminar
20-25/05/96	P. CAYRE	ORSTOM	Visite PELFISH Project
20-30/05/96	F. GERLOTTO E. MARCHAL P. PETITGAS	ORSTOM	Attend to AKUSTIKAN 2's Seminar
	J. MASSE	IFREMER	
18/06-08/07/96	J. PANFILI	ORSTOM	Experiment on otolith ciruli validation on some fish species using tetracycline together with Suwarso in Ancol RIMF laboratory
22-30/06/96	I. CLUCAS	LML Consultant	Verified the work of Jamal Basmal on fish quality and delivered their report and recommendation for further studies in fish postharvest and quality control

Annex 4 : WORKSHOPS and SEMINARS

Seminar on the Pelagic Fishery Assessment in the Java Sea	Jakarta	March 21, 1991
Training courses on Fresh Pelagic Fish Handling, Hygiene and Sanitation	Tegal Pekalongan Juwana	May 1-2, 1993 May 4-5, 1993 May 7-8, 1993
Workshop on vessel, gear, postharvest technologies and socio economics on the Java Sea purse-seine fishery	Semarang	May 13, 1993
Seminar on fishing gear technology of the Java Sea purse seine fishery	Pekalongan Juwana	October 5, 1993 October 6, 1993
Biology, Dynamic and Exploitation of the small pelagic fishes in the Java Sea (BIODYNEX)	Jakarta	March 21-25, 1994
Workshop on fisheries acoustics of the small pelagic fishes in the Java Sea (AKUSTIKAN 1)	Jakarta	December 5-10, 1994
Seminar on socio-economics, innovation and management of the small pelagic fishery of the Java Sea (SOSEKIMA)	Semarang	December 4-7, 1995
Workshop on fisheries acoustics of the small pelagic fishes in the Java Sea (AKUSTIKAN 2)	Jakarta	May 20-24, 1996
Seminar on fisheries acoustics of the small pelagic fishes in the Java Sea (AKUSTIKAN 2)	Semarang	May 27-29, 1996

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Annex 6 : R/V BAWAL PUTIH I Cruises
Main Characteristics

Abbreviations used :

Meteorology	**G** = good; **M** = medium (force 2-3 Sea); **B** = bad (force 3-5 Sea)
Moon	0 = new moon; 1 = first quarter; 2 = full moon; 3 = last quarter
Log, radar, GPS	**G** = good; **M** = average functioning; **N** = absent or malfunction
Navigation	**G** = precise positioning; **M** = average or occasional positioning; **N** = estimated positioning without electronic equipment
Engines	**G** = good (speed around 7 knots); **M** = medium (≈ 6 knots); **B** = bad (≈ 5 knots or less with occasional stops)
Environment	**Y** = operational; **N** = non operational
Sampling	**Y** = realized; **N** = non realized
Transit SMG	Transit from Semarang to ... Matasiri (**Mat**)
	/ and from ... to Semarang Masalembo (**Mao**) Bawean (**Baw**) Tambelan (**Tam**) North Semarang (**Nsm**) Lumulumu / Balikpapan (**Lm / Bp**) Sumatera East (**Sum**)
Gridding, transect	**ND** = route repeated during the day and the night
	N = only one route during the night
	A = only one route during the day and the night
Slope	**Y** = route along the slope of the continental shelf
PS-PS	**O** = random route by night from seiner to seiner
Attractions	Number of attraction realized
TS while anchored	**Y** = TS measurement made at the anchorage on fish in cage
TS during transect	**Y** = TS measurement made on the way
Calibration	**Y** = equipment calibration
Various	**A/E** = route with illumination phase
	Maco = coastal route around Matasiri
	PPS = positioning of purse seiners
	RU = attraction under rumpon
	Bpper = route around Bawal Putih while light attraction

Survey	21	22	23	24	25	26	27	31	32	33
Year	1992							1993		
Month	Mar.	May	Jun.	Sep.	Oct.	Nov.	Dec.	Apr.	May	Jun.
Meteorology	G	M	G/M	G	G	G	M	G	B	B
Moon	4	0-1	4	1	0	4	4	0	0	0
VESSEL										
Log	M	M	N	M	M	M	M	M	M	M
Radar	M	M	N	N	G	G	G	G	G	G
GPS	N	N	N	G	G	G	G	G	G	G
Navigation	M	M	M	G	G	G	G	G	G	G
Engine	G	G/M	G	M	G	G	M/B	M	M	B
ENVIRONMENT										
Thermosalino	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Profiles	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Quantameter	N	N	N	N	N	N	Y	Y	Y	Y
SAMPLING										
Pelagic trawl	N	N	N	N	N	N	N	Y	N	Y
Bottom trawl	N	N	N	N	Y	Y	Y	Y	N	N
Purseiner	Y	Y	Y	Y	Y	Y	N	Y	Y	N
ECHO INTEGRATION										
Transit SMG	Mat/Mat	Mat/Mat	Mat/Mat	Mat/Mat	Mao/Mao	Mao/Mat	Mat/Mat	Tam/Tam	Baw/Baw	Baw/Baw
Gridding	2xND	ND		ND	2xA	A	A	ND	N	
Transect	ND					N				
Slope	A							N		N
PS-PS	0									
Attraction		3				2	2	1	8	1
TS										
Anchored				Y			Y			
On the way	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CALIBRATION	Y			Y	Y	Y	Y			
VARIOUS		A/E	Maco	PPS	PPS	PPS		PPS	RU	Bpper

