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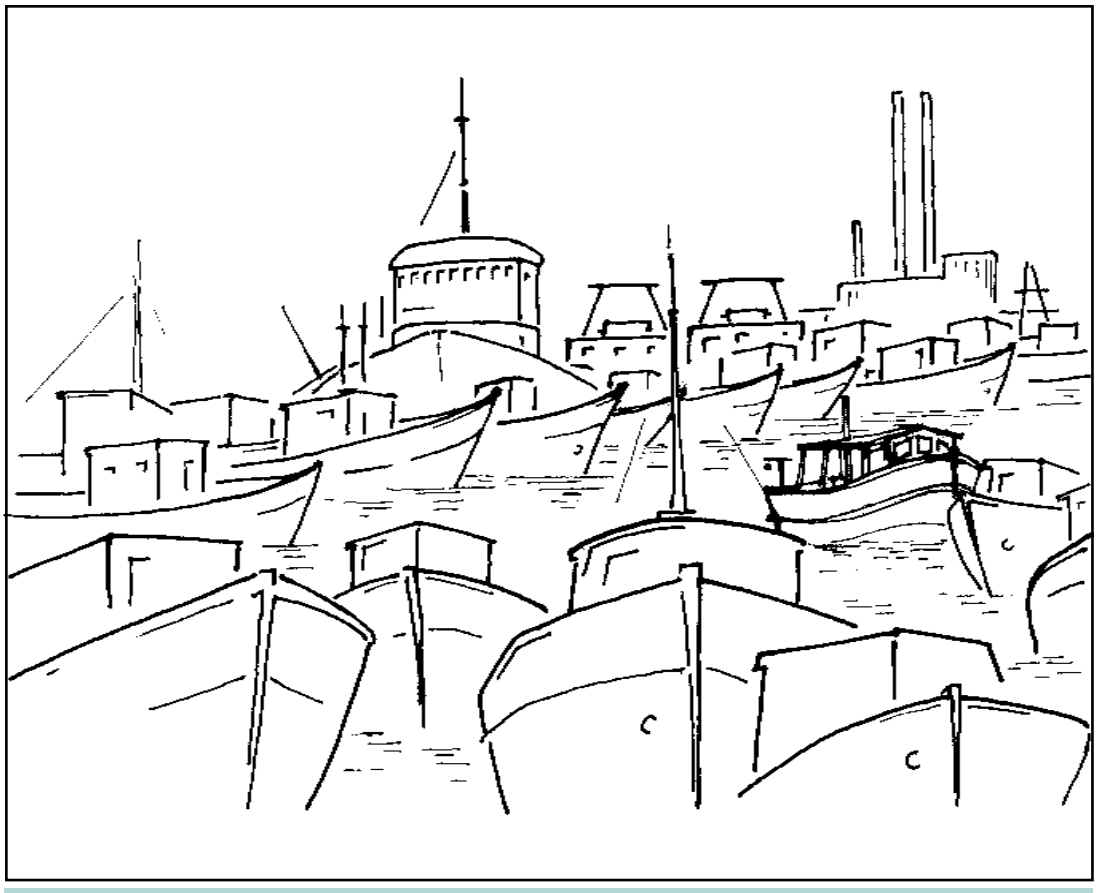
Fishing fleet profiling methodology



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by
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PREPARATION OF THIS DOCUMENT

This technical paper on fishing fleet profiling methodology is aimed at fisheries managers and decision-makers in developing countries who may have a scientific background but who are not necessarily specialists in statistics. It provides methods for profiling fishing fleets according to the available data and different management needs. Its aim is to provide a practical guide which makes these methods easily accessible, and which demonstrates the principles underlying the different standard techniques for profiling fishing fleets without claiming to eliminate the need for expert statistical analysis of complex multivariate data sets. The methods presented are of specific interest to technical staff in Fisheries Departments and those responsible for the collection and analysis of data on fishery resources and fleets. This work is based on experiences profiling different fishing fleets, notably the Moroccan coastal fishery and the artisanal fishery of Senegal, as well as numerous studies carried out by Ifremer on French fisheries. Many of the examples provided in this document are drawn from previous work on profiling fleets, and include extracts from the following documents:

- **Ferraris, J**. 1997. Typologie de la flottille côtière marocaine. Tome 1: analyse des caractéristiques techniques des bateaux; Tome 2: analyse des stratégies d'exploitation. Projet FAO TCP/MOR/4556.
- **Pelletier, D. & Ferraris, J**. 2000. A multivariate approach for defining fishing tactics from commercial catch and effort data. *Can. J. Fish. Aquat. Sci.* 57: 1-15.
- **Rochet, M.J., Ferraris, J., Biseau, A. & Sabatier, R.** 1994. Méthodes pour la typologie des flottilles de pêche: bilan et ouverture. Séminaire de typologie des flottilles, Nantes, 29-31 mars 1994. Ifremer, Nantes.

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ABSTRACT

A fishing fleet profile aims to assist in understanding the complexity and structure of fisheries from a technical and socio-economic point of view, or from the point of view of fishing strategies. A profile consists of analysing the characteristics of individual units of the fleet, for example the boats, in order to classify these units and summarize the heterogeneity of the whole through a description of the component elements and their interrelationships. The identification of the various qualitative and quantitative parameters describing a fishing fleet, together with the characteristics of the boats associated with these parameters, constitutes a profile of the fleet. This document describes the steps necessary to produce such a profile, from planning and the implementation of the fleet survey, through data processing to the presentation of the results.

The processes of analysis, classification and description require the application of specific statistical methods in order to extract the items of information that are fundamental and relevant to the objectives of the profile from a data-set consisting of the variables describing the units of the fleet. Various methods of data analysis are presented here in order to demonstrate their potential uses and relevance to different situations. The aim is to make them intuitively comprehensible without elaborating upon their theoretical basis. The Moroccan inshore fishery and the Senegalese small-scale fisheries have been used as examples in this document.

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1. INTRODUCTION AND CONTEXT

Fisheries management poses considerable difficulties for decision-makers, who are required to take a precautionary approach to the exploitation of renewable resources and to the sustainable development of activities based on those resources.

These difficulties result from:

- the common problem, in developing countries, of a scarcity of reliable fisheries statistics;
- an inadequate understanding of the status of resources and of the ecological processes necessary for forecasting the evolution of systems;
- the lack of a holistic approach to biological, ecological and socio-economic aspects of fisheries.

One of the reasons for inadequacy in fishery management is a failure to study the reactions and adaptations of fishers to management interventions, which would result in a better understanding of their reactions to change. The drawing-up of a fishery management plan necessitates an up-to-date knowledge of fishing fleets, including technical and socio-economic characteristics as well as fishing capacity. The process of profiling fishing fleets aims to provide the basic elements of a better understanding of these different components.

These management problems and the implementation of scientific investigations have led to the realization that the fisheries models that are commonly used are too simplistic to describe the complex reality of fishing. These models were originally developed for single-species fisheries without taking into account factors such as the environment, ecology, or the behaviour of the various actors in the fishery. New models have been put forward in the course of fisheries research, based on analysing the interaction dynamics of fishers, of resources, and their environment. The "Fishery System" is analysed in all its complexity – from the process of capture to the processes of production and management. In parallel, the evolution of information technology, particularly with the availability of computers, the establishment of digital databases and the accessibility of user-friendly statistical software, has promoted the development and implementation of the new methods resulting from this realization.

The benefits expected from profiling a fishing fleet, in terms of designing and implementing fishery management plans, result from a better understanding the fishery. The different components of a fishery can be classified according to parameters describing their average characteristics, and their variability is a function of criteria such as typical fishing techniques, tactics and strategies, or socio-economic aspects. This analysis provides a better assessment of the impact of fishing on the resource, through an improved description of fishing capacity and the spatio-temporal strategies of fishing fleets, and leads to decisions which are more appropriate to the fishery management plans concerned.

Fleet profiling is thus a tool that helps fishery managers to more completely understand a fishery and thus to make decisions that are more appropriate to the resource and the fishing method. By "fleet profile" we mean the description of the different components of a fishery: components which can then be quantified and classified according to their characteristics. These descriptions are important in order to clarify the similarities and variability of items in the same category, as

well as the differences between categories. The purpose of fleet profiling is actually to assemble a synthetic picture of a whole that is often difficult to grasp in all its reality and heterogeneity.

In fisheries, the initial classification is usually based on simple criteria:

- the type of fishery, using economic (industrial/artisanal) or spatial (coastal/oceanic) criteria;
- the port from which the fleet operates;
- the fishing gear used in the fleet: purse seine, trawl, nets, lines, etc.;
- the size or age of the vessels;
- the species targeted: fish, molluscs, crustaceans, etc.;
- the market or usage-category of the landed product: fresh, frozen, preserved, fishmeal etc.

However, the last two categories above pose the problem that the same fishery unit may contribute to several different classes – for example, the same boat may land different species destined for different markets – and will be included in different classes by a percentage equal to the percentage of the classifying catch.

One, two, sometimes even three variables can serve as the basic criteria for classifying and differentiating the components relating to the fishery resource being exploited by a fleet. However the manager or the scientist must analyse the fishery components which jointly exploit a particular geographical zone even more precisely. The fleet profile aims to provide the information necessary to make sound decisions in the context of fishery management plans, whether this concern the allocation of fishing quotas, defining fishing areas (e.g. Marine Protected Areas), fishing periods (opening and closing of seasons), or economic measures.

It is possible to distinguish different kinds of profile depending on the question being asked or the objective desired. The evaluation of fishing capacity is not carried out using the same criteria that are used for the reorganization or the modernization of the fishing sector. The first question requires an evaluation of the status of landings with regard to the technical specification and behaviour of fishing units, whereas the second requires a judgment of the potential of the sector and the identification of constraints to its organization. But whilst the data sets that are subject to fleet-profiling are different, in both cases the methods applied in order to produce the profiles are similar.

A profile of a fishing fleet provides a better understanding of the relationships between the fishers and the measures applied to the fishery units, fishing schedules and fishing areas (these concepts are presented in Figure 1). The result of a profiling process is presented as a list of categories of fishing units (fleets 1, 2 and 3). The relative importance of each category comprising the overall fishery is calculated, and is accompanied by a summary of the characteristics of each of the categories. As a result it is possible to estimate the catches associated with each fleet (since the overall list of vessels is known), according to the fishing methods practiced throughout the year, on the fishery map, by season.

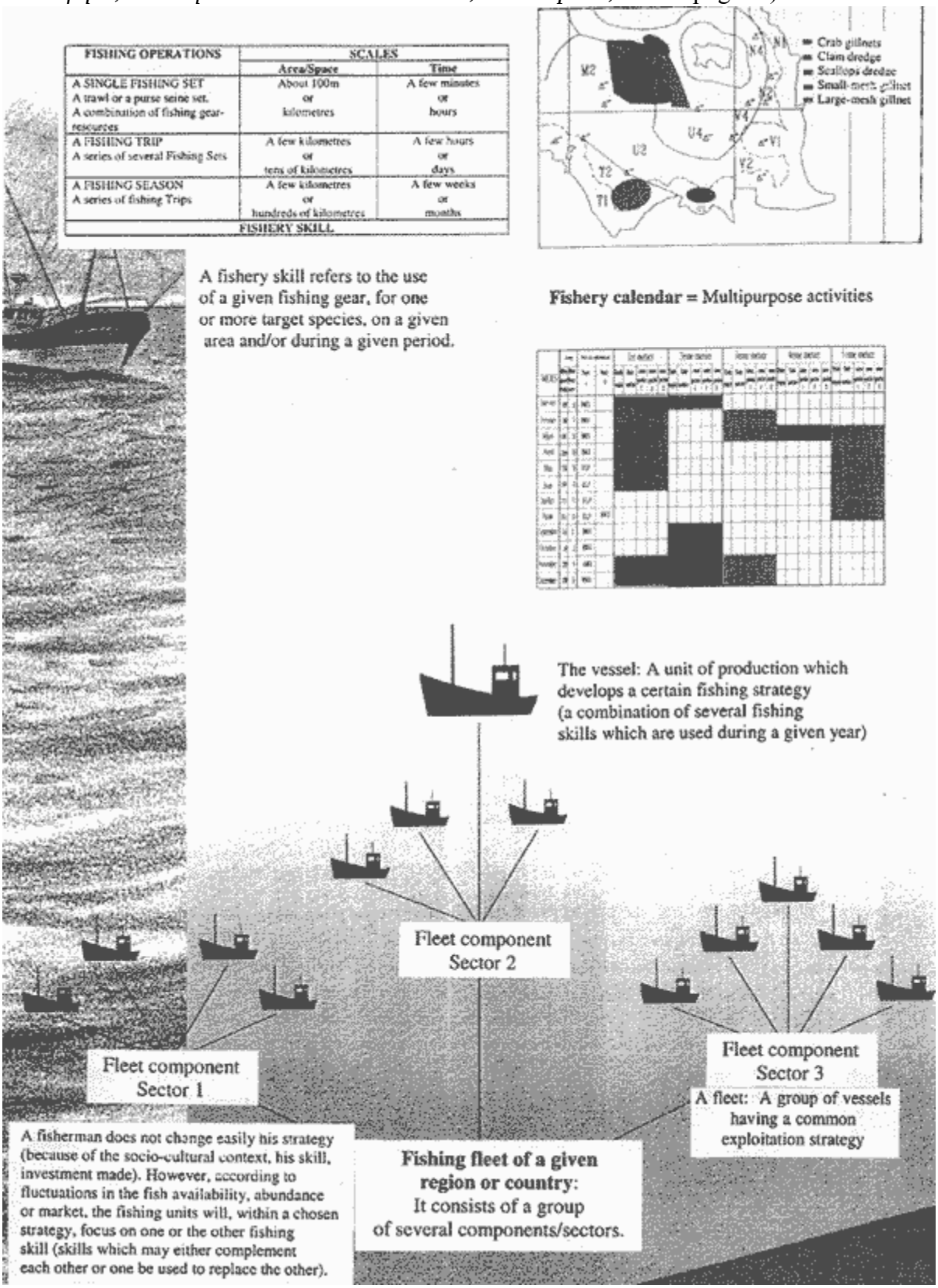
The methods for fleet profiling described in this document are based on quantitative approaches to a substantial set of data, requiring the maximum amount of information to be taken into account in order to describe the fundamental complexity of the system under consideration: the variability of the fishing units within the fleet. The implementation of these methods necessitates a rigorous approach to the acquisition of data, through the design and implementation of survey systems through to database management and statistical analysis. To implement these processes efficiently requires technical skill, but appropriate specialist support can minimize the need for advanced statistical knowledge by the primary investigator.

