
MONITORING, CONTROL AND SURVEILLANCE OF FISHERIES IN MALAYSIA

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1. BACKGROUND ON THE FISHERIES INDUSTRY IN MALAYSIA

Even though the fisheries industry has not been the main contributor to the country's economy, fish is still a very important source of protein for the nation. In 1996, it contributed about 1.54% of the Gross Domestic Product. Total production from the fisheries sector amounted to 1.2 million tonnes, valued at \$M 3 840 million, with marine fisheries contributing about 90%. More than 80% of the marine fisheries production came from fishing vessels licensed to operate in the coastal areas (less than 30 nautical miles from the coast). Currently, production from these waters can only be sustained at its present, maximum level, and so emphasis is being focused on the exploitation of the deep-sea waters, as well as on the development of aquaculture. Nevertheless, the importance of fisheries management in these areas has been fully recognized and not allowed to weaken; in fact, as can be seen, various areas have been strengthened.

The fisheries industry in Malaysia began with small vessels operating artisanal gears, but, in the 1960s, the introduction of commercial gears, especially trawls and purse seines, changed the whole fishing industry dramatically. As much as the production of fish increased, these efficient gears have had an impact on the fisheries resources. This problem was aggravated by the fact that the rapid expansion of the fishing fleet was contained within the coastal/territorial waters.

Today, more than 95% of the 34 000 registered fishing vessels still operate in waters less than 30 nautical miles from the coastline. Of these, 80% are traditional vessels operating fishing gears like gill or drift nets, hook and line, push nets, traps, etc. Alongside this artisanal fishery are commercial fishing vessels operating trawls and purse seines. Such vessels comprise 18% of the whole fishing fleet. Some of these vessels could also fish beyond the 30-nautical-mile limit, in the exclusive economic zone (EEZ), but exploitation of the fisheries resources in EEZ waters is done by a fleet of about 600 deep-sea vessels.

To understand the need for sound fisheries management, therefore, it is important to note that production from the commercial gears within the 30-nautical-mile limit (i.e., 18% of the total fleet) amounts to 60-70% of the total national fish production. This strongly reflects its efficiency, but at the same explains the overexploitation in this zone, which is causing various socio-economic problems for the artisanal fishers and the fishing industry as a whole.

Management and conservative measures have been formulated to control exploitation and at the same time to resolve conflicts and socio-economic constraints in the coastal zones. These management measures form the backbone of the monitoring, control and surveillance (MCS) system today. Of course, taking into consideration obligations under the United Nations Convention on the Law of the Sea (UNCLOS) and other international agreements, additional elements have been incorporated into the framework of management measures. For example, data collection and data processing were improved, more manpower and patrol vessels were added,

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surveillance was done in conjunction with other agencies, new methods of surveillance – including aerial surveillance and the use of vessel monitoring systems (VMS) – were used to cope with the vast EEZ areas, international laws were adopted, the main legislation (the Fisheries Act) was reviewed, a more comprehensive licensing policy was formulated, resource surveys were conducted in the EEZ, and new technologies were used in data collection and data processing.

The concept of community-based fisheries management (CBFM) has been accorded proper respect, although the concept is not new for Malaysia. Measures have been formulated and implemented based on a fisher-community perspective. The zoning system, for example, has been implemented based on the needs of traditional fishers. Regulations, such as those preventing fishing vessels from migrating to another fishing area, for example from the west coast of peninsular Malaysia to the east coast, have been made based on the fishers' perspective of protecting their fisheries resource. The potential for CBFM to assist MCS has been seriously looked into. Application of this concept implies that fishers will be educated to perceive that fisheries resource management will benefit themselves. It is confidently expected that the intelligent application of CBFM will not only improve effectiveness in fisheries management but at the same time reduce costs in control and enforcement.

The MCS system of Malaysia has therefore come a long way from the basic need of fisheries management for the territorial/coastal waters, evolving to cope with new obligations and international concerns, especially those pertaining to management, conservation and utilization of fisheries resources in the EEZ.

2. MCS BY THE MALAYSIA DEPARTMENT OF FISHERIES.

MCS is mainly done by the Department of Fisheries (DOF), Malaysia, though other agencies are involved, including the marine police, navy, and to a certain extent agencies under the Ministry of Science and Environment. The DOF organizational structure is shown in the figure at the end of this paper.