Survey	34	35	36	41	42	51	52	53
Year	1993			1994		1995		
Month	Oct.	Nov.	Dec.	Feb.	Apr.	Jan.	Feb.	May

Meteorology	B	G	B	B	G	B	M	G
Moon	4	0-1	4	1	0	4	0	0

VESSEL								
Log	G	G	G	G	G	G	G	G
Radar	G	G	G	G	G	G	G	G
GPS	G	G	G/N	G	G	G	G	G
Navigation	G	G	G/N	G	G	G	G	G
Engine	G	G	M	B	G	G	G	M

ENVIRONMENT								
Thermosalino	Y	Y	N	Y	Y	Y	Y	Y
Profiles	Y	Y	Y	Y	Y	Y	Y	Y
Quantameter	Y	Y	Y	Y	Y	Y	Y	Y

SAMPLING								
Pelagic trawl	Y	Y	Y	Y	Y	Y	Y	Y
Bottom trawl	Y	Y	Y	Y	Y	Y	Y	Y
Purseiner	Y	Y	Y	Y	N	Y	Y	Y

ECHO INTEGRATION								
Transit SMG	Mat/Mat	Mat/Mat	Mat/Mat	Mat/Mat	Nsm	Lm/Bp	Bp/sm	Sum
Gridding	A	N	N/D	A	N/D		A	
Transect	N/D			N/D	N/D	N/D	N/D	N/D
Slope	Y			Y		Y	Y	
PS-PS	0			0			0	
Attraction	1	7	5					

TS								
Anchored								
On the way	Y	Y	Y	Y	Y	Y	Y	Y

CALIBRATION			Y		Y	Y		

VARIOUS	PPS	BPper	RU	PPS			PPS	

Annex 7 : Summary of Experts and Counterparts working in the Project

Landell Mills Ld	Expertise	Periode	Counterpart	Institution
S. Mc Elroy	Economist	Short-term	Purwanto	DGF
			Bambang Ariadi	DGF
			Sarjono	RIMF
J. Rogers	Quality Control	Short-term	M. Saleh	RIMF
A. Reilly	Quality Control	Short-term	M. Saleh	RIMF
			J. Basmal	RIMF
I. Clucas	Fish Quality	Short-term	J. Basmal	RIMF
			A. Sari	RIMF
C. Temple	Naval Architect	Short-term	Wijopriono	RIMF
P. Gueguen	Fishing Master	1993-1995	Wijopriono	RIMF
J.P. Troadec	Management	Short-term	J. Widodo	RIMF
S. Cunningham	Economist	Short-term	Bambang E. Priono	DGF
S. Pascoe	Economist	Short-term		
D. Cox	Refrigeration	Short-term		
ORSTOM				
T. Boely (Director)	Fish Biologist	1990-1993	J. Widodo	RIMF
J.R.Durand (Director)	Bioecologist	1993-1997	J. Widodo	RIMF
M. Potier	Fish Biologist	1990-1995	S. Nurhakim	RIMF
			B. Sadhotomo	RIMF
			S.B. Atmaja	RIMF
			Suwarso	RIMF
D. Petit	Acoustics	1991-1997	D. Nugroho	RIMF
P. Cotel	Acoustics	1991-1997		
J. Roch	Economist	1993-1997	S. Widjaja	RIMF
			C. Nurasa	RIMF
			E. Susilowati	UNDIP
J.M Ecoutin	Fish Biologist	1994-1997	S.B. Atmaja	RIMF
I. Antunes	Geographist	1994-1997	T. Susilowati	
N. Luong	Agroeconomist	1994-1996	E. Rachmat	RIMF
L. Vuichard	Economist	1995-1997	Sarjono	RIMF
			E. Rachmat	RIMF
B. Campillo	Naval Architect	Short-term	A. Sumitro	DGF
F. Gerlotto	Acoustics	Short-term		
P. Freon	Fish Biologist	Short-term		
P. Petitgas	Geostatistics	Short-term		
E. Clignet	Sociologist	Short-term	R. Widjatmono	RIMF
J.Y.Weigel	Economist	Short-term	S. Widjaja	RIMF
J. Panfili	Fish Biologist	Short-term	Suwarso	RIMF
IFREMER				
P.Y. Dremiere	Gear technology	Short-term	Wijopriono	RIMF
J.P George	Fishing Master	Short-term	Wijopriono	RIMF
PRIVATE				
G. Serre	Fish Quality	Short-term		

Annex 8 : LIST of EQUIPMENT and VEHICLES

PELFISH INVENTORY MATERIALS and EQUIPMENTS

a. Installed in R/V BAWAL PUTIH I or in Semarang (Container Bawal Putih)