The following chapters present the principles for profiling a fleet. Without elaborating on the details of the data-processing or statistical techniques used, the following are provided:

- principles for the acquisition, management and analysis of data;
- the presentation of results, their interpretation and their use;
- a discussion of the means necessary to implement any subsequent actions.

Examples are provided in text boxes, like this, to illustrate the various points presented in the document. They are drawn mainly from a profiling process on the Moroccan inshore fishery carried out in 1996–97 by the Institute National de Recherche Halieutique of Casablanca (Morocco), under FAO project TCP/MOR/4556.

Figure 1: From hauling the trawl to the fishing fleet (from "*La pêche*" by the *Centre de culture scientifique, technique et industrielle de la mer, Océanopolis, Brest* - page 33).



2. METHODOLOGY

2.1.Preparatory work

Profiling fishing fleets requires input from several types of specialists: samplers, data-processing specialists, statistical analysts, and experts in various fields (sociologists, economists, biologists as well as fishing industry and fisheries staff). For this reason, it is very important that preparations are exhaustive and cover all of the following steps:

- Clarification of the nature of the problem and the questions posed: this step must include consultation with the specialists responsible for the profile as well as those who commission the study; this dictates the choice of methods and defines the context of the profile (the fishery concerned and information needs).

- Answering the question: "Which data is needed to provide which information?" This requires the specification of information that is necessary to answer the questions posed, from which the nature and the number of the variables to be collected can be ascertained. Each of the issues that are considered in establishing the fishing fleet's profile (such as vessel characteristics, social and economic issues, fishing activity) includes a considerable number of variables. BEWARE: "A surfeit of information is detrimental to the analysis!" Wanting to collect too much data is a common mistake. It reduces the effectiveness of the investigation and its analysis in terms of output, duration, cost, or the effectiveness of reporting. Generally, the choice of questions will be guided by the relevance of the variables to the analysis, in respect of the objective of the profile and of the costs resulting from the planned duration of the investigation. For this reason it is necessary to coordinate the planning of data-gathering along with data-processing.

- Planning the survey: the choice of sampling personnel, the development of the questionnaire, selection of sampling units (definition of the target population, sampling strategy), drafting guidelines for the investigators, validation of the questionnaire (this step often permits the revision of certain question and helps determine the time required to carry out the study, as well as contributing to the training of the sampling personnel).

- Planning the processing of the data: taking into account aspects of data-processing for the data entry, encoding, validation, and processing of data – the choice of equipment (hardware, software) and of the personnel for the task; the statistical analysis of the data (which methods for which questions and which data?) The process of planning the analytical methodology often makes it possible to review the relevance of the information and to consider the nature and attributes of the measured variables which will direct the statistical methodological choices to be made.

- Training needs: identifying the procedures to be carried out, and their timing, makes it possible to specify the expertise necessary to carry out the work and to identify the requirements for training and for external inputs. The first specifically concerns the training of the investigators and sampling personnel, and this must never be neglected as the quality of the data will depend on the quality of their work.

- Communication/information needs: fishing fleet profiling requires the acquisition of data to be precisely aligned with the component units of the fishery. The investigation of the fishers and/or the owners of the fishery units must be clearly announced in advance, specifying the objectives, the need for professional participation and the likely impact of the study on the people concerned. It is also appropriate to anticipate disseminating the results of the study to these same people, who in general have a direct interest in the questions which have warranted the need for a profile of the fleet.

- Cost-estimation: planning all the above steps makes it possible to estimate the costs associated with the process of profiling a fishing fleet, from design to utilisation of the results obtained.

2.2. Survey techniques

The information necessary to produce a fishing fleet profile can thus be of various types: fishing effort, catch, vessel characteristics, fishing behaviour (tactics, strategies), etc. These data are generally obtained by various survey techniques; they require the effective participation of the subjects of the study, and on the application of a questionnaire by technical staff of the Fisheries Department or on a request to an agency specialized in carrying out such investigations. Irrespective of the technique used, several principles should be taken into account:

- rigorous selection of appropriate people to carry out the acquisition of the data in the field;

- preliminary training of the investigators: including sessions to explain the content of the questions to the investigators before any acquisition of data;

- holding field interviews. Regardless of the nature of information gathered, administering the questionnaire generally requires meeting with professionals (fishing, captains, ship-owners) whilst they are working. Such investigations can cover sensitive issues in the fishery and the field work often requires preliminary discussion to explain the context of the study and its objective. Biases found in the results of this type of investigation are often due to erroneous answers given in response to questions, whether it is due to unwillingness, or to lack of understanding of the questions posed. This type of field work requires some tact and perseverance by data recorders in order to provide the best psychological environment to obtain the necessary information.

- identification of local counterparts and someone to act as focal point for information.

2.2.1. Fishery catch and effort

The different aspects of fishery catch and effort data-collection will not elaborated upon in this document since this is a traditional part of the normal duties of those in charge of monitoring fishing, and fisheries management.

For industrial fisheries, this information is generally acquired by means of catch-effort return forms, or log-books, given to fishers who are obliged to complete them as a licensing requirement. Catch and effort data from these fisheries makes it usually possible to carry out an exhaustive analysis of the fishery. The compilation of the volume unloaded, by species or

commercial category, and of duration of fishing for the various vessels, provides the total catch and effort of fisheries. These are the data used to establish the fisheries models used in the working groups that make recommendations for the management of industrial fisheries under the control of regional fisheries management organizations such as ICCAT. In addition, these data can provide the means for detailed analyses of fishing strategies since it is often possible to reconstitute the effort and catch by fishing trip, and the calendar for each vessel (see Section 2.2.3).

For small-scale inshore fisheries or artisanal fisheries, information is collected from surveying fish landing points, which makes it possible to obtain catch and effort estimates from complete fishing trips. Data are collected for a sample of the fishery, which is often difficult to study because of the number of fishing units and the spatial and temporal dispersal of landing points. These routine investigations are generally carried out by technical staff of government fisheries services; they must be rigorously sustained, and the work of the investigators must be encouraged and remunerated accordingly in order to ensure the long-term stability of the system.

2.2.2. Characteristics of fishing units

Fishing fleets are generally the subject of a regular census, which provides an exhaustive inventory of fishing units. The issue of fishing licences provides the opportunity for an annual inventory of active units, to obtain information on the general characteristics of the vessels and to catalogue them according to activities which are subject to regulation. This census makes it possible to define a frame survey, which will be used later to provide a context for sampling the fishery. A "frame survey" identifies the whole range of accessible and countable elements, from which it is possible to take a fragment (sample) to extrapolate the state of the whole (population), for example: a list of postal addresses for the demographic census; a list of telephone numbers for a census of the population accessible by telephone; a list of vessel serial numbers for a licenced vessels in a fleet.

A sample from the total population is usually necessary in a survey to establish a profile of fishing fleets**.** This type of profiling is carried out occasionally, not routinely, and requires detailed information on the fishing units, something which is difficult to obtain for the entire fleet. An investigation into the characteristics of the fishing units can consist of many questions asked on a variety of topics: design features of the boat, fishing gear, fishing operations, operating accounts and crew. The frame survey then makes it possible to randomly choose samples from the whole population, which assures the representativity of the fleet sample.

In 1996, the Direction de la Marine Marchande of Morocco *estimated the number of registered boats (units) in the inshore fishery to be 2 169. Each unit was described by 19 variables describing the general characteristics of the boats. Using information from the* Direction des Pêches Maritimes et de l'Aquaculture *on fishing licences in 1996, the active fishery in 1996 was estimated to comprise 1 777 vessels, not including artisanal fishing boats. Within the framework of the Inshore Fishery Modernisation Programme, an investigation was carried out to profile the fleet. A representative sample of 497 fishing units was selected from the list and from the descriptions of the 1 777 boats which constituted the frame.*

2.2.3. Following-up to acquire supplementary data on fishing units

The databases that result from the obligatory completion of logbooks in certain fisheries make it possible to reconstruct "fishing calendars" for the various units. It is then possible to profile the fishing fleet according to fishing activities over a period of time, and to answer questions about the dynamics of exploitation. In the case of fisheries where port-sampling is carried out, these calendars can only be established by systematically pursuing supplementary data for a sample of fishing units. This type of investigation is relatively difficult to implement for it requires assiduous fieldwork to regularly make contact with units during the course of their fishing operations. The information necessary to classify fishing behaviour generally requires direct discussion with the skipper of the fishing boat. They would have to be interviewed on return to port and the frequency of contact will thus depend on the time at sea, each interview relating to one or more previous trips (a maximum of two days proceeding the day of the interview, since the quality of the data depends on the memory of the person questioned).

A follow-up survey of fishing units was carried out by the Centre de recherche océanographique de Dakar-Thiaroye *(Senegal) in 1992. It surveyed a hundred fishing units to describing the tactics and strategies of artisanal fishing. This supplementary follow-up survey was carried out in order to help develop a model to simulate the dynamics of the fishery, which required a better understanding of the comportment of fishing units in the short- to medium-term. The investigation consisted of three parts: 1 – vessel specifications, 2 – the description of trips by regularly sampling on return from fishing, and interview with fishers, and 3 – the frequency and the nature of fishing activity during the course of the year (reason for return, fishing area, or fishing gear).*

2.3. Development of questionnaires

The development of the questionnaire must be based on consensus between the various beneficiaries of the investigation. Several meetings are generally necessary:

1. to identify the topic and the nature of the questions;
2. to obtain agreement on the wording of the questions;
3. to test and validate the prototype questionnaire.

The questionnaire usually consists of several parts classified by topic (e.g.: technical characteristics, fishing activities, catch, social and economic information). Annex I provides an example of a questionnaire, implemented in Morocco for the profile of its coastal fleets, which consisted of several parts; 12 pages in total. Although rather cumbersome, this questionnaire had to be comprehensive enough to provide all of the information necessary to design a programme of modernization for the fleet and for the conversion of fishing vessels. In fact, all the information required by the questionnaire in Annex I would not have been necessary to fulfill the requirements of a fleet profile. The entire data-set resulting from the questionnaire used the Moroccan survey could be used by many researchers working on fishery development or management problems, but it should be noted that such a questionnaire is perhaps a little too lengthy, making it difficult to plan data-processing and analysis.

List of topics used in the typology of fleets for the Moroccan inshore fishery study (See Annex I):

Vessel Technical specification (questionnaire submitted to all the sampled vessels)
- *Characteristics of the vessel*
- *Propulsion*
- *Capacity*
- *Bridge equipment*
- *Fishing gear*
- *Deck equipment*
- *Safety on board*
- *Fishing operations*
- *Method of sharing costs and benefits*
- *Refrigeration*
- *Running costs*
- *Maintenance of the boat and equipment*

Crew questionnaire (questionnaire submitted to a sub sample of the sampled vessels)
- *Fishing master*
- *Assistant fishing master*
- *Engineer*
- *Second engineer*
- *Deckhands*

A questionnaire generally consists of several types of question:

- numerical: quantitative (e.g. vessel size);
- nominal: qualitative value (e.g. target species name);
- scale: response on a scale of satisfaction or agreement (e.g. frequency of fishing trips: 1 = less than average, 2 = average, 3 = more than average);
- simple: only one possible answer (e.g. primary target species);
- multiple: several possible answers (e.g. the top three target species);
- simple text: answer comprising a word or a code (e.g. name of the port at which operations are based).