As can be seen from the organizational chart, data collection for the MONITORING of the fisheries resources is mainly done by the Fisheries Management and Information System (FMIS) [1] branch under the Planning Division, supported by the Resource Research Branch [2] of the Fisheries Research Institute (FRI). FMIS collects catch and effort data by sampling. It also collects catch and effort data of deep-sea vessels, using complete enumeration through the implementation of logbook systems. The Sectoral Planning Branch [3], of the Corporate Planning Division, apart from coordinating all matters pertaining to MCS matters overall, also collects socio-economic data. Fisheries resource monitoring is carried out by the Resource Research Branch of FRI, which also collect biological data to estimate resource yields. The FMIS section also collaborates with and gets information from other agencies such as the Statistics Department.

The point where the monitoring results are translated into plans, policies and regulations is coordinated by the Resource Management Branch [4] of the Resource Management and Protection Division. Of course, this section works closely with other DOF branches, and even with other agencies, both national and international, including universities. This section also plays an important role in working with other agencies on environmental issues, especially relating to obligations under UNCLOS. In line with this, protection and conservation of marine ecosystems have also been a priority, and this is handled by the Marine Parks Branch [5] of the Resource Management and Protection Division.

The function of MCS is carried out by the Resource Management and Protection Division. Its Monitoring and Control Branch [6], working closely with the Resource Management Branch, formulates and implement control policies, plans and strategies to ensure that regulatory conditions are set so that exploitation of the fisheries resource may be conducted responsibly. Working closely with them, and backing up the policies, will be the Legal Unit [7], which will lay down the legislative structure and support so that these policies and measures can be implemented consistent with the legal system of the country. Together, they lay out the fisheries management plan and transfer these plans from practical situations into legislation, and the passage of fisheries legislation.

Physical surveillance is done by the Resource Protection branch [8] as a last resort against those who do not comply.

3. ACTIVITIES IN MCS.

3.1 Monitoring.

Monitoring involves the collection of data on biological, economic and social aspects of the fisheries, and information on the fishers, boats and gears. The data collected are used to monitor changes in catch rates, catch compositions, fish size and population structure of the fish species to observe effects of the fishing pressure on the fish stocks. This data-gathering phase includes the collection and analysis of resource assessment data to identify fishing trends and patterns, which in turn will provide input into the fisheries planning exercise.

3.1.1 Types of data collected

Biological data, a primary prerequisite for fish stock assessment, are collected on both a routine and an as-needed basis. These data are backed up with biological surveys conducted on quite a regular basis. Most of the stock assessment is done using the holistic model approach, where a sample-based data-collection programme provides most of the input data. Data collection for using the analytical model, however, are not well covered, mainly because it is more complicated, requiring time series length frequency data for growth parameters and mortality rates determination. Apart from catch and effort data, other types of data collected cover fishers, vessels and gears, fisher's socio-economic demographic data, compliance data like offences and prosecution, as well as sightings of foreign vessels.

3.1.2 Collection of biological data.

Biological data are collected by various methods. Catch and effort data are collected by sample-based methods, as well as by census. Other biological data – such as length frequency and other growth parameters – are not collected on a routine basis, but regular surveys are conducted to capture these data sets. Stock assessment data collection is also done by research survey where FRI biologists conduct fisheries resource assessment research using research vessels in the coastal and in the deep-sea areas of the Straits of Malacca and the South China Sea. The assessment of the demersal and the pelagic fish stocks are done using the trawl swept-area method and acoustic methods, respectively.

The sample-based data collection is done routinely every month by full-time enumerators. Data collected by this method includes catches, effort – such as number of trips, hauls, etc. – and ex-vessel prices of commercial species.

A complete enumeration (census-type) system of data collection is also done for the deep-sea vessels in view of the fact that better quality catch and effort data is required for the resources in the EEZ, both to be responsible to the obligations of UNCLOS and also to ensure that

DOF can make more effective plans and strategies for the management and the development of the deep-sea fishing industry. The logbook system was made compulsory and incorporated in the licensing conditions. The logbook records – for every trip – catch data on major species, detailed effort data, area of fishing, and some cost and earning data for socio-economic purposes. However, not all data are collected on a routine and regular basis. Useful information within the fishing community, which is important for fisheries management, at times are not easily obtained. They are normally obtained through dialogue and meetings with the fishing community itself.