No. inv.	Equipment description	Supplier	Date of Purchase	Price FF	Price ECU	Price Rp
1	1 unit YANMAR Marine Diesel 6 KDGE 165HP/1450 RPM	Marine Power, JKT	8/13/90			75,000,000
3	Spare parts YANMAR 6 MA-DT (needle/delivery valve, plunger & barrel, etc)	Aneka Jaya LS, JKT	4/8/91			7,470,000
4	Electromagnetic LOG BEN Model Galatee MK 3	Dwi Tunggal J.,JKT	5/20/91			31,920,000
19	Container in wood 170x250	CV. Wardhani, SMG	9/27/91			5,725,000
20	Spare parts YANMAR 6 MADT 900 HP (rubber packing,exhaust/auction valve bearing turbo, etc)	Aneka Jaya LS, JKT	10/4/91			27,172,000
21	1 AC National CS 702 KH	Surya Bers., JKT	11/15/91			1,385,000
22	Acoustige cage steel 27mm	CV. Wardhani, SMG	11/30/91			485,000
23	Binacular (jumelle)	Pasaraya, JKT	11/30/91			400,000
24	UPS merlin Gerin SX 3000/3KVA10'	Merlin Gerin, JKT	1/22/92			12,500,000
29	1 set Pompe GRUNDFOS CRN2-20 0,37 KW	SMG JayaTek, SMG	5/22/92			2,229,300
30	Spare parts YANMAR (packing exmanifold needle valve, ball bearing, mec seal)	Aneka Jaya LS, JKT	5/8/92			7,731,250
33	1 unit Container BP I + acc.	CV. Wardhani, SMG	6/14/92			5,522,000
36	Rubber bonnel	EUROLABO, FR	jul-92	14,105.49		
37	Annexe BP I (rowing boat)	Indah Setiawaty,SMG	sep-92			4,750,000
38	Spare parts Generator Engine no.1 YANMAR 6 KF AL 170 HP x	Aneka Jaya LS, JKT	sep-92			16,044,105
39	RACAL DECCA colour Radar+ accesories (marine radar equipm.)	Racal Marine, UK	9/8/92	51,477.36		
40	1 GPS RAY 390 + stowe trailing log+kent moore hand held electronic tachometer	Energy Control, UK	9/10/92	13,626.31		
51	200 m wire rope Ø12mm,15mm 650 kg chain cable, etc. (accastillage navire BPI)	CV. Itisari, SMG	2/16/93			4,650,000
52	Snap houk- forme pompier acier GALVA Ø14mm (1400 unités)	AYELLO, FR	2/16/93	2,194.62		
53	1 unit FURUNO Model CN-8 color net recorder for AC110/ 220 V+acc., AC Rectifier RU3423	RICO, SNG	2/16/93	56,212.15		
57	Pulley PMC 20 Snap houk- inox Ø12	Docks&Entrepots,FR	4/6/93	1,490.80		
63	Spare parts YANMAR	Sarana Teknik, SMG	8/24/93			24,950,000
89	Moteur JOHNSONS 40 CV	Toko Sejahtera,BPN	1/31/95			3,000,000
90	Walkie Talkie ICOM IC-26XAT	Alcom Service, SMG	1/31/95			540,000
96	Spare parts YANMAR, Nosel Yanmar 6 MA BT, 6KF AL, mech. seal	Marag Mandiri, SMG	4/30/95			2,800,000
145	5 reversion thermometer Soren Inst systems RTM 4002	Duncan, UK	mar-92		9,596.00	

b. Installed in Purse Seiners

No. inv.	Equipment description	Supplier	Date of Purchase	Price FF	Price ECU	Price Rp
43	1 Echosounder FURUNO FE4300+Acc	Gegana Sakti, JKT	11/10/92			3,150,000
45	2 off RAYTHEON GPS 390 sys	Energy Control, UK	12/7/92	16,919.82		
49	2 Units FURUNO Model FE 4300 echosounder for DC 11-15V+Acc	RICO, SGP	1/19/93	7,596.00		
55	Ice crusher machine	Sinar Logam, IDMY	3/31/93			500,000
91	6 GPS FURUNO-APGPS MK8 (@5290 FF)	SEDAM, FR	2/27/95	31,740.00		
	5 GPS Sondeurs FURUNO FCV668 (@ 5045 FF)	idem		25,225.00		
99	Making 2 Cold Storage 3700x2750x2290mm Fib.glass 4mm	Gaya Teknik, JKT	5/17/95			12,000,000
101	Cold Storage Fibre glass	Tiga Arga, SMG	6/30/95			8,500,000
102	2 Cold Storage 3700x2750x 2290 mm, Fibre glass 4 mm	Gaya Teknik , JKT	6/2/95			12,000,000
106	Ice crusher machine CHANG CHAI 12 PK		9/30/95			650,000
107	Ice crusher	Sinar Logam, IDMY	3/13/96			475,000
108	Ice crusher machine CHANG CHAI 12 PK		3/14/96			650,000