It is possible to distinguish between "closed" questions, which require a response to a given series of choices (for example: "type of vessel = trawler, sardine boat, longliner, mixed gear, or other (specify)". The "other" heading makes it possible in hindsight to create a new category if it proves to be relevant and numerous), and "open" questions, to be answered in an open-ended textual form (e.g. a detailed description of the holds). The answers to this last type of question can be classified and coded at a later stage in the treatment or can be left as comments available on the questionnaire forms.

The answers to the questions are either quantitative (e.g.: "horsepower of engine?") or qualitative (e.g.: "manufacturer of engine?"). In the first case it is important to explain the units of measurement used in the questionnaire, to avoid errors resulting from mistakes of scale. Generally, the questionnaire should include all of the information necessary to guide the investigator during course of the study (e.g.: "engine power: *to be indicated in horsepower*"; "operational capacity: *to be indicated in rpm*"; "position of bridge equipment: *to be marked on*

the diagram provided"; "number of fishing operations per fishing trip; *to be indicated, for a trawler as the number of deployments of the trawl, for a sardine boat as the number of deployments of the net, for longliner, in a number of sets"*). There should be a brief explanatory guide to each questionnaire to remind the investigators of the guidelines for properly implementing the survey. In the case of a qualitative answer (to a question of the *nominal* type) it is desirable to indicate on the questionnaire the list of possible answers: (e.g. "Type of vessel: *trawler, longliner, liner, seiner or other*") in order to avoid errors of understanding in the question or the recording of information.

In parallel with designing and prototyping the questionnaire, it is necessary to anticipate computer input and data processing requirements, since these may have an influence on the coding of the information. Several computer applications (e.g. *Sphynx*, *Question*) exist for the purpose of designing and editing a questionnaire, while at the same time providing support for data input, and offering statistical processing functions to assist in the presentation of results. Such software makes it possible to anticipate the required analytical steps at the time the questions are formulated (chronological order of the questions, placing the questions in comparison with others, grouping the questions logically by type, maximum number of modalities for a nominal question), and to minimize any problems of execution or management of the investigation down the line, in particular during the recording, the validation and coding, and the compilation of data.

The questionnaire can be used both for implementation in the field and for computer input of the data. For this it must be designed in such a way that responses in the field can be made in the form required by the database software. It then consists of a section for writing the answers at the time of the interview, and a section for coding the information, putting it into a form suitable for computer input. This type of form has the advantage of minimizing transcription errors during coding, which can be carried out by the investigator between two surveys (and not by a third person), and of economizing on forms.

Annex II provides an example of the form used for the follow-up survey of fishing units in the Senegal artisanal fishery. This example illustrates the design of a questionnaire for the simultaneous acquisition of information in the field and its coding for the data-processing. It also demonstrates the type of questions to ask in order to profile a fishing fleet according to fishing behaviour.

2.4. Sampling techniques

A survey which contains a large number of questions is seldom possible to implement across the whole population. In obtaining a manageable sample it is necessary to define a subset of units which provide the best possible representation of the total population (in this case, the fishing fleet). According to statistical theory, a sample is most likely to be representative if it is selected randomly, without bias in the choice of sample units by the investigator. This rigorous technique requires access to a frame survey in order to define a random sample, based on a known, non-zero, probability of each unit taking part in the investigation. This minimizes bias arising from a lack of correspondence between the investigated sample and the population onto which one seeks to extrapolate the results of the investigation. However, random sampling sometimes poses problems from the point of view of logistics and cost. It is necessary to make contact with the randomly identified fishing vessels in the sample, irrespective of their locality or their

availability. A sample selected on a non-random basis, where the units of the sample are chosen according to pre-established criteria, is one of the strategies often practiced in order to cope with these constraints. In this case, one seeks to obtain a sample as representative as possible of the full range of heterogeneity observed within the fishery. Stratified sampling makes it possible moreover to maximize precision whilst minimizing effort in the acquisition of information. The stratification allows existing knowledge about the heterogeneity of the fishery to be taken into account, in particular the spatial dimensions (geographical distribution) and fishing techniques.

A sample of 497 fishing vessels in the Moroccan coastal fleet was selected, on a logical basis according to the availability of fishing masters, in order to cover 25-30 % of the vessels of each port and type of boat (trawler, sardine boat and longliner). The survey was guided by information on fishing licences provided by the Direction de la Marine Marchande *and the* Direction des Pêches Maritimes et de l'Aquaculture*, which gave the number of units listed for each of the ports and types of vessels. The choice of units in the field was made with the aim of ensuring the most representative possible coverage of the diversity of the fleet, in particular from the point of view of horsepower, age, and length of boat. This technique of sampling is similar to the "quota method". The statistical population – the vessels of the coastal fleet – is stratified according to two criteria: geographical (port) and type of fishing licence (trawler, sardine boat or longliner); the total of the boats by stratum (a combination of port * type of licence) represents the whole of the active coastal fleet at a given point in time, according to the data provided by the administrative services in 1996. The completely random selection of 25-30 % of the units estimated in each stratum provides a representative sampling of the spatial heterogeneity and of all the licence types in the coastal fishery.*

Even if the sample does not allow the valid extrapolation of results to the entire statistical population (that is to say, all of the elements - here all of the vessels of the fishing fleet - from which the sample was selected according to the sampling criteria), classification is nevertheless of interest from a descriptive and qualitative point of view. Indeed, apart from the classification of fishing vessels as such, one of the major objectives of a fleet profile is to try to distinguish different classes within a heterogeneous assemblage, by highlighting variables that differentiate between the various classes. Even if the relative proportions within the total population are not respected, the process of identifying types within the sample still makes it possible to establish their characteristics, their specificities and their differences. A second, less detailed, survey can then be carried out on the whole population in order to evaluate the importance of the types highlighted by the first step. However, it is preferable to start with an adequate sample in order to target the two objectives directly, that is to say the quantification as well as the identification of the various types of units in the fishing fleet.

2.5. Data-processing techniques

Once the fieldwork has been completed, the information that has been gathered must be centralized and input to the computer. Data entry is tiresome work, but it is necessary to accord it some attention because of inevitable errors in reading and entering the information, especially if it is not carried out by people accustomed to using a keyboard for data-entry. In order to minimize these errors, it is often advisable to carry out:

1. duplicate data-entry (investment in this is profitable compared to the costs resulting from errors detected later in the database) and;

2. data input masking: this makes it possible, at the point of entry on the keyboard, to limit input to the type of answers that are acceptable as responses to that question (e.g.: as a result of a mistake in reading the forms, the entry of a quantitative datum - for example "12" in a column corresponding to a qualitative question - for example "fishing licence?"- can be made impossible). Input masking can also allow the entry of quantitative values which correspond only to the range of possible answers to the question. The program can be set to prevent, for example, the entry of the value "2001" in response to the question "age of the boat"? The data entry mask is generally defined at the time that the questionnaire is designed or the data-entry module of the database is programmed.

The computerized data can be stored in tabular form in a spreadsheet (e.g. Microsoft Excel, Lotus 123) or more compactly and efficiently in a relational database management system (e.g. Access, Oracle, dBase). The design of a database requires some technical skill, but the exercise can be profitable, particularly where there are large quantities of data which need to be regularly updated and/or transferred to other information processing systems.

Data on the 497 fishing units was produced by a survey, carried out by the Institut National de Recherche Halieutique, (*INRH) in Morocco, of the inshore fishery, and entered and stored using dBase. Eight different files resulted:*

1- General characteristics + bridge equipment;
2- Navigation equipment;
3- Fishing gear: trawl + seine;
4- Fishing gear: net + other;
5- Fishing operations;
6- System for dividing the income from fishing;
7- Operating accounts;
8- Crew characteristics.

Each file comprised 497 records and a number of fields corresponding to the number of variables relevant to each topic. Several key fields are common to different files, such as the port and the name of the boat. This establishes a relationship allowing later concatenation (joining) of the files. The assemblage of 8 files on the Moroccan fishing units includes a total of 601 variables, of which 550 are unique.

The data entered into a data processing system can be subject to secondary treatment by other users. There are two types of data-processing compatibility problems: a difference in the type of computer or operating system (commonly: PC - the so-called "wintel" machines, Apple Macintosh or Sun/Unix machines) - and a difference in format of files produced by the data processing software (files produced by the Excel spreadsheet program possess by default, for example, the filename extension ".XLS" which makes it possible to identify the software which created the file. There now exist means for importing and exporting files between several different types of computer and data-processing programs, which overcomes most problems of compatibility.

The data in the 8 files of the INRH survey were entered using a dBase program, resulting in files with a ".DBF" extension. In order to be accessible to certain other programs, these original files were then exported to TEXT format (file extension ".TXT"). Using the SAS statistical software package, the 8 files were merged into one data file consisting of 497 different units and 550 variables (SAS data files with an ".SSD" file extension). Another conversion to TEXT format of this unified file then made it possible to import the data into it the SPAD data-analysis program to carry out the typological analysis that resulted in the profile. The profile of the Moroccan fleets thus required the use of three data-processing software packages: dBase for the basic data-entry and compilation, SAS for the management of the data and certain statistical treatments, and SPAD for the typological analysis itself.

The data processing sequence can thus comprise a series of manipulations involving various computers and data-processing programs. The processing of data often requires the use of several data-processing tools, according to the functionality of each: management of the data (input, verification, and compilation), graphical analyses, elementary statistical analyses, multivariate data analysis. However, one person must be in charge of the original database, in order to avoid problems of revision or duplication of the data. On the other hand, since several people are often involved in the analytical steps, appropriate documentation describing the format of the data files must be available. This documentation should normally provide the following information:

- the name of the file and a description of the contents of the file;

- the name of the variable corresponding to each field (or column) in the file;

- the specific and complete meaning of each field/variable

This list includes as many lines as there are fields (variables) in the file. It is also advisable to indicate the size and the nature (quantitative, qualitative, and textual) of the variable described by each field, in order to facilitate reading the data during secondary treatment.

Annex III provides a description of the 8 files produced during the entry of data resulting from the survey questionnaires used in profiling Moroccan coastal fleets. This example demonstrates how each question was titled and expressed in the form of one or several fields in the computer file.

It is also common to use existing data files arising from other sources and providing additional information about the subject of the study. The problems encountered when interfacing the data from various sources often result from the data coding system. To extract data from file "B" in order to add them to the data of file "A" requires the presence of a common field (called a "key" field), i.e. a common reference that is identical between the two files, such as a vessel name. This process requires, on the one hand, identification of the two data sources and the availability of expertise to solve the problems encountered and, on the other hand, a preliminary analysis of the two files A and B to check the adequacy of the key reference used in merging the two files.

For the Moroccan coastal fleet, the Direction de la Marine Marchande *held a data-file of boats registered in 1996, which included entries on 2,169 boats with 19 variables describing each. In parallel, the* Direction des Pêches Maritimes *provided a data-file of boats operational in the coastal fishery, consisting of the holders of fishing licences in 1996. This file included 1,777 units and 14 variables. These data were used to assess how representative the "profile study" sample of 497 boats was in comparison to the registered fleet as a whole, as well as the part of the fleet licenced for fishing in 1996. It was necessary, as a starting point, to "clean" the data-files by checking the appearance of the boats in the sample with the two master files, on the basis of registration number and the name of the boat (it was necessary, for example, to add to the file the information on several boats which had been given licences after 1996, and which were therefore not listed in the master file of 1996) as well as the integrity of the lists of boats in the different files (e.g.: certain vessel names were duplicated and had to be removed from the master files).*

2.6. Statistical processing

2.6.1. Steps in statistical processing

Whatever the nature of the data – catch and effort, fishing vessel characteristics, or fishing calendars – the data processing for a fleet profile requires the following steps:

- Validating the data: at this stage, if the data were never subject to preliminary validation, it may be possible to check the acquisition process and to correct any errors. It is possible to evaluate the rate of response to the questions, and any missing data;

- The definition of data tables: by choosing the individuals and the variables which will be subject to statistical analysis. Statistical software generally uses a data file which is a table with a number of lines or rows equal to the number of individuals (the *n* elements of the sample, which are the *n* fishing units which are the subject of the profile) and a number of columns or fields equal to the number of variables on which the statistical analysis will be carried out. At this stage, it is useful to distinguish two types of variables: principal variables and supplementary variables: The former are taken into account during the typological construction of the profile (active variables), whereas the latter take effect at a secondary level to help explain the profile that results. For example, it is not appropriate to use the variable "port" in the development of the profile (otherwise the boats will be classified according to geographical criteria, amongst other things) but to look *a posteriori* to see if a profile established on the basis of other variables (vessel characteristics, fishing activity schedules) has any relationship to the variable "port": the latter is then called a "supplementary variable", and is used to explain the results obtained from the "active variables".

- The description of each variable of interest by univariate analysis. The initial step in any statistical analysis is the systematic analysis of the variables, starting with their elementary statistics (mean, standard deviation, minimum, maximum, and mode, median). In addition to an understanding of the data and their variability, this stage often contributes to detection of errors within the table. In fact, analysis often provides the best validation of the data! Systems of double-entry and data input-masking (see 2.5) do not make it possible to detect all entry errors and it is common to find aberrations in the data files when looking at the results of analysis.