3.1.3 Collection of other data.

Data on vessels and gears are collected as vessels and years are licensed. This system captures not only new registrations but also changes, like change of ownership, hulls, gears and engines. Data on fishers were collected initially through a census survey, and later updated by a computerized Fisherman's Profile System. Compliance data, including offences and prosecutions, are captured whenever offences or prosecutions occur, again through a computer system. Prices of the major commercial species are collected using a sample-based programme similar to the method used for catch and effort data capture. Ex-vessel prices are collected as part of the catch and effort exercise. Wholesale and retail prices are collected at major markets throughout the country.

3.1.4 Data processing and dissemination.

As can be seen from the foregoing, various data are already collected via a computerized information system. Reports and information on vessels, gears, fishers, offences and prosecutions can easily be processed and produced by such a system. Data captured for the vessel registration system is decentralized at the state and district level. Catch and effort data are collected on the ground, and captured also at the district and state level. Reports and information can thus be obtained from either the state system or from headquarters. In addition to the annual *Fisheries Statistical Bulletin*, other information and reports are produced and disseminated. The details of the information technology infrastructure are considered in a later section. DOF considers the dissemination of information as an important element in the process of communicating with the fishing community. Such dissemination, done through extension services, will create awareness, in line with the nation's fisheries management agenda, thus increasing compliance achievement.

3.2 CONTROL.

3.2.1 Comprehensive licensing policy

Control of the fisheries and the fishers is through implementation of a comprehensive licensing policy, which is supported by effective legislation. Various measures have been taken to ensure control over the fishing effort. These measures, which are clearly defined, also provide clear guidelines for the fishing community on what they can and cannot do, thus giving transparency in fisheries management. The various measures taken under the comprehensive licensing policy are considered in the following paragraphs.

(i) *Licensing of all vessels in operation* Successful applicants for new fishing vessels are given permits to build. Upon completion and satisfactory fulfilment of the requisite conditions, new vessel licences are issued for the vessel and the gear. These licenses are renewed on an annual basis. Before renewal, each fishing vessel is inspected to ensure that it complies with the set conditions. No modifications or changes of gear types are allowed without authorization. The exercise also checks for duplication of fishing units. The renewal exercise also acts as a census survey to determine exactly the actual number of fishers working on each fishing vessel.

(ii) *Zoning of fishing areas* Zoning is implemented to ensure that the resources are exploited in a responsible manner, while minimizing or preventing conflicts over the utilization of the fisheries resources. Only artisanal fishing is allowed in the coastal waters, with commercial operators kept further away from shore. The zoning system used is summarized in Table 1.

(iii) *Quota on fishing units* Based on indicators like catch per unit effort (CPUE), resource status of the fishing areas are estimated, as these results will form the basis for setting quotas on the number of fishing units allowed to operate in certain areas.

(iv) *Control on fishing units* To control the fishing fleet, each fishing vessel is assigned an identification number, which is carved into or welded permanently on the hull. The numbering system identifies the state issuing the license. This is particularly important for zone A and B vessels, because their fishing areas are also confined to the waters of their respective States. To facilitate this control, vessels from each state have a different colouring scheme. Enforcement of these controls is done during the annual licence renewal, when checks are conducted. Very stringent penalties help discourage infringements. For example, many confiscated vessels make up some of the artificial reefs established for stock enhancement.

(v) *Mandatory report on fishing activities* Especially for deep-sea vessels, it is required by law for vessels to report their operations for each trip, using registered forms. Every deep-sea vessel has to report to DOF the amount of fuel, ice, number of fishers, date of departure, date of arrival back to base, and area of fishing.

3.2.2 Fisheries legal framework.

The legal framework is an important component in the implementation of fisheries resource management and conservation. Malaysia's ratification of UNCLOS on 14th October 1996 shows her commitment towards international law. The problem of illegal fishing or encroachment by foreign fishing vessels into Malaysian EEZ waters are taken care of in the provisions of the Fisheries Act, 1985. That law allows for control of fishing effort and of the fishing areas. Basically the two types of control necessary are:

- (i) to ensure that no unauthorized vessels are fishing; and
- (ii) to ensure that the authorized (licensed) vessels comply with the licence conditions imposed by DOF.

These controls and the necessary law was first provided by the Fisheries Act, 1963, which provided coherent legislation for Malaysian fisheries waters, taking into account the interaction between small-scale, traditional fisheries and commercial fisheries, and to ensure equitable allocation of resources through sound development, management and conservation measures.