c. Others equipments in Ancol

2	LASER Computer IBM PC AT 286-12 CPU 1MB (16Mhz) KeyBoard Laser 101 Monitor Philips Printer Citizen 180 D	Laser Computer, JKT	4/12/91			2,562,500
32	COMPAQ DeskPro 386DX33M unité dis 5" 120 Mo Moniteur couleur VGA 14" MS/DOS 5.0 Compaq 3"1/2	BCS Informatique Fr	6/29/92	31,715.28		
72	1 PROLINEA 4/33, 16 MB; 3.4" 1.44 MB & 5.25", 1.2MB;240MB HD Compaq SVGA Monitor, mouse	Infoland, JKT	4/28/94			6,100,000
73	1 PROLINEA 4/33, 16 MB; 3.4" 1.44 MB & 5.25", 1.2MB;240MB HD Compaq SVGA Monitor, mouse	idem	idem			6,100,000
74	1 PROLINEA 4/25s;4MB RAM;1.44MB 3.5"&1.2 MB 5.25";120 MB Compaq SVGA Monitor 14 "	idem	idem			3,500,000
75	1 PROLINEA 4/25s;4MB RAM;1.44MB 3.5"&1.2 MB 5.25";120 MB Compaq SVGA Monitor 14 "	idem	idem			3,500,000
76	1 PROLINEA 4/25s;4MB RAM;1.44MB 3.5"&1.2 MB 5.25";120 MB Compaq SVGA Monitor 14 "	idem	idem			3,500,000
93	Laser Jet 4P (2MB) Printer	Istidata Com., JKT	3/31/95			2,551,500
97	1 Unit Computer ACER Note 730i	Galsys, JKT	5/8/95			2,650,000
98	SVGA Control High Res 14 " COMPAQ	Robicomp Karya,JKT	5/8/95			750,000
100	1 Unit ACER Note 760ic RAM 8MB processor i 486 key, external Dx2/ Mhz, KeyBoard 85/86 key, ext VGA	Glasys, JKT	6/2/95			5,350,000
104	1 Unit Monitor GTC 14" B&W VGA	Suryacom Jaya,JKT	8/31/95			250,000
65	HP Scanjet II P+log+CTE/ISA	ECS Difussion	22/09/93	5,600.00		
5	1 AC single split CS1800KH	Maju Bersama, JKT	5/14/91			3,443,000
6	1 AC single split CS1800KH	idem	idem			3,443,000
7	1 AC dual split Cs91vw23Dx2	idem	idem			3,950,000
8	1 AC dual split Cs91vw23Dx2	idem	idem			3,950,000
9	1 Ac single split CS 900KH		idem			2,350,000
48	1 unit AC National 1 1/2 PK CW 120	TIARA, JKT	10/13/93			1,335,000
81	AC Window National CN-09L52	TIARA, JKT	11/21/94			1,175,000
82	AC Single split 2PK CN-1803 KH +	TIARA, JKT	11/29/94			3,325,000
83	1 AC Split Single National 2PK CU-1803KH+CS-1803 KH +CZ-4F+Acc	TIARA, JKT	11/30/94			3,325,000