- The study of the relationships between the variables of interest through bivariate analysis. A bivariate analysis is carried out through statistical methods which make it possible to study the relationship between variables taken pairwise (two by two). These methods include graphical techniques and quantitative techniques which offer the possibility of testing the strength of the relationship between the variables.

- The study of the similarities between the individuals and between the variables of the table by multivariate analysis. These statistical methods make it possible to visualize and to quantify, on the one hand, the relations between all the variables retained following the bivariate analysis and, on the other hand, the resemblances between the individuals of the table described by the "multivariable" of the table. These methods include graphical techniques to visualize the relationships between the individuals and between the variables, and quantitative techniques which provide indices to interpret the results and, if required, to test the validity of the statistical model.

- The synopsis and restitution of the results: one of the great difficulties of statistical analyses involving a large number of variables, including the typological analyses necessary for a fishery profile, is to provide a sufficiently clear, overall summary synthesis of the successive analyses carried out on all of the variables that describe the individuals in the data tables**.**

2.6.2. Methods of statistical processing

Statistics offers a range of methods, the choice of which will depend on four factors:

1. the type of variables: qualitative or quantitative;
2. the status of the variables: explanatory or dependent;
3. the number of variables: one, two or multiple;
4. the type of analysis: exploratory (descriptive) or confirmatory (test).

Producing a fishing fleet profile consists of exploring the structure of the data by analyses, on the one hand, of the relationships between the variables and, on the other hand, of the similarities between the individuals described by these variables. The first type of analysis allows the selection of the most relevant variables for the profile, and brings out the combinations of values of these variables which will best characterize the different classes of fishing unit. The second type of analysis makes these classes clear by grouping the individuals that resemble each other, on the basis of the description of the variables in the data tables. Two stages are recognized:

- setting up the data structure; and
- interpreting the data structure.

The first stage utilizes exploratory or descriptive methods to summaries the data set in the form of statistical tables or graphs (e.g.: classes of individuals described by their means). The second stage requires the use of statistical tests to validate the relevance of the classes by highlighting the significant variables of these classes.

2.6.2.1. Statistical tables

Variables can be summarized by several statistical indices. For quantitative variables, the average or the median is used to describe the location of n individuals within the range of the variable and its standard deviation, whilst the minimum and the maximum are used to describe their dispersion (variability). It is also interesting to make use of quantiles which correspond to the values of the variable which separate the n individuals by a given percentage. For example, the quartiles which separate the distribution into 4 equal parts: Q1 for the first 25% [Min-Q1], the median which separates the distribution in two equal parts [Q1-Med] = [Med-Q3] = 25% and Q3 for the last 25% [Q3-max]; or the (per) centiles which separate the distribution in 100 equal parts. It is particularly useful to analyse C1 and C99, since these correspond respectively to the value of the variable which defines 1% of the extreme individuals of the distribution [min-C1] = [C99-Max] = 1%.

Qualitative variables are described by the frequency, in absolute value (number) and relative value (percentage), of the individuals in the different values (modal classes) of the variable.

The 497 boats in the sample of the Moroccan coastal fleet were characterized by elementary statistical analysis of the quantitative variables available in the 2 master files ("Registration" and " licence") in order to assess the representativity of the sample compared to the whole fleet. The number in the sample, N indicates the number of values found in the file; it does not necessarily correspond to the number of boats of the sample, 497: indeed, there is no information on several of these boats in the files provided by the administration (there is missing data).

VARIABLE NAME	VARIABLE LABEL	N	Mean	St. Deviation	Minimum	Maximum
L_HT	overall length	233	16.1417167	4.8511686	6.00	26.76
CREUX	draught	274	2.0914964	0.6626511	0.70	3.46
TJB	gross tonnage	497	38.9603058	26.0614706	2.33	133.47
LARGEUR	beam	255	4.9809412	1.5224519	1.76	8.60
CV_MOT	engine power	497	238.4265594	137.6390468	26.00	675.00
NBANCONS	age of boat	340	15.1117647	10.6560262	2	68
	year of construction	340	1981.89	10.5660262	1929	1995

The boats in the sample have, for example, a length which varies from 6.00 to 26.76 m, with an average of 16.14 m. The standard deviation of 4.85 m indicates that the majority of the sample has a length ranging between 11.26 (16.14 – 4.84) and 20.99 m (16.14 + 4.84).

At the same time, the distribution of the 497 boats by area and fishing method can be studied. The total of the lines and the columns describes the distribution of the sample between the various fishing areas used by Moroccan boats and the various fishing methods. The percentage by area, if stratified sampling has been carried out correctly, must reflect the percentage of the total fleet. This cross-tabulation makes it possible to study the relation between the two qualitative variables (area and fishing method) based on the distribution of individuals to the various cells of the table.

(CHAL: trawler, CHPA: trawler-longliner, CHSA: trawler-sardine boat, DIV: various, SARD: sardine boat, SECH: seiner-trawler, SEPA: seiner-longliner, PASA: longliner-sardine boat, PALA: longliner).

	TYPE										
	CHAL	CHPA	CHSA	DIV	PALA	PASA	SARD	SECH	SEPA	TOTAL	%
REGION											
1. NADOR	3	.	8	.	11	12	12	2	4	52	10.46
2. AL HOCEINA	3	1	7	.	10	9	16	.	.	46	9.26
3. TANGIER	15	.	3	1	35	13	21	.	2	90	18.11
4. LARACHE	2	.	.	.	6	.	14	.	.	22	4.43
5. KENITRA	3	.	5	1	1	2	2	.	.	14	2.82
6. CASABLANCA	17	.	5	1	8	9	19	.	.	59	11.87
7. SAFI	20	3	4	4	12	1	8	.	.	52	10.46
8. AGADIR	35	1	.	.	10	.	30	.	.	76	15.29
9. LAAYOUNE	20	.	2	.	5	.	11	.	.	38	7.65
10.TAN-TAN	17	3	3	2	7	2	14	.	.	48	9.66
TOTAL	135	8	37	9	105	48	147	2	6	497	100%
%	27.16	1.61	7.44	1.81	21.13	9.65	29.58	0.40	1.21		100%

This table shows that the greatest number of boats is based in Tangier, with longliners and sardine boats being in the majority. The cross-tabulation illustrates a relationship between the area and the fishing method: in the north of Morocco there is a predominance of sardine boats (except in Tangier), whereas south of Casablanca, the coastal fleet is dominated by trawlers.

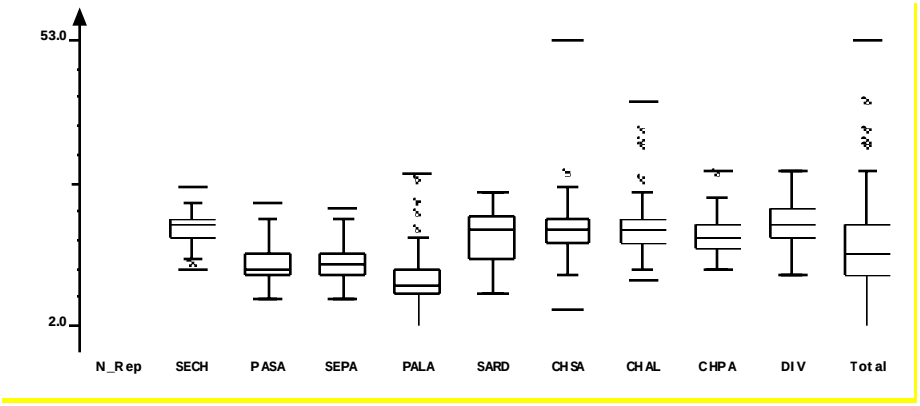
2.6.2.2. Statistical graphs

Statistical tables can be associated with graphs which make it possible to visualize the distribution as well as the relationship between variables; for example, it is possible to distinguish:

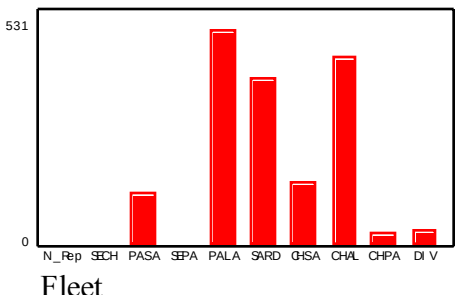
- The histogram which represents the number of individuals, by class, for a qualitative (or semi-quantitative) variable;
- The box plot which represents the quantiles of a quantitative variable;
- The scatter diagram which plots the position of each individual according to two quantitative variables (a group of points whose shape indicates the degree of relationship between the two variables);
- The straight line or curve which illustrates the function which connects two variables.

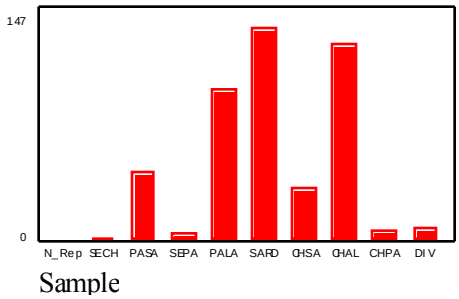
The graph makes it possible to explore the structure of the data quickly and to compare several data-sets. It is also used at the conclusion of a presentation to summarize and illustrate the values of a statistical table.

In the illustration below, the length of boat by licence-type, in a sample of the Moroccan coastal fleet, is compared on the basis of quantiles, and illustrated by box plots. The vertical axis corresponds to boat-length. Each box is delimited by the quartiles Q1 and Q3, whose variation Q3-Q1 corresponds to 50% of the vessels that are longer than the centre of the distribution. The horizontal line in the centre of the box represents the median value: if this line is in the middle of the box, it indicates that the distribution of the variable is symmetrical. The two ends of the vertical bars correspond to the values of the first and last percentiles (C1 and C99) and delimit 98 % of the sample distribution (= 497 boats); the points below or above the C1 and C99 percentiles correspond to the 1 % of the boats which have a value for this variable outside the distribution (e.g.: PALA or CHAL). The two extremes indicate the minimum and maximum values of the variable. For example, in this representation it can be seen that the "longline" fishing boats are smaller than the trawlers or the sardine boats, and that the seiner-trawlers are the most homogeneous group of boats in length (the box plot is small).

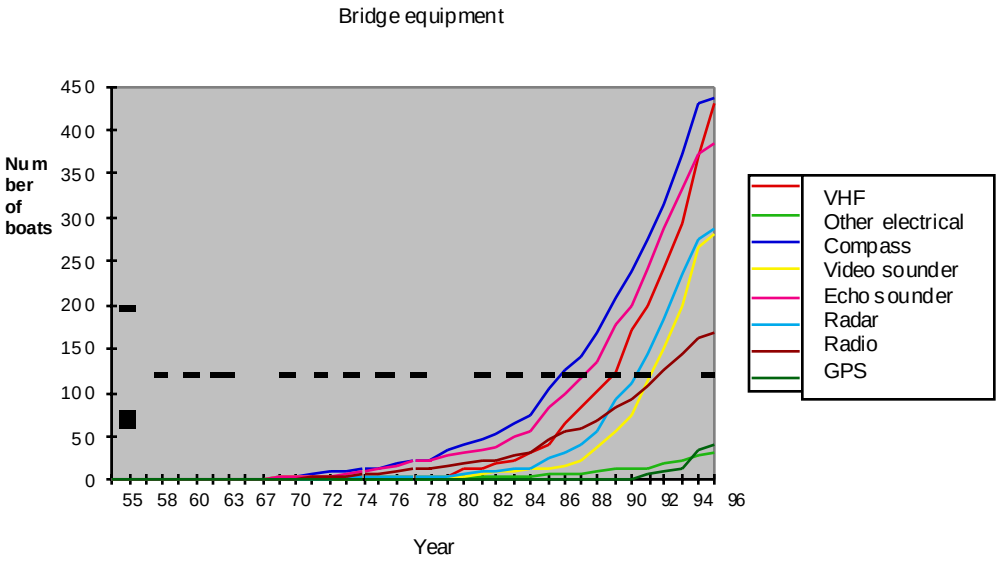


The comparison of the "type of fishing licence" frequency distributions between the sample and the total fleet (from which the sample is taken = boats in the file " licence 96") is illustrated by the frequency distribution histograms of the two data files (i.e. the 497 fleet sample individuals and 1,777 total fleet individuals partitioned amongst the 9 classes of the qualitative variable "fishing method"). The comparison between the two graphs shows that the sample over-estimates the sardine boats and underestimates the longliners compared to the information available in the master-file on licences operational in 1996. It would therefore be necessary to "rectify" or account for this bias in the sampling when conclusions are extrapolated to the entire coastal fishing fleet.





The evolution over a period of time of the number of boats that have acquired electronic equipment is illustrated by a cumulative frequency curve. Comparing the shapes of these curves for the various types of equipment makes it possible to illustrate the progress of modernization in Moroccan coastal fleets. It shows an acceleration in the 1990s of the acquisition of basic equipment (compass, VHF and sounder) - undoubtedly a result of incentive programmes - and the introduction of new equipment, such as the GPS, since 1995.