The proclamation of the EEZ extended Malaysian fisheries waters to 162 000 square nautical miles. In addition, with the wide responsibilities provided for under UNCLOS, the Fisheries Act, 1963, became inadequate for the management of the fisheries resources.

Table 1. Sea zones and the vessels licensed to fish in them

| Zone | | Boat sizes operating |
|------|--------------------------------------|--|
| A | Less than 5 n.mi. from the coastline | Artisanal fishing vessels (these may fish beyond the 5 n.mi. limit) |
| B | From 5 to 12 n.mi. | Trawlers or purse seiners below 40 GRT |
| C1 | From 12 to 30 n.mi. | Trawlers and other vessels between 40 and 70 GRT |
| C2 | Beyond 30 n.mi. | Offshore fishing vessels (mostly trawlers and purse seiners over 70 GRT) |

The Fisheries Act, 1985, repealed the Fisheries Act, 1963. The 1985 Act made provision for the MCS of fishing vessels in EEZ waters. Foreign fishing vessels apprehended for fishing without licenses are severely dealt with by mandatory sentences. The objective of this Act is to provide for better conservation, management and development of fisheries in Malaysia in light of Malaysia's commitment towards UNCLOS. The provisions of the Fisheries Act, 1985, follow the provision of UNCLOS. Briefly, the Act covers:

- administration of fisheries in Malaysia;
- licensing and management of local maritime/estuarine fishing operations;
- control of fishing by foreign fishing vessels in Malaysian fisheries waters;
- offences, and prohibition and control of certain methods of fishing;
- establishment of marine parks and marine reserves; and
- offences and legal procedures relating to the implementation of the Act.

The Exclusive Economic Zone Act, 1984, supplements prior legislation, including the Continental Shelf Act, 1966, and the Fisheries Act, 1963, (at that time). Section 3 of the Exclusive Economic Zone Act, 1984, proclaims an EEZ extending to 200 nautical miles from the baselines from which the breadth of the territorial sea is measured. Section 4 of the Act declares Malaysian sovereign rights in the EEZ.

3.3 Surveillance.

Even though management measures are, on the whole, adhered to, surveillance has to be continuously done to ensure that irresponsible actions are contained.

The observation required for maintaining compliance with regulatory controls imposed on fishing activities is carried out by the Resource Protection Branch of the Resource Management and Protection Division. Basically, the set up of compliance control is based on the old concept of enforcement within the coastal zones. However, with an emerging new role, especially that of compliance with obligations under UNCLOS, the role of the enforcement branch in monitoring has been extended to include validation of data collection. Enforcement is carried out with a fleet of about 100 patrol vessels, some of which are capable of doing patrols in the EEZ. More importantly, compliance activities are regularly performed and coordinated with other agencies through the Maritime Enforcement Coordinating Committee (MECC). This arrangement enables fisheries compliance activities to be carried out together with the marine police and the navy.

Surveillance is implemented through:

- aerial surveillance;
- sea surveillance; and
- VMS.

Aerial surveillance is regularly done using chartered aircraft with DOF Inspectors on board to visually detect encroachment of foreign vessels into the EEZ, and also any other illegal fishing activities. Sea patrol craft are then mobilized in response to sightings, in order to apprehend the unauthorized fishing vessel. Data on locations, numbers, gear used and nationality of vessels are also recorded and kept by DOF.

Basically three type of sea surveillance are done. Routine patrols are implemented on a regular basis covering a specific area within a certain period. The objective of such patrols is mainly deterrent, but at the same time any transgression detected is acted upon promptly. The second type of patrol is normally aimed at tracking and arresting illegal fishing activities as a result

of reports and intelligence obtained. The third type of patrol activity is normally done in conjunction with components from MECC, supporting them on request and sometimes mounting special joint operations.

Transgression are handled in various ways: by warnings, compounding, arrests and even seizure of vessels, depending on the offences. All cases concerning the Fisheries Act and the regulations made thereunder are dealt with by DOF as implementing agency.

The latest compliance method for surveillance to be used by DOF is VMS recently established. When fully implemented, all offshore vessels (in Zone C2), including foreign-owned vessels under charter to Malaysians, will be fitted with an automatic location communicator (ALC), which will transmit data on position, speed and course to the ground station in the DOF Control Centre. The VMS is seen as management tool to manage and control the activities of the offshore vessels. This is done by the intelligence component of the VMS, which can detect and report the following events:

- vessel leaving port;
- vessel fishing in prohibited zone;
- vessel crosses into neighbouring country to land the catch;
- vessel transships at sea; and
- vessel returns to port.