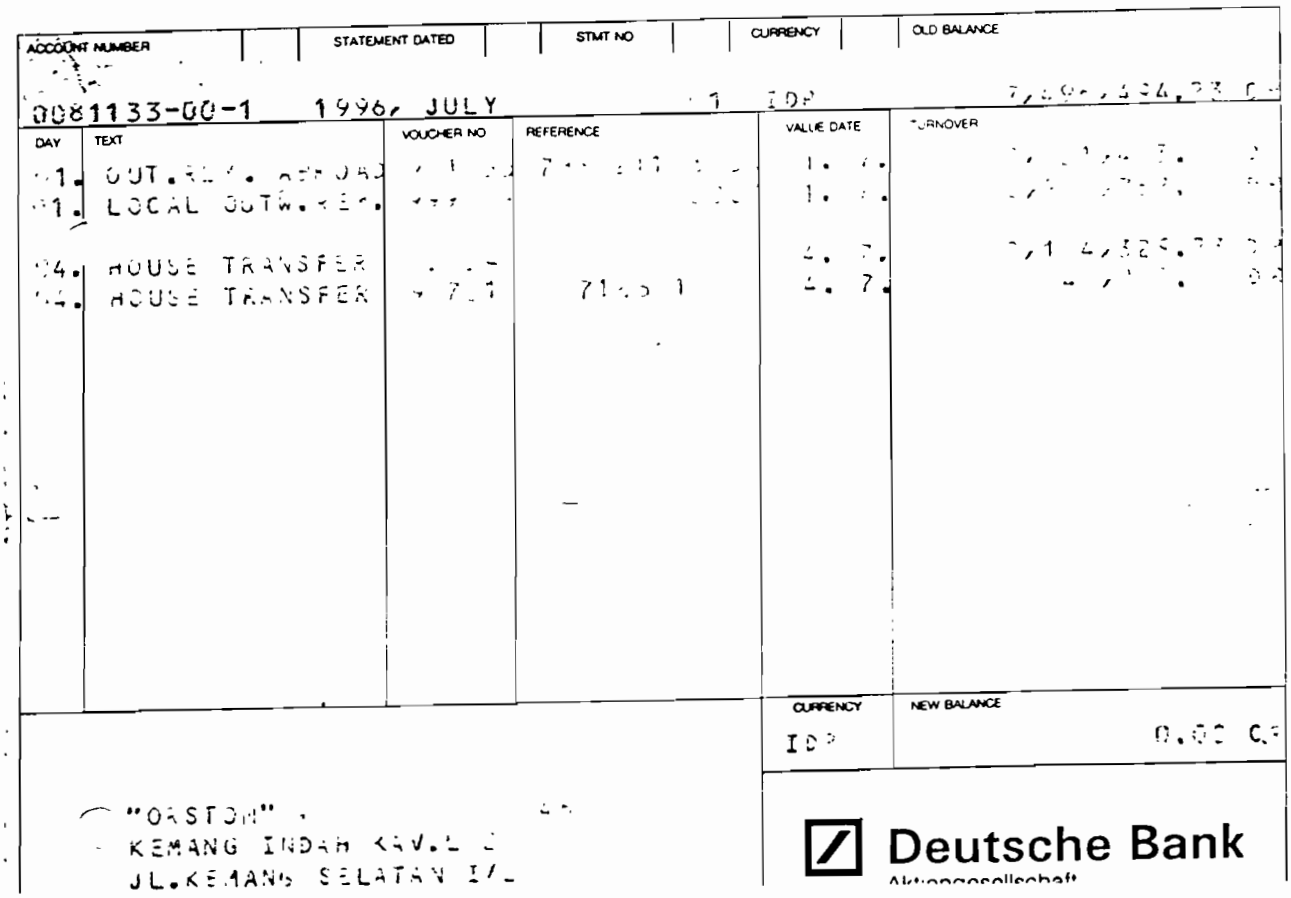
84	1 AC Split Single National 2PK CU-1803KH+CS-1803 KH +CZ-4F+Acc	idem	idem			3,325,000
87	1 unit AC Window GENERAL 1.5 PK AFG-12AGS	TIARA, JKT	12/29/94			1,450,000
88	1 unit AC Window GENERAL 1.5 PK AFG-12AGS	idem	idem			1,450,000
12	1 Ref. MITSUBISHI MR 340 W	Djawa Baru, JKT	6/12/91			2,402,400
13	Cheast Freezer F-30V DERBY					1,560,000
15	TOYOTA Kijang Rover grey B7008ML	Maju Bersama, JKT	6/22/91			29,950,000
16	TOYOTA Kijang Rover blue B7012ML	idem	idem			29,950,000
69	TOYOTA Kijang Rover Blue B1742BX	Toyota Astra, JKT	12/2/93			23,351,000
70	PEUGEOT 405 SRi (1993) B1754BX	PT. Astra Inter, JKT	12/22/93			39,600,000
95	TOYOTA Kijang Rover Red B1811AX	Toyota Astra, JKT	4/26/95			25,251,000
17	Facsimile FO 300 SHARP	Tritanu, JKT	7/12/91			2,480,000
14	Type Writer SHARP XQ 315	Tritanu, JKT	6/18/91			880,000
100	Modem Racal Datacom type RMD	Dymar Jaya Ind, JKT	4/16/93			1,366,200
18	Micropac XP 1000 Merlin Gerin	Merlin Gerin, JKT	9/20/91			1,800,000
56	1 unit UPS type XP1000 merlin Gerin	Merlin Gerin, JKT	4/1/93			1,800,000
25	Pocket thermometer et autre mat de mésure pour statistique	Kane May, UK	3/25/92	14,950.97		
26	EAGLE Ultra P portable LCD, stowe trailing log, Kent Moore hand held elec. tachometer	Energy Control, UK	3/25/92	7,929.16		
28	11 unit box aluminium	Cipta Kreasi, JKT	5/31/92			2,760,000
47	(counting pulley type 1143+ counter 3 digits-type1061)	Nereides, FR	1/19/93	23,315.00		
54	Display Printer, etc	Kane May, Ltd, UK	2/16/93	12,125.87		
59	Bridgemaster ancils + autotack Geographics Kit-14"(marine elec.)	Racal Marine, UK	4/30/93	19,487.06		
61	LICOR LI-1935A PAR Sensor 340	Sea Birds, USA	6/11/93	4,736.69		
62	Laboratory apparatus (microscope, binocular,olympus Model CHT 213 E)	Philips Harris, UK	6/4/93	11,465.41		
77	Panneau PELFISH	QZ Design, JKT	5/30/94			4,725,000
79	1 Reflecta Slide Projector	Nissin Photo, JKT	11/30/94			400,000
	1 Reflecta Rotary Magasin&adaptor	idem				150,000
80	1 Da-lite Projector Screen 96x96	idem				850,000
92	PTS Overhead Projector AV-300	Samafitro, JKT	2/28/95			825,000
85	CANON Photocopy NP-6016+ auto document feeder+Acc.	SAMAFITRO, JKT	12/7/94			10,025,000
103	Binocular Alpene 10x25	Samaritaine	6/30/95			527,270
140	5 lenses x 20 ref.13807040	COM-INT, Italy	fév-92		400.00	
	1 lighting ref. 13804027				100.00	
	10 Ichtyometer 50 cm				1,015.22	
	4 Ichtyometer 100 cm				638.14	
	2 Ichtyometer 150 cm				406.09	
141	1 Elect. weighing balance LC 220		nov-91		2,305.99	
	2 Elect. weighing balance LC 2200				3,857.82	
	10 Spring balance 0-200 gr				391.58	
	10 Spring balance 0-1000 gr				391.58	
	5 Spring balance 0-5000 gr				199.42	
	1 Binocular Stereomicroscope				2,842.60	
	1 Binocular Stereomicroscope				4,205.89	
	1 Dissection Stereomicroscope				1,863.64	
	5 Haemocytometer 150 cm				181.29	
	5 Stemple pipettes				126.90	
	transit case				317.18	
142	1 SONY Digital tape Recorder + Acc		nov-92		4,002.85	10,231,000
	1 Portable Oscilloscope 60 MHz type 3355 PM Philips				6,102.89	
	1 Oscilloscope numeric memory Philips PM 3050 +software+plotter,etc				6,500.28	
	1 Numeric multimeter FLUKE				1,177.65	
	1 Function generator				1,878.87	
	1 Resistance Box				482.23	