2.6.2.3. Statistical tests

The relationship between two variables, whether quantitative, qualitative or mixed (1 quantitative and 1 qualitative), can be tested using statistical methods (hypothesis testing). To interpret the results of the classification, and therefore, to find the variables which explain significant differences between the classes in the profile, 3 methods are normally used:

1. The Chi squared (χ^2) test, which makes it possible to see if there is a significant relationship between two qualitative variables, or to compare two distributions (for example, to compare the distribution of fishing methods, between the sample and the total population in the master file of licences from 1996);
2. The t-test of comparison between two averages, which makes it possible to compare the average of a quantitative variable between two groups;
3. and the Analysis of Variance test which makes it possible to compare the averages of two groups or more (an extension of the t-test).

In profiling fishing fleets, determining the structure of the profile consists of separating out those classes of vessels which are similar to each other from those which are different. Interpretation of the structure therefore consists of using statistical tests to find the variables which illustrate significant differences between classes. For qualitative variables, we compare the frequency distribution of the individuals, in the various modes of each variable, between the class and the whole sample. For quantitative variables, we compare the averages observed for the class and for the whole sample. These various indicators (frequencies and averages) are included in the tables

representing the results of the typological analysis in order to summarize the variables that are characteristic of the classes. It is through the study of the values and the significant modes of the classes that it is possible to provide an interpretation of the class and to thereby validate the relevance of the typological profile.

A comparison of the distribution of fishing methods in the sample of 497 boats, and the target population of 1 777 boats licenced, was carried out using a χ^2 test. The results confirm that there is a significant difference between the sample and the population, due to an under-estimate of the number of longliners compared to sardine boat.

Concurrently, we may compare the lengths of the boats in the total population with those in the sample, for each fishing method, in order to see if the sample is significantly different from the total population with respect to the size of the boat. The comparison of this quantitative variable between the various groups of boats – 7 types of fishing boats (the seiners are included in the miscellaneous category) in 2 files (licences 96 and sample = 14 groups) is carried out through an analysis of variance with two factors. Factor 1 is the group of boats associated with each of the two files (population/survey), and factor 2 is the fishing method.

*The statistical analysis shows that there is a significant difference, on the one hand, between the two datasets - based on the analysis of the probability that the value of the test is higher than a theoretical value called F (this probability must be lower than 5 % to demonstrate a significant difference between the compared groups). In this particular case, this significant difference between the population and the sample of boats is due to the relative importance of the sardine boats and the longliners. On the other hand, a significant difference is found between fishing methods; this confirms the differences suggested from the box plots in the previous graphical analysis of the data. However there is no significant interaction between the groups of boats in the two files and the fishing method (this interaction is labeled "method*file"), since the probability that the value of the test is higher than F is 0.2203. This probability is greater than 5 % , indicating that the sizes of the boats classified by fishing method in the sample are similar to the sizes of boats by fishing method in the total population. The analysis of variance model is significant overall: it explains 66 % of the total variability of the lengths observed for the boats for the various fishing methods, and the different files. The value of R^2 makes it possible to evaluate the goodness of fit of the statistical model.*

RESULTS OF THE ANALYSIS OF VARIANCE FOR TWO FACTORS:

Variable: L_HT length

Sources of Variation	degrees of Freedom	Sum of Squares	Mean square	F	Pr > F
Model	13	112.22883042	8.63298696	172.53	0.0001
Error	1151	57.59382612	0.05003808		
Total	1164	169.82265654			

R-squared
0.660859

Sources of Variation	degrees of Freedom	Sum of Squares	Mean square	F	Pr > F
FILE	1	3.32892686	3.32892686	66.53	0.0001
FISHING METHOD	6	108.48631299	18.08105217	361.35	0.0001
METHOD*FILE	6	0.41359056	0.06893176	1.38	0.2203

2.6.2.4. Data Analysis

"Data Analysis" is a term for the array of statistical methods used for multidimensional (or multivariate) descriptive analysis. For the typology of fishing fleets, we use two types of methods: factorial analyses and automatic classification.

These methods, which are based primarily on a geometrical approach, make it possible to measure the resemblance, or the distance, between individuals and between variables, and to establish their degree of similarity. These similarities are visualized either by plotting a "cloud" of individuals (or variables) on a factorial plot, or by the shape of a dichotomous tree (dendrogram), whose success junctions illustrate the grouping of individuals. By slicing across the tree, the total population of the individuals under analysis can be partitioned, and interpreted according to the variables that are used in the analysis (active variables) and to the variables that are external to the analysis (additional variables). These partitioned groups, when interpreted, constitute the result of the typological profile: namely, the identification and the description of the elements within the various classes.

There are various methods of factorial analysis and classification, the choice of which depends on the characteristics of the data set being analysed, in particular the quantitative or qualitative nature of the data, and of the criterion which will be used to measure the relationship between the individuals or variables. To choose a method judiciously requires at least some knowledge of the theoretical basis of the techniques of data analysis.

Figure 2 shows the various stages in the exploration of the structure of the data by these methods. For the first stage, it is advisable to carry out a factorial analysis to explore the structure of the data, by studying the relationships between the variables and the resemblance between the individuals that are the subject of the typology.

Figure 3 illustrates, as an example, the result obtained from a factorial analysis designed to study the relationship between some qualitative variables (Multiple Correspondence Analysis). Four qualitative variables are used to classify strategies in a multispecies fishery: 1 – the target (signified by the catch profile of the fishing vessels), 2 – the period, 3 – the gear, and 4 – the fishing grounds. The factorial technique makes it possible to visualize the proximities between the various modalities of the variables (8 targets, 12 months, 3 gears and 28 fishing grounds).

In the same way, it is possible to analyse the plot of the individuals and to visualize the position of the fishing units on the plot of the variables.

The second step in typological analysis then consists of grouping the individuals by means of a classification algorithm or automatic partition. There are many classification algorithms, and their choice depends on the principle of agglomeration, and thus of resemblance between the individuals typifying the classes. Again, the choice of method requires some knowledge of the principles underlying the method.

The profile of the 497 boats of the Moroccan coastal fleets was carried out using four methods of multidimensional analysis:

1. *Principal Components Analysis (PCA) to study the similarities between boats according to quantitative variables (a method based on the linear correlations of the variables);*
2. *Multiple Correspondence Analysis (MCA) to analyse the similarities between boats according to qualitative variables (method based on multivariate contingency tables);*
3. *Ward's Ascending Hierarchical Clustering (AHC) (a method based on the variances within and between groups);*
4. *Partition around moving centers (method of optimization of partitions based on variances).*

Classification is carried out based on the factorial co-ordinates of the individual vessels on the principal factorial axes, in order to smooth the variability of the data and to obtain a classification tree (dendrogram) of the separate classes.

Slicing the dendrogram makes it possible to define a partition of the individual vessels in a particular number of classes. This partition is then optimized by the moving centers algorithm which makes it possible to adjust, a posteriori, the individual boats in the classes in order to minimize within-cluster variability and to maximize between-clusters variability. This whole procedure, the factorial analysis, followed by classification, then partition, helps to reveal the underlying structure of the data in the table.

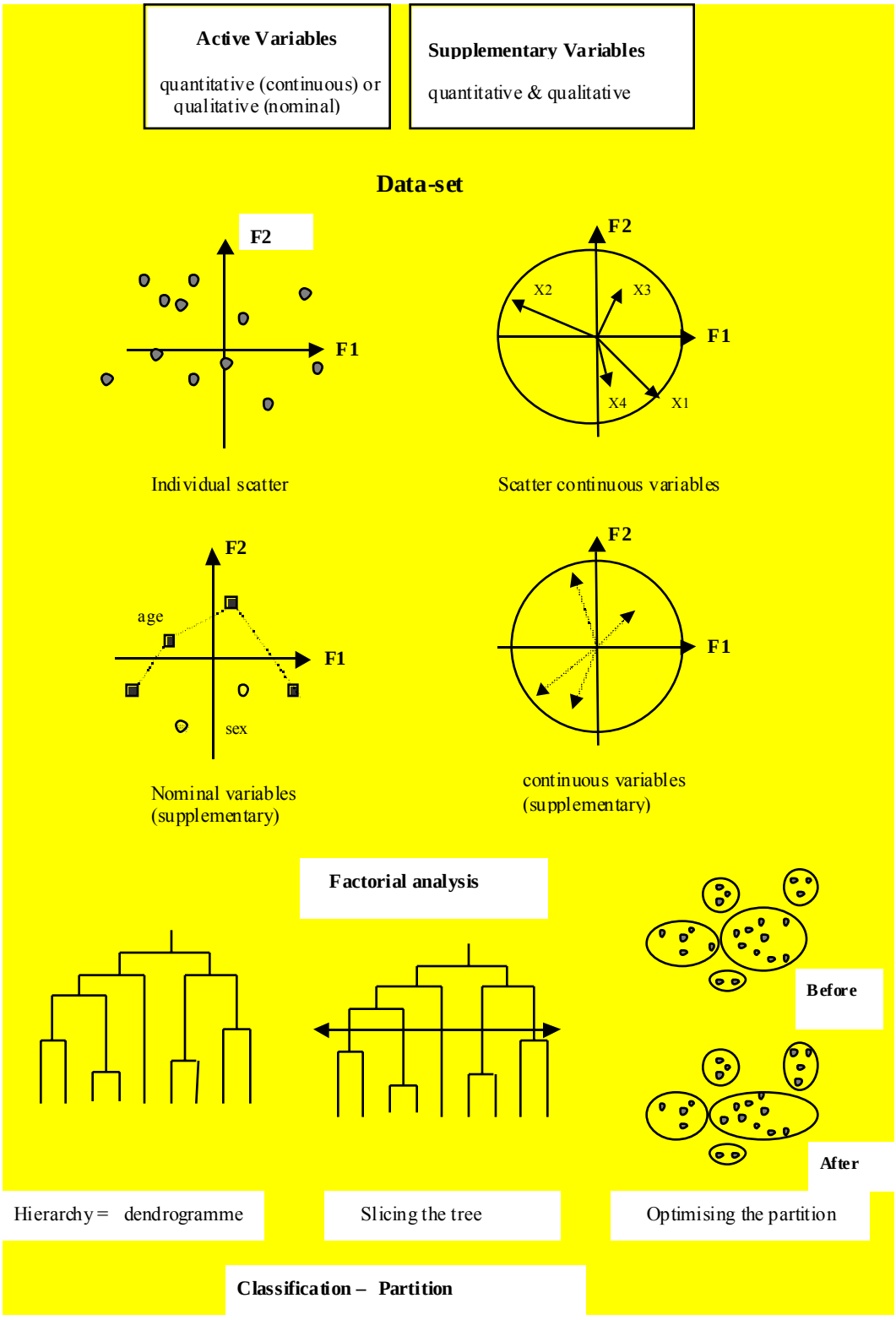


Figure 2: Exploring the structure of the data by Data Analysis methods

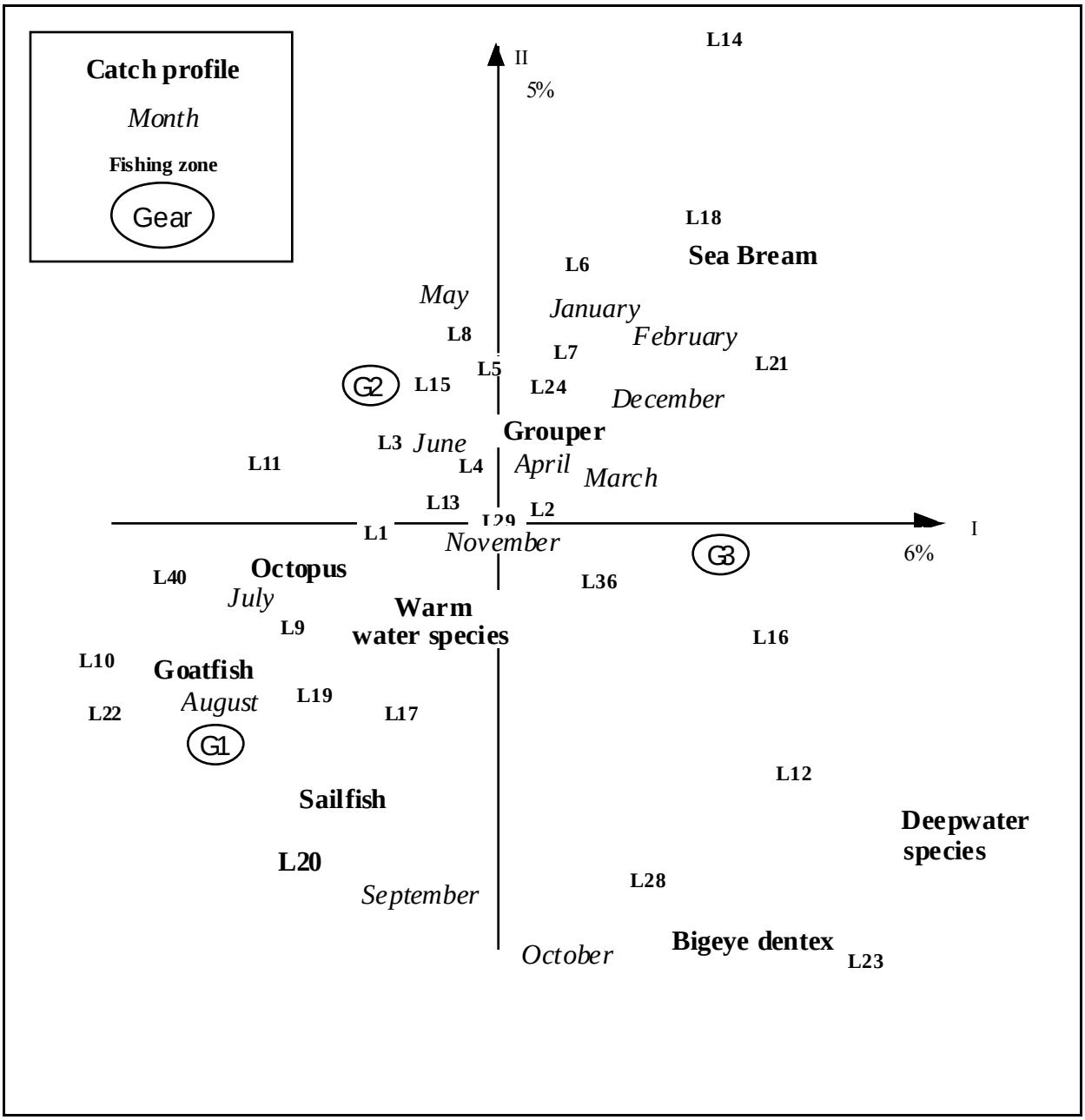


Figure 3: Example of a factorial map resulting from a Multiple Correspondence Analysis applied to qualitative variables to carry out a typological analysis of fishing strategies (artisanal fisheries of Kayar in Senegal in 1992)