The use of the VMS is seen not only as a tool in surveillance but also potentially useful for other purposes, including strengthening the collection of data from EEZ waters and providing valuable information to fleet managers. The information on vessels approaching landing ports will facilitate data collection by enumerators. This catch data, coupled with the actual fishing areas as given by the VMS, will provide useful information on the fisheries resources in the EEZ waters.

3.3 Information system and MCS.

MCS generates a large amount of data. These come from sample-based data collection of catch and effort data. The licensing system updates data whenever there is renewal or application for change to an existing vessel and gear, so that a good overview can be maintained. In an efficient MCS system, these data have to be processed and analysed to provide the input into the fisheries planning and decision making exercise.

In the past, data processing was done manually, and required significant manpower resources, time and costs to produce reports and information, which often contained errors and inconsistencies. Reports appeared about two years after data were collected, thus providing information that was highly out of date, and forming a poor basis for management decisions.

From 1988, computer-based information systems have been undergoing development. These systems have been very useful, allowing decentralization and streamlining of data collection. More important, reports and the needed information can be produced within days, with reasonable manpower requirements. To support this, many application systems have been developed. The Catch and Effort System captures data at state level, and produce the catch and effort reports and information. The Boat Registration System is not only able to produce reports on effort, but also to assist greatly in the day-to-day licensing activities. The Offences System not only keeps a database on offences and prosecutions, but also itself is a Decision Support System that tracks offences and helps DOF decide on the action needing to be taken. The Logbook System captures logbook data and processes them into reports and information. The Fisherman Profile System keeps a record of fishers, including the demographic data needed for socio-economic studies.

These systems have helped MCS by providing updated information, with the flexibility to generate different reports that have the feature of being consistent and accurate. In the initial years, the system was not integrated, with limitations imposed by the software available at the time. The integration of the database began when Canada provided an aid grant through CIDA in 1992, and introduced a project that had the following objectives:

- improve long-term development and management of fisheries in Malaysia;
- optimize exploitation of the living resources in the Malaysian EEZ;
- assist Malaysia in fulfilling its obligations under UNCLOS by developing an effective MCS Programme; and
- assist Malaysia in developing human resources and technical expertise.

The project delivered a number of successful components, namely:

- A Vessel Tracking System;
- A VHF Communication System; and
- A National Integrated Database Management System (NIDBMS).

The concepts of the VMS explained in an earlier section was the result of this component of the project. The VHF communications system allowed for scrambling, contributing to radio security and eavesdropping prevention for communication in enforcement operations at sea.

The NIDBMS is a corporate database implemented nationwide on a wide-area network (WAN). It streamlines data collection, makes information available to all levels all over the country and thus provides for data integration. It organizes data into the way the department does its work and automates many administrative and routine processes. For example, an application for licence renewal, which is done at the district level, will be recorded and reach the State Office online in real time through the WAN. After the State processes the application, it reaches DOF Headquarters in Kuala Lumpur within 24 hours.

The NIDBMS collects, streamlines and integrates corporate data and provides the information needed for decision making, planning and strategy development in MCS matters. It enables corporate data to be processed to produce accurate, consistent, current, relevant and comprehensive information.

Integrating the data in this manner, the NIDBMS links the various activities inherent in effective MCS so that MCS can be implemented in a more coordinated and consolidated manner.

4. CONCLUSIONS

As can be seen, MCS in Malaysia was not conjured up overnight, but was mooted years back, as fisheries management and conservation measures were formulated and implemented. However, major structural changes were made and enhancements added to cope with the changing fishing industry itself, and also to accommodate the country's obligations under UNCLOS and to reflect international concerns.

As much as continuous efforts have been made to improve MCS in Malaysia, it is certainly too enthusiastic to claim that the MCS system is now the most effective or efficient. Much has yet to be done, especially in consolidating the effectiveness of MCS itself through the years. The various measures taken ostensibly under the auspices of MCS have to be looked at in a different light, in a more binding way, to allow the concept of MCS to mould these measures into a powerful integrated system, so that, together, it becomes a power tool in fisheries management.