143	1 Plugs & cables				19.29	
	1 Laptop PC Computer				2 842 60	
	1 Keyboard Azerty				110.22	
	1 Keyboard Qwerty				110.22	
	2 MS DOS Compatible				284.26	
	2 Batteries AC Adaptor				197.24	
	2 Carrying cases				135.46	
	2 Mouse/Souries				150.83	
	2 Cable connector -laptop				400.57	
	2 All nons quite cabling				38.58	
	1 Dust cover				77.30	
	1 Connective cabling disk reader/PC				19.29	
	1 Box of optical discs				1,508.31	
	4 Uninterruptable power regulators				6,188.17	
145	1 Thermosalinometer (surface)	DUNCAN, UK	mar-92		9,595.00	
	Model SBE 21					
	1 Oceanogrpahic Probe Sea		mar-92		11,382.00	
	Birds Elec, Seacat Profiler SBE 19					
	1 Quantameter+Data Logger		nov-92		4,747.00	
	1 Induction salinometer		nov-92		4,842.00	
	5 Capacity bottles (1.7 l)				5,084.00	
	1 Capacity bottles (5,0 l)				1,280.00	
146	1 Hydroacoustic ass. System I					84917 USD
	(BIOSONICS Model 102 Echo					
	Sounder +Acc)					
	1 Hydroacoustics ass. system II					36362 USD
	(BIOSONICS Model 105 Echo					
	Sounder +Acc)					
	Training & Testing					15312 USD
	Freight					2500 USD
	Tech. Bonus					6071 USD
	Total					133020USD
147	1 INES MOVIES	ORCA, France	jul-91	168,805.00		
	set of acquisition, processing,					
	storage &display sys +Acc					
148	Computer	AGENA, Italy				
	1 DESK PRO 386/20e model 110 4HD		jul-91	29,365.00		
	1 Mon Color type VGA			3,360.00		
	Lect Disq 5,25" 1.2 HD			2,210.00		
	Co processor 00387 20MHz			6,510.00		
	Carte serie/parallele pour DeskPro			700.00		
	et portable					
	Sourie serie et PS/2+Pc Paint			1,183.00		
	MS DOS 4.01 Dual Media			840.00		
	EPSON LQ 550 Printer			3,173.00		
	Interface serie RS 232 C			933.00		
	Cable serie DB25M/25F 2M			283.00		
	PC buffer 64 KD PC/centronics			1,350.00		
	Carte IEEE avec cable 488 LM			3,850.00		
149	COMPUTER	COM-INT			4,499.72	11.501.000
	WANG Microsytem PC 382 HD					
	WANG Keyboard					
150	COMPUTER	COM-INT			6,342.34	16,211.000
	WANG Microsystems PC 382 HD					
	WANG Dot Matrix Printer					
151	COMPUTER	COM-INT			9,140.26	23,363.000
	WANG Monitor					
	WANG PC 382 HD					
	WANG Keyboard					
152	Sumagraphics Digitisor	COM-INT			1,672.21	4,274,000

Annex 9 : PROJECT EXPENSES 1990-1996 (in ECU)

	1990	1991	1992	1993	1994	Brussels	TOTAL 1	1995	1996	TOTAL 2	TOTAL
1-EQUIPMENT&SUPPLIES	31,943.53	126,292.44	97,818.37	101,572.17	30,167.50	275,537.33	663,331.34	36,646	0.00	36,645.74	699,977.08
Scientific equipment		3,809.27	5,906.12	4,551.51	183.58	222,510.03	236,960.51	8,564.63		8,564.63	245,525.14
Fishing gears			44,563.10	21,057.60			65,620.70	547.81		547.81	66,168.51
Vessels equipments	31,943.53	57,770.90	22,426.44	30,660.01			142,800.88	2,288.48		2,288.48	145,089.36
Computers		1,988.64	4,592.61	2,239.18	9,756.16	53,027.30	71,603.89	4,233.56		4,233.56	75,837.45
Vehicules		46,786.85	1,623.23	26,533.16			74,943.24	8,678.58		8,678.58	83,621.82
Furnishing		15,936.78	1,546.57	3,085.05	4,505.58		25,073.98	191.36		191.36	25,265.82
Equip.mat for various techn			17,160.30	13,445.66	15,722.18		46,328.14	12,141.32		12,141.32	58,469.46
2-TRAINING&TA (local)	7,315.15	34,383.75	46,347.22	82,171.09	148,410.89	0.00	318,628.10	228,367.93	91,928.41	320,296.34	638,924.44
Training in Indonesia, person		1,429.67	79,43	7,909.66	29,090.10		38,508.86	35,991.93	27,398.71	63,390.64	101,899.50
Training in Indonesia, doc.				967.83	1,251.06		2,218.89	5,409.36	775.81	6,185.17	8,404.06
Training abroad		8,042.17	6,766.13	15,064.92	35,146.53		65,019.75	18,861.70	5,231.53	24,093.23	89,112.98
Local short terms experts	7,315.15	24,911.91	39,501.66,	58,228.68	82,923.20		212,880.60	168,104.94	58,522.36	226,627.30	439,507.90
3-TECHNIC. ASSISTANCE										0.00	0.00
4-OPERATION&MAINT.	12,769.53	83755.64	155,927.58	153,478.22	100,895.59	0.00	506,826.56	114,657.67	48,109.42	162,767.09	669,593.65
Fitting out building		6,607.10	1,994.04	1,135.39	8,218.41		17,954.94	1,440.15		1,440.15	19,395.09
General operation cost				23,391.93	39,442.35		62,834.28	50,303.53	30,105.82	80,409.35	143,243.63
Field operation cost	12,769.53	75,728.07	152,147.23	95,890.10	30,704.45		367,239.38	25,691.49	9,229.81	34,921.44	402,160.82
Bawal Putih operation cost				30,010.55	15,623.35		45,633.90	25,951.49	1,569.22	27,520.71	73,154.61
General seminar		1,420.47	1,786.31	3,010.25	6,907.03		13,164.06	11,270.87	7,207.57	18,475.44	31,639.50
5-TOTAL	52,028.21	244,431.83	300,093.17	337,221.48	279,473.98	275,537.33	1,488,786.00	379,671.34	140,037.83	519,709.17	2,008,495.17