2.6.3 The process of analysis

The stages of analysis can be summarized in the form of a flow chart representing the different steps of the process, the data sets on which the analyses are carried out, with their size (i.e.: the number of individuals and variables), and the methods selected for carrying out the analyses. An example is presented below showing 3 processes of analysis of the fishing fleet profile, in respect of the tactics of fishing (Figure 4), the technical characteristics of the boats (Figure 5) and the strategies of exploitation (Figure 6).

Figure 4 illustrates the approach taken with the catch and effort data in order to produce a fleet profile based on fishing tactics, corresponding to the processes applied to the artisanal fisheries of Senegal and the trawl fisheries of the Celtic Sea. "Fishing tactics" refers to the choices made during a fishing trip or a particular fishing set or haul, where the fishing takes place, the duration, the fishing effort (gear used for a certain time) and the target species. The flowchart summarizes the sequence of methods used to carry out two successive classifications: the results of the first classification, based on target species, are used to build a second table of figures which gather together various variables of interest in order to identify fishing tactics. If all the trips by the vessels of the fleet turn out to be classifiable by their tactics, it is then possible to construct a third table which will illustrate the time spent by each boat utilizing various fishing tactics (a fishing calendar or schedule).

Figure 5 illustrates the process of analysis used in producing a profile based on the technical characteristics of the boats of the Moroccan coastal fleets. The first stage consists of testing how representative is the sample of 497 boats used in the investigation compared to the population in the master-file covering the whole Moroccan fleet (i.e.: the 2 169 boats of the file "Armament" provided by the Direction de la Marine Marchande *and the 1 777 boats of the file "Licence96" provided by the* Direction des Pêches Maritimes et de l'Aquaculture. *The second stage consists of describing each variable according to its basic statistics. The third stage is the fleet profile itself. All the variables involved in the analysis are quantitative, and the process of establishing the structure of the data set is accomplished by a Principal Components Analysis followed of an automatic classification based on the technical characteristics variables (117 variables from the first 4 files of the database: 1 – general characteristics and bridge equipment, 2 – deck equipment, 3 and 4 – fishing gear: trawl, seine, net, other). Structural interpretation consists of making statistical calculations for each class identified by the typological study, for all the variables of the data table.*

*Figure 6 illustrates the second analysis applied to the 497 boats of the Moroccan fleet, this time in order to establish the relative importance of the various fishing strategies. File 5 of the database, entitled "Fishing operations", included 124 variables describing up to 4 different fishing operations carried out by each boat during 1995. Each operation in the survey questionnaire covers a fishing campaign described by the gear used, the fishing ground visited, the species captured and the period (the months at the beginning and end of the fishing season). A campaign includes all similar fishing trips from the point of view of gear, target species and fishing zone. By analysing the combination of variables [gear * species * zone * period] it is possible to see whether boats involved in different fishing campaigns use several strategies over the course of time, in particular the general-purpose boats with multipurpose licences.*

The analysis of exploitation strategies is based on the study of fishing campaigns and carried out in 3 successive stages:

1. A profile of fishing operations by campaign-type

The fishing operations file is modified in order to produce records by fishing operation (one boat carrying out 4 different operations thus generates 4 records): a table is obtained with 1064 lines, one for each fishing operation. As each operation is described by 29 variables according to different criteria (catch, place, period), it is necessary as a precondition to balance the weight of these different criteria (weight function of the number of variables describing the criterion) before classifying the fishing operations. Each of the three criteria is finally expressed as a qualitative variable constructed from 3 successive classifications carried out on the 1 064 fishing operations.

For each classification, the operations are described by the variables relevant to the topic considered, that is to say:
- the list of the captured species, for the study of targets;
- the geographical range of the zones visited (and possibly, the depth-range);
- months included in the period of fishing.

Following these first 3 classifications, each operation is described by a species category, a zone category and a period category. The initial multivariate table is then synthesized, with 3 qualitative variables resulting from the 29 initial variables. The fishing campaign is described by the combination of these 3 new variables: zone fished, period, target, and by the variable gear. A Multiple Correspondence Analysis can be used to analyse this kind of table in order to determine resemblances (amongst the 1 064 operations) on the basis of the relationship between the modes (classes) of these nominal variables. A new classification makes it possible to clarify the "fishing-type" campaigns.

2. Construction of a profile of fishing schedules:

Elucidating the exploitation strategies then consists of describing each boat according to its fishing schedule, that is to say the time spent on the different campaign-types identified in the preceding stage. The new matrix of data is based on the 497 boats, described by the number of months associated with the different campaign types. This table is subjected to a factorial analysis (PCA) and a new profile is built to highlight the classes of boats that are engaged in the same fishing activities during the course of the year.

3. Interpretation of exploitation strategies based on the variables in the other data files:

Classes of boats using similar strategies are then analysed in relation to the entire available data set, particularly the technical specification of each boat.

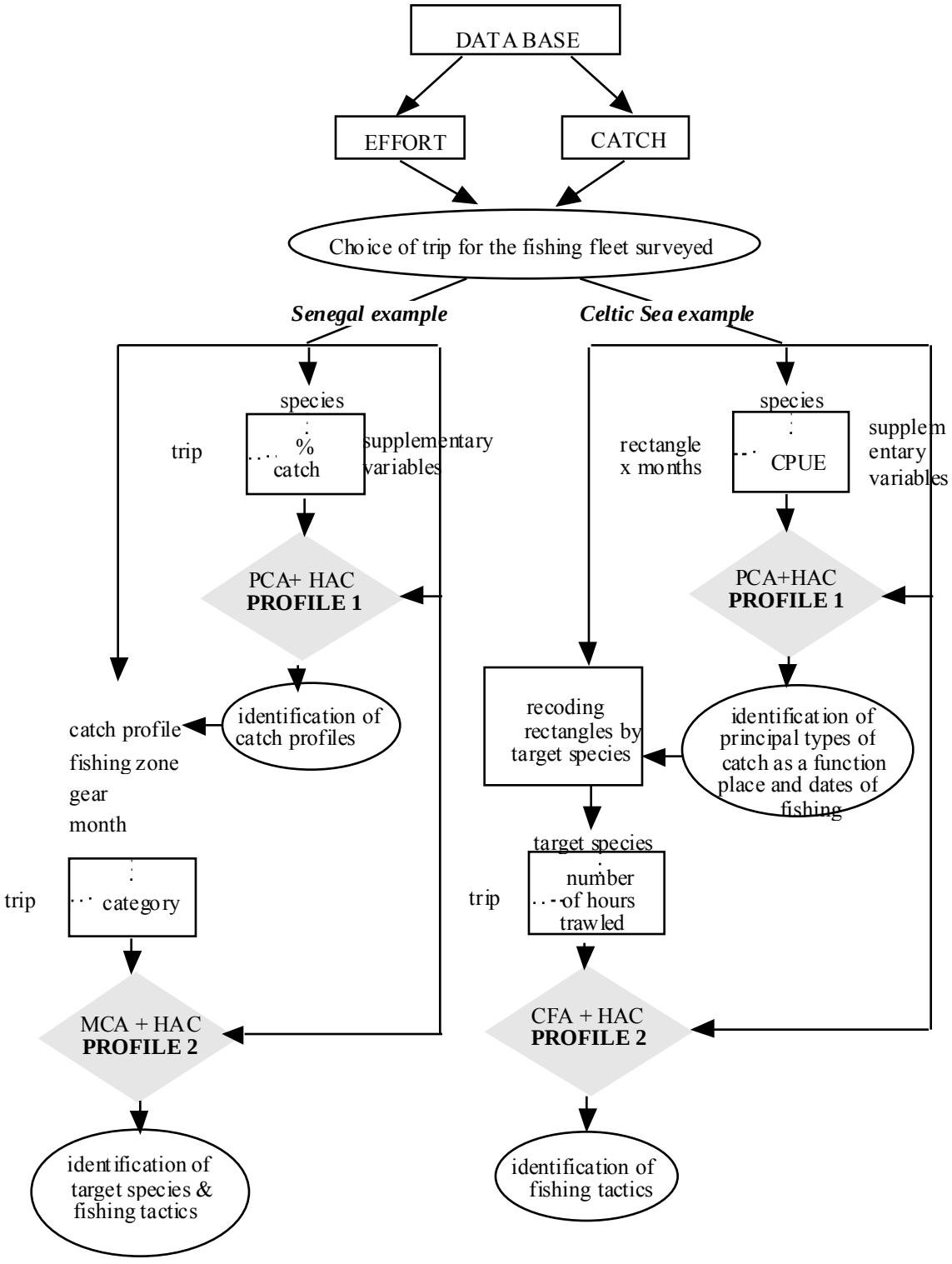


Figure 4: Process of analysis. Flowchart of the methodology to produce the profile of fishing tactics used by the artisanal fisheries in Senegal and the trawl fisheries of the Celtic Sea (PCA: Principal Components Analysis; MCA: Multiple Correspondences Analysis; CA: Correspondences Analysis; AHC: Ascending hierarchical clustering) (drawn from Pelletier and Ferraris, 2000)

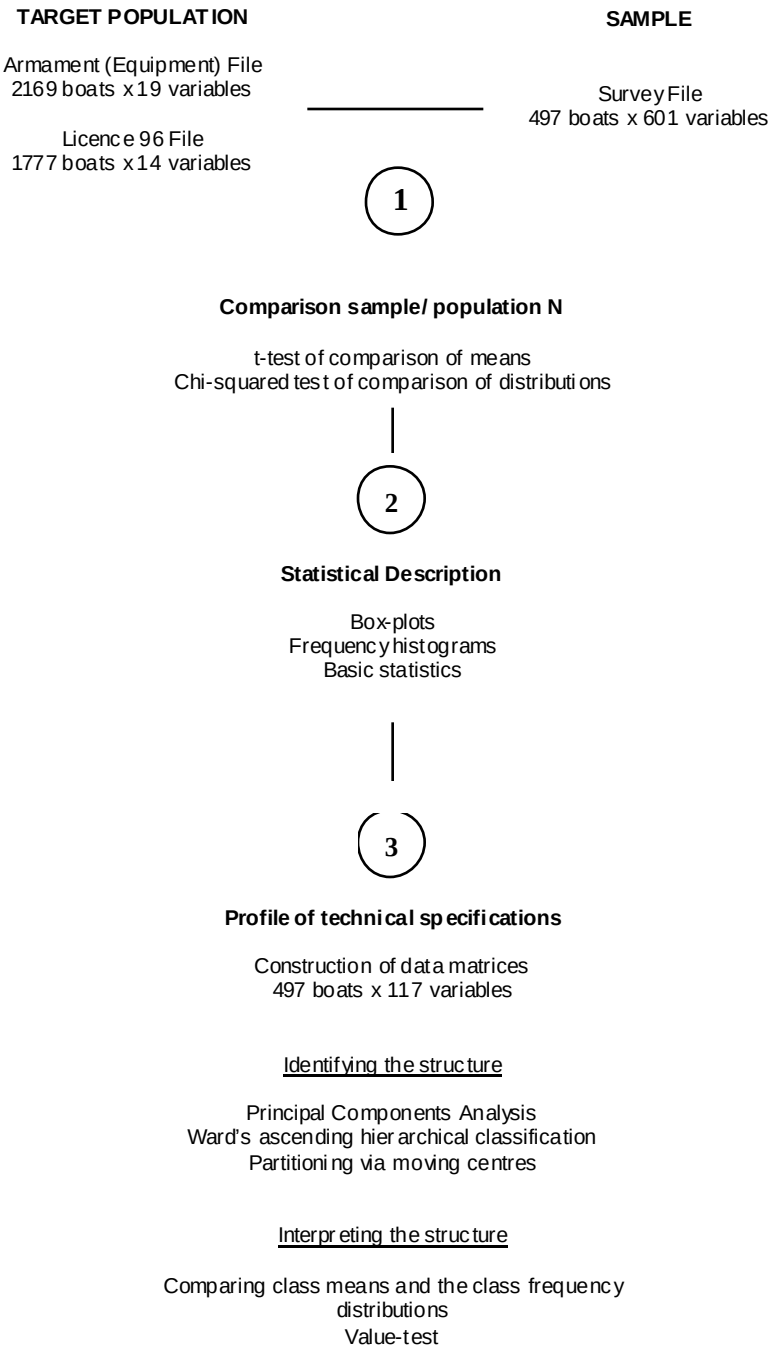


Figure 5: Process of analysis of the profile of the Moroccan fleet based on technical specifications