Especially where fish stocks are shared and maritime jurisdictions are adjacent, regional cooperation in MCS will be beneficial. The effectiveness and cost savings in the implementation

of MCS at a regional level should be looked into so that the neighbouring countries in the region can work together to manage our fisheries resources in a responsible manner.

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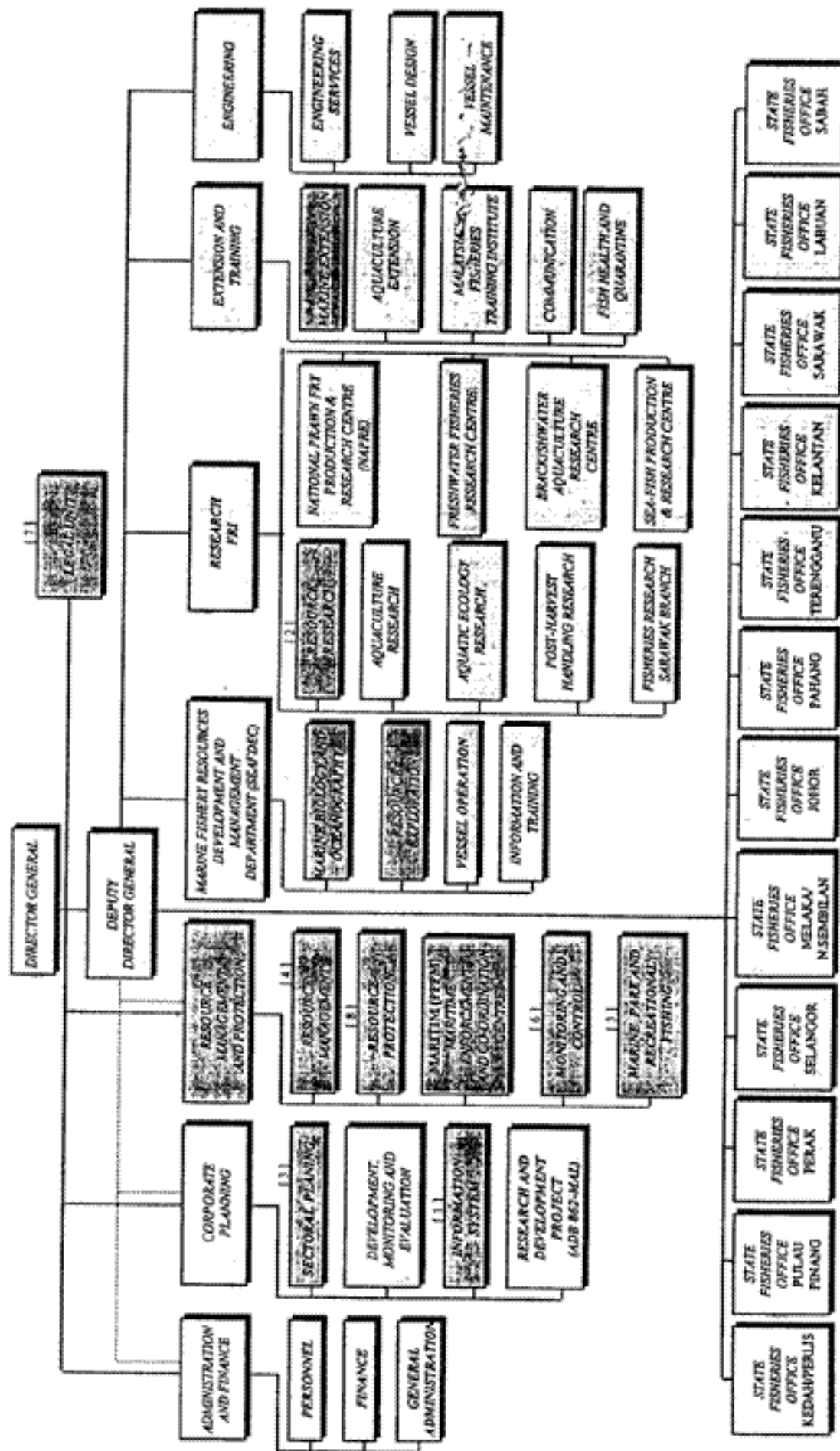
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Organization Units of Department of Fisheries Involved With MCS Activities



Note :- The shaded units are involved directly with MCS activities. The numbers designated is used with reference to the text in the paper.

Figure 1 Organizational structure of the Department of Fisheries (DOF), Malaysia