Annex 10 : BANK ACCOUNTS CLOSURE



ACCOUNT NUMBER	STATEMENT DATED	STMT NO	CURRENCY	OLD BALANCE
0081133-00-1	1996/ JULY		IDR	7,[illegible]

DAY	TEXT	VOUCHER NO	REFERENCE	VALUE DATE	TURNOVER
01.	OUT.[illegible]			1. 7.	
01.	LOCAL OUTW.[illegible]			1. 7.	
04.	HOUSE TRANSFER			4. 7.	2,14,325.[illegible]
04.	HOUSE TRANSFER		71[illegible]	4. 7.	

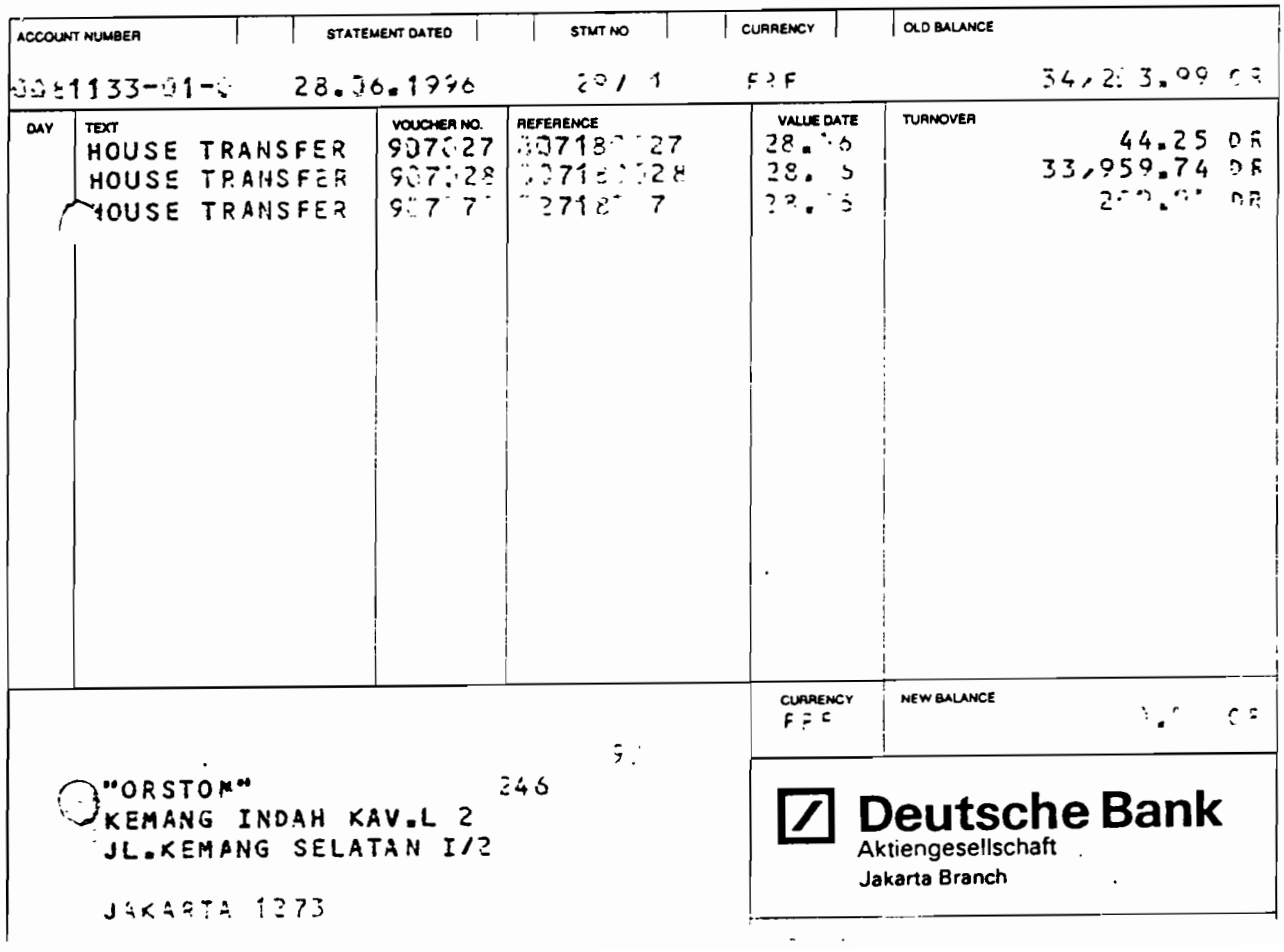
CURRENCY	NEW BALANCE
IDR	0.00 CR

"ORSTOM"
KEMANG INDAH KAV.L 2
JL.KEMANG SELATAN I/2

Deutsche Bank
Aktiengesellschaft

STATEMEN OF ACCOL

The entries on the been posted to your Please check this and notify us with of any objectio statement of ac considered correct your objections within fourteen d receipt of this Cheques, bills of and other collectic are credited subjec payment Debits an issued by you honoured if the de reversed on the accounting day



ACCOUNT NUMBER	STATEMENT DATED	STMT NO	CURRENCY	OLD BALANCE
0081133-01-[illegible]	28.06.1996	29/ 1	FRF	34,2[illegible]3.99 CR

DAY	TEXT	VOUCHER NO.	REFERENCE	VALUE DATE	TURNOVER
	HOUSE TRANSFER	907[illegible]27	00718[illegible]27	28.[illegible]6	44.25 DR
	HOUSE TRANSFER	907[illegible]28	00718[illegible]28	28. 6	33,959.74 DR
	HOUSE TRANSFER	907[illegible]7	00718[illegible]7	28.[illegible]6	2[illegible].[illegible] DR

CURRENCY	NEW BALANCE
FRF	[illegible] CR

"ORSTOM" 246
KEMANG INDAH KAV.L 2
JL.KEMANG SELATAN I/2

JAKARTA 1273

Deutsche Bank
Aktiengesellschaft
Jakarta Branch

Attachment to the Monthly Stat

The entries on th been posted to you Please check this to the monthly sta notify us without d objections The Att the monthly statemen is considered corr your objections r within fourteen receipt of this to the monthly Cheques, bills of and other collecti are credited subje payment Debits an issued by you honoured if the d reversed on the accounting day

Annex 11 : Technical Assistance Summary (from Annex D/Rider 3)

ANNEX D - FINANCIAL PROVISIONS
Contract between : The Commission of the European Communities and Landell Mills