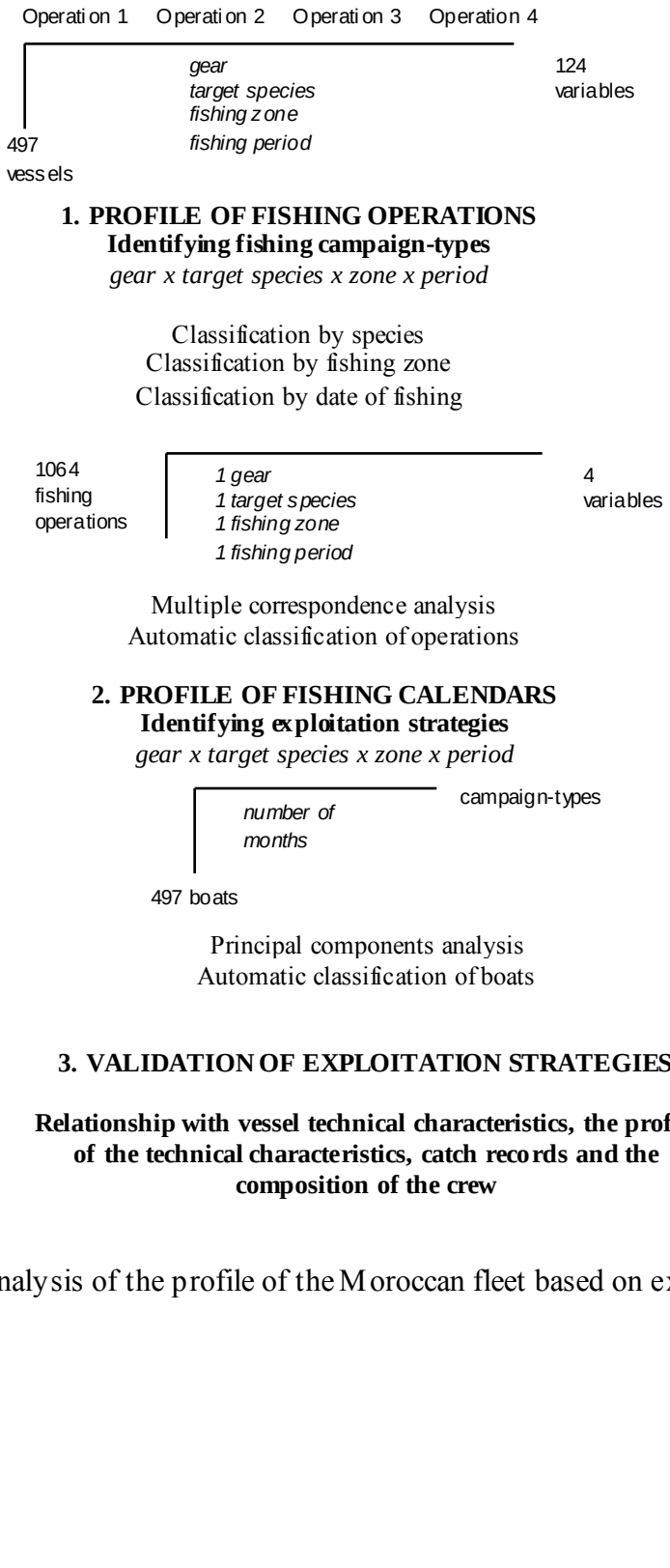


Figure 6: Process of analysis of the profile of the Moroccan fleet based on exploitation strategies

3. RESULTS

3.1. Empirical interpretation of results

The results obtained, following a hierarchical classification, are presented in the form of a tree illustrating the successive grouping of the elements under analysis, in classes which ultimately amalgamate to form a single unique group which represents the total population. The tree can be interpreted in a descending (from the "trunk" to the "leaves" of the tree) or ascending (from the "leaves" to the "trunk ") fashion. The problem lies in the definition of an appropriate cut in the tree to establish the number of classes relevant to the profile.

The data analyst will suggest, using statistical criteria, one or more cuts based on "gaps" between successive "nodes" (a "node" being a subdivision of one branch into two branches): a greater gap, with more sub-branches emanating from it, indicates a significant difference with the other branches of the node. The quantitative criteria used to set the level at which cuts will be made are:

- the numbers in the classes (in general, the creation of very small classes should be avoided);
- the percentage of the variability explained by the typology, measured in terms of the ratio of within-cluster inertia to total inertia, (where inertia is a measure of the variability of a cluster). Between-clusters inertia represents the variability between the classes: the larger it is, the more different are the groups. Total inertia corresponds to the variability of the whole subject of the classification, and is equal to within-cluster variability plus between-clusters variability. The ratio "between-clusters variability / total variability" gives the percentage of variability taken into account by representing the sum of K classes. Within-cluster variability makes it possible to assess the degree of heterogeneity of each class and the possible relevance of choosing a cut with K+1 classes to split off the most dissimilar group.

The general structure of the tree provides us with information on the heterogeneity of the data set and on the efficiency of the classification to define classes within it. The result depends on the classification algorithm used; that is why it is always necessary to specify which method has been used. It is not sufficient to say, for example, that an Ascending Hierarchical Clustering – AHC – has been used. In the example of the Moroccan coastal fleet profile, the method used for hierarchical classification is Ward's algorithm (a clustering technique based on variance). The result also depends on the size of the data-table being classified and therefore on the number of individuals and variables used. This last point is critical. In fact, if the number of individuals or the number of variables changes, you are likely to obtain slightly different results, especially if the structure of the data is "fuzzy". The more the elements of the profile are different, with distinct, valid classes, the more stable will be the results of the typological analysis. The main difficulty lies in constructing the data table to be analysed, in the choice of individuals and variables, and in the coding of the data. It may be necessary to remove "aberrant" individuals (and to then treat them as additional individuals), to avoid redundant variables, to cluster the modalities of nominal variables (to avoid including modalities for very weak frequencies). The first data-table can, if necessary (as is often the case), be modified, following the analysis of the relationships amongst variables and amongst individuals. This is why it is advisable as a first stage, to carry out a factorial analysis. This makes it possible to take account, in successive factorial analyses, of the sources of variability in the data set, and to identify the variables responsible for this heterogeneity and to locate the atypical individuals. This examination of the

data-structure helps to plan the steps in the analysis. This is a useful first step, since it allows the data set to speak for itself and respond to successive adjustments. It is generally necessary, in the construction of the data-table, to refer back several times. Figure 7 illustrates these successive stages and the feedback that is often necessary in analysing the data set.

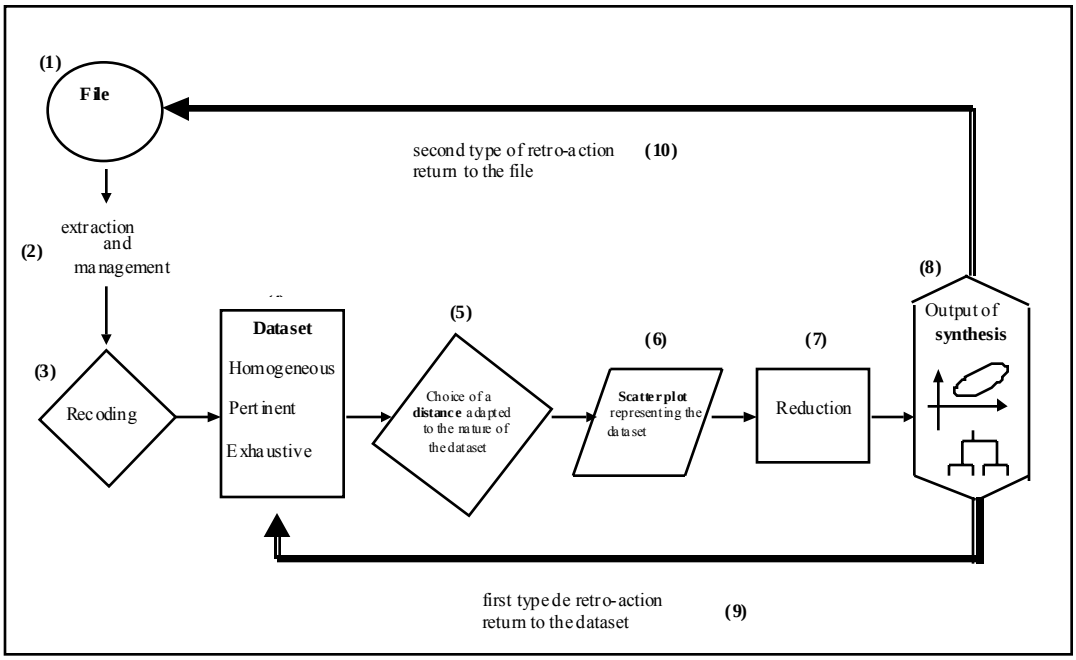
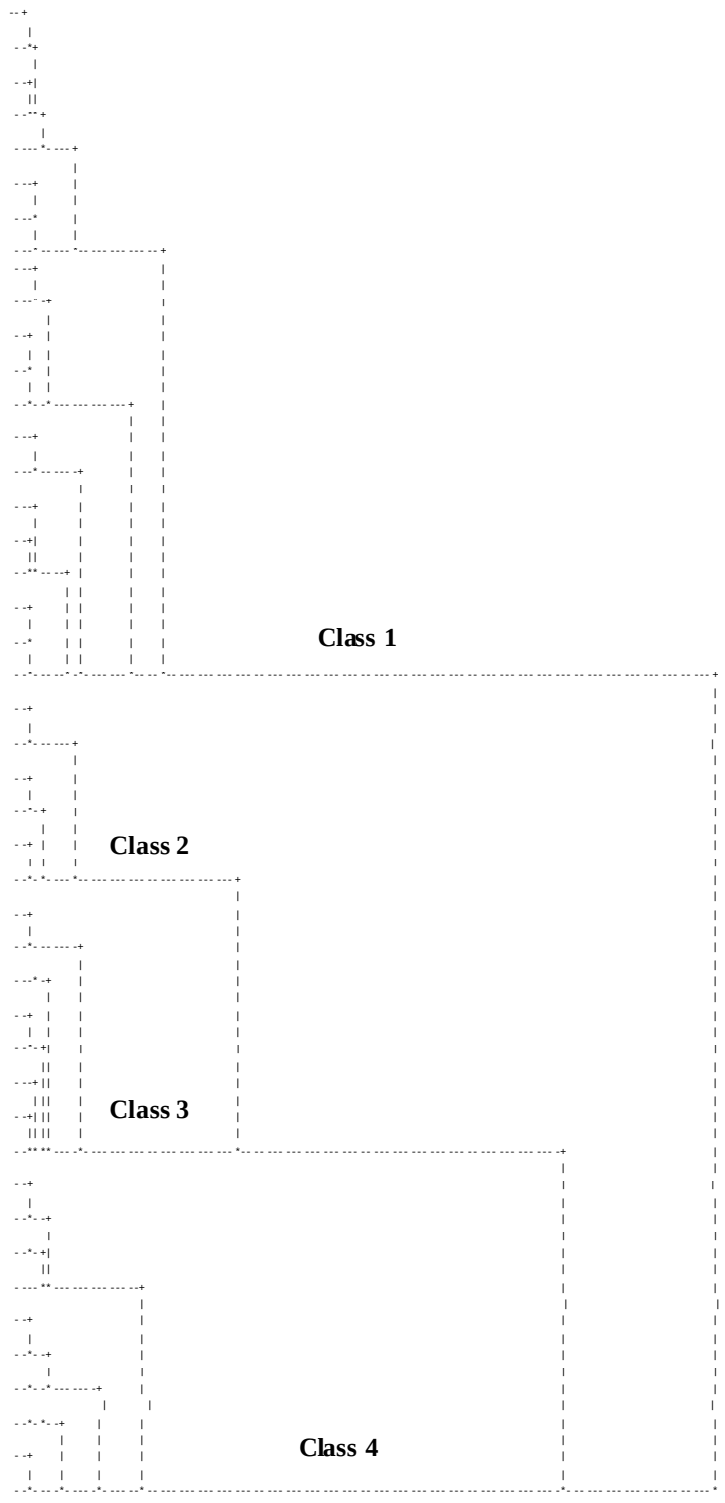


Figure 7: 10 essential check-points in the analysis of data (adapted from J.P. Fénelon, 1981. *Qu'est-ce que l'analyse des données?* Lefonen, Paris, page 89).