Project = JAVA SEA PELAGIC FISHERIES (Contract No 700/91/73000/201/013-01-03)

COSTS	UNIT	Original No Units (Contract + riders 1/2)	RATE PER UNIT ECU	Original Total ECU	Additional Unit Covered By Rider 3	Additional Amount Covered By Rider 3	NEW TOTAL AMOUNT
A1 : HONORARIA							
CATEGORY1 : CORE TEAM							
1 Fisheries Economist	Man month	7.0	9,000	63,000			63,000
2 Vessel Technologist	Man month	5.5	8,800	48,400			48,400
3 Senior Post Harvest Expert	Man month	1.0	9,350	9,350			9,350
4 Fishery Management Expert	Man month	0	9,350	0	9	84,150	84,150
CATEGORY2 : TECHNICAL EXPERTS							
5 Boat Builder	Man month	1.5	5,800	8,700			8,700
6 Master Fisherman	Man month	14.5	7,000	101,500			101,500
7 Master Fisherman (extension period)	Man month	-	7,000	-	7,5	52,500	52,500
8 Electronic Specilist	Man month	0.25	8,750	2,188			2,188
9 Refrigeration Engineer	Man month	0.25	8,525	2,131			2,131
10 Fish Processing Technologist	Man month	7.0	9,350	65,450			65,450
11 Fish Quality Control Specialist	Man month	3.8	8,250	30,938	2	16,500	47,438
CATEGORY3 : UNALLOCATED INPUTS							
12 Unallocated Expert	Man month	0.5	7,000	3,500			3,500
13 Technical Expert	Man month	-	8,250		2	16,500	16,500
TOTAL A1				335,157		169,650	504,807
A2 : DAILY ALLOWANCE							
EUROPE (Brussels)	Day	0	155	0		(1)	
INDONESIA[3]	Day	860	75	64,485	615	46,140	110,625
TOTAL A				399,642		215,790	615,432
B. LUMP SUM COST							
TRAVEL TO AIRPORT	per trip	15	0	0			
AIR FREIGHT	per trip	15	110	1,650	11	1,210	2,860
MISCELLANEOUS	office costs		0	0			
TOTAL B				1,650		1,210	2,860
C. REFUNDABLE COST							
C1. AIR TRAVEL COSTS[2]							
FLIGHTS (EUR/JKT/SMRG/EUR)	Y return	1,160	16	18,560	11	12,760	31,320
TOTAL C				18,560		12,760	31,320
TOTAL ESTIMATED COST (A+B+C)				419,852		229,760	649,912

[3] Per diem for Master Fisherman (75 ECU = 50 ECU housing, installation...+ 25 ECU per diem for mission).
(1) Adapted in order to fit with total number of unit.
2) The flight cost are to be considered as an approximate average