The hierarchical classification tree (or dendrogram) resulting from the analysis of the technical specifications of 497 boats of the Moroccan coastal fleet, is illustrated below. This representation of the tree is limited to 45 branches, whereas the complete tree comprises 497 (the number of individuals in the classification). The structure underlined illustrates 3, even 4 quite distinct classes. Cutting the tree into 4 classes explains 40.87 % of the total variability in technical specifications for the 497 boats.

Ward's Heirarchical classification of 497 vessels described by their technical specifications



Once the number of classes has been decided, the analyst generates the statistics (mean, standard deviation, frequency) for all the significant variables (active and supplementary) of the partition, in order to describe each class resulting from the typological classification. At the same time, it is often useful to provide a list of the individuals in each class, as well as the list of the individuals closest to the centroid of the class. These individuals, which are typical of the class mean, are called "paragons": they are the stereotypical components of the class (e.g.: boat-types representative of the average characteristics of that class of boats).

The next step brings in the **field specialist**. It is usually difficult for the person is in charge of the analysis to also carry out the interpretation of results by themselves. The expert can judge the validity of the classes and potential problems involved in the assignment of individuals to classes. From the list of the characteristic variables for each class, the expert can normally give a name to each class, on the basis of association of these variables. The goal of classification is to confirm the existence of classes suspected by the experts and, eventually, to reveal categories unsuspected even by the experts! This interpretation work must be undertaken jointly by the analyst and the owner of the data in order to take into account qualitative elements which are non-quantifiable and difficult to represent in tabular form, but which are known through experience to local scientists or administrators. During the course of a typological study, individual experience undeniably guides the interpretation of the data. This is why it is necessary to combine expert knowledge and the objectivity and rigor of statistical analysis. This requires a concerted effort and, in practice, the organization of working groups.

*Work on the profile of Moroccan coastal fishery started with a survey carried out in 1996-97 by the INRH, based in Casablanca. Data was analyse by an FAO consultant at ORSTOM (*Institut Français de Recherche Scientifique pour le Développement en Coopération*) based in France. In addition numerous exchanges by fax or email, several trips and meetings took place in connection with the data processing:*

- the first trip by the data analyst to Morocco: preparatory meeting, recommendations for the database, the results expected, activities to be carried out and collaboration necessary;

- a second trip by the data analyst, seven months later, lasting one week: presentation of the results obtained from the typology of the fleet's technical characteristics (see the diagram of analysis presented in Figure 5): comments from various experts, validation of the first typology (concerning the technical characteristics of the vessels of the fleet), evaluation of the data processing activity. Notably, a work-programming meeting was organized between the FAO consultant and the representatives of the three institutions involved in the Fisheries Modernization Programme (the INRH, l'Office National des Pêche et le Ministère des Pêches Maritimes*). Each variable of the investigation was reviewed with the specialists, in order to define particular requests for specific treatments (presentation of certain tables, calculation of new composite variables, for example: range of costs for purchase of electronic equipment; relationship tonnage/power, tonnage/number of people aboard; relation between length of cable on the winch and the horsepower of the trawler in order to determine the possibilities of prospecting by large trawlers in the deepest zones);*

- a trip by a technician of the Service de Technologie de l'INRH, *a "field specialist", to France the following month, for one week: a detailed study of the results of the statistical analysis as a function of the characteristics of the investigation, an expert knowledge of the Moroccan fleet, and the objectives being pursued;*

- submission of the first report on the typology of vessel technical characteristics;
- a third and last trip by the data analyst, also for a week, the following month: for the development of the profile of the fishing strategies (see the procedure of analysis presented in Figure 6);

The conclusion of the data-analysis and the handing-over of the final report, with the appendices and the diskettes containing the programs and processed data, occurred before the end of 1997. The analysis of the information, from planning to analysis and the submission of results, thus required a full year, calling upon part-time external resources.

3.2. Examples of Fleet Profiling

3.2.1. Catch and fishing effort

A fleet profile based on catch and fishing effort may be commissioned, for example, within the framework of a study to analyse the structure of the fleet (type, number and characteristic of the various units composing the fleet) in respect of its potential impact on resources. The objective, from the point of view of management, is to better understand fishing pressure and the sustainability of exploitation by taking into account the particular interactions between the vessels. The analysis can be based on the annual or monthly catch-composition by vessel or of the catch per unit of effort (CPUE). The classification of fishing vessels on the basis of their catches and their fishing effort, and the identification of homogeneous categories within the fleet, are necessary in order to calculate fishing power or to be able to model the allocation of fishing effort. A discussion on using the results of a fleets profile was made by Biseau (*in* Rochet *et al.*, 1994).

Fleet profiling based on catches is generally carried out on a fine temporal scale, either at the level of the fishing trip, the trawl, or the monthly landing. This type of analysis is implemented at the initial stages of a fleet profile because the criterion subject to classification is no longer the vessel but the fishing trip. This kind of profile is necessary in order to study multi-species fisheries or species associated within the catch. In general, analyses of production are carried out in parallel with those of fishing effort. Coupling two profiles using different criteria is fairly common: for example, cross-tabulations between two independent profiles based on the same set of fishing trips produced, on the one hand, from activities (fishing effort) and, on the other hand, from production (catch). Or coupling of analyses between the quantity of catch and the frequency of fishing zone use. The process of analysis in Figure 4 shows two examples of coupling (artisanal fisheries in Senegal and the trawl fisheries of the Celtic Sea) between the catch data set and the fishing effort data set.

The profile of artisanal fishing tactics in Senegal was implemented by the technicians of the Centre de Recherche Océanographique de Dakar-Thiaroye, *using routine follow-up data samples. The plan of analysis (Figure 4) applied to the catch and effort data, for each trip sampled in 1992, made it possible to identify 6 types of fishing behaviour (behaviour-types or "tactics"). Each tactic or behaviour-type is described by a combination of the 4 qualitative variables (Figure 3) describing a type of fishing behaviour (target species* * gear * place of fishing * month) and by supplementary variables (depth and crew).

In the table below, each tactic is named after the most characteristic category of the variable "catch profile" (bold). The target species is assumed to be the most characteristic category of the variable catch per species (in italics). In the first column, the number of illustrative individuals assigned to the cluster (i.e. the tactic) is reported in parentheses. In the gear column, G1 corresponds to no engine, G2 corresponds to an engine power < 9 kW, and G3 corresponds to an engine power > 9 kW. Depth is coded in 7 categories, but only characteristic depth ranges are reported for clarity (taken from Pelletier & Ferraris, Can. Journal Fish. 2000).

	Active variables				Illustrative variables		
Cluster size	Catch profile (tactic name in bold)	Gear	Location	Month	Catch per species (target species in italics)	Depth	Crew size
1490 (24)	**1. Sea bream**	G2 G3	L14, L6, L13, L21, L7	Feb., Jan., Mar., Dec., Nov., May	*Pagellus bellottii* Decapterus rhonchus Brachydeuterus auritus Dentex canariensis	25 to 50m	4, 3, 5
1321 (15)	**2. Grouper** Warm-water group	G3	L2, L24, L5, L8, L15, L17	June, Jul., Apr.	*Epinephelus aeneus* Sparus caeruleostictus Pomadasys incisus Epinephelus goreensis Pomatomus saltator Plectorhynchus mediterraneus Epinephelus gigas	10 to 25m and 75 to 120m	3, 2
339 (2)	**3. Goatfish**	G1	L15, L40, L10, L11	Jul., Aug., Sep.	*Pseudupeneus prayensis* Diplodus vulgaris Pomadasys rogeri Sparus caeruleostictus Plectorhynchus mediterraneus	10 to 50m	1, 2
449 (13)	**4. Sailfish** Warm-water group	G2	L20, L13, L7	Aug. , Sep., Jul., Oct.	*Istiophorus platypterus* Scyris alexandrinus Coryphaena hippurus Brachydeuterus auritus	25 to 75m	2
1112 (39)	**5. Octopus** Warm-water group	G1	L9, L11, L40, L10, L17	Mar., Oct., May, Nov., Apr.	*Octopus vulgaris*	<25m	1
716 (1)	**6. Deepwater group**	G3	L16, L23, L21, L17	Mar., Dec., Apr., Oct., Sep., Feb., Jan	*Dentex spp.* Branchiostegus semifasciatus Brotula barbata Scorpaena spp. Merluccius senegalensis Centrophorus spp. Trachurus trachurus	>75m	4, 5

3.2.2. Vessel technical characteristics

A fleet profile that is based on the technical specifications of the vessels requires that variables be pre-selected. In fact, these variables generally fall under several headings which convey information only if the boat possesses the element described by the heading (e.g.: "dimensions of

fishing gear: seine" will be given only if the preceding variable "presence of a seine" is positive, i.e. if there is a net on board!) It is therefore judicious to make several classifications: the first on the variables common to all the boats (general characteristics), then by sub-groups each corresponding to a group of boats of the same type for which the same series of data exist. As far as possible, the number of variables under each heading must be balanced in order to avoid giving too much weight to a heading as a result of its number of variables. Indeed, the calculation of similarity between two boats will be a function of the variation observed for each variable and thus of the number of variables per heading. It is also advisable to include any redundant variable as an additional variable along with those kept active, in order to build the classification tree. The additional variables are reintroduced at the point of interpretation of the classes and provide *a posteriori* proof that the effect related to these variables did not contribute to the classification. For example, the majority of variables relating to technical specifications is to some extent connected to the size of the boat (or even depends on it): storage capacities, quantities of gear or equipment, etc. It is thus sensible to preserve, as supplementary, variables of size (length, power, hold) to at least demonstrate that the classes are constructed in such a way that there is a good separation of the boats according to size.

The results of the profile finally appear, after a series of successive analyses, as classification trees and statistical tables. Presentation of the results generally consists of the key points emerging from the analysis, along with the recommended actions. Presented below, in detail, is the result obtained from profiling the Moroccan coastal fleet according to technical specification.

The process of profiling the technical characteristics of the Moroccan coastal fleet took place in several stages:
1- a global profile on 29 active variables: propulsion = 4, equipment = 5, gear types = 4, hold capacities = 6, electronics = 6 and safety = 4.
2- sectoral profiles carried out on each principal group of the first profile, starting with the variables specific to each group (in this particular case, three principal groups were identified during the course of the global profile, therefore three sectoral profiles were carried out). Appendix IV provides a list of the active variables and supplementary (or "illustrative") variables used for each of these profiles.

1. Global profile

The first profile defines 3 groups (or branches) whose first explanatory variable is the <u>dominant activity</u>:
- the first branch corresponds to 98% of boats whose dominant activity is trawling. The class is made up of 72.4% trawlers, 13.8% trawler-sardine boats, 13.8% others;
- the second branch corresponds to the dominant activity of the sardine boats: 92.6% of the activity is in this class, which is relatively specific to this activity, and the class is homogeneous for this activity at 98.3% . 89% of the SARD licence type are in this class, but 26% of the boats of the class are not of this type (heterogeneity of the class);
- the third branch is associated with the dominant activity of the longliners (specificity of longliners = 95% ; homogeneity = 80.6% longliners + 7.2% not specified): the class is made up of 76 % boat type PAL, 20.86 % type PALSA.

These first results thus demonstrate that there are some contradictions between the type of licence and the dominant activity practiced by the ships, and that the type of licence does not consistently reflect the nature of the equipment on board the fishing vessels.

2. Three sectoral profiles

2.1 – In the profile of the first group (or branch) of 181 boats whose dominant activity is trawling, it is possible to recognize 4 classes according to the size of the unit and the type of boat:

- boats corresponding to the mean characteristics of the variables used (class 1 = 110 boats);
- boats below the average (class 2 = 30 boats); this class has principal characteristics as follows: length = 16 m; gross tonnage = 29.8 tons; power = 173 hp (with older engines – 11 years compared to 7 years for the boats in group I) and a geographical component (71.4% of the boats from the same port (M'diq) pertaining to group I are found in this class).
- boats above the average (class 3 = 31 boats); this class groups together large vessels, with greater capacity; and the principal characteristics of the boats are: length = 21.4 m; power = 433 hp; gross tonnage = 75.2 tons and the units are well equipped electronically (94% have a radio; 58% a GPS)
- class 4 (= 10 boats) covers boats whose dominant activity is sardine boat or longliner; these boats are on average smaller than those of class 2 (14.8 m) with a higher gross tonnage (36.6 tons); 50% of these units are equipped with a nozzle.

Analysis shows the first 3 classes to be distinct, once the units lacking a trawl are not included. The classification reveals the same structure as previously, that is to say a structure based on size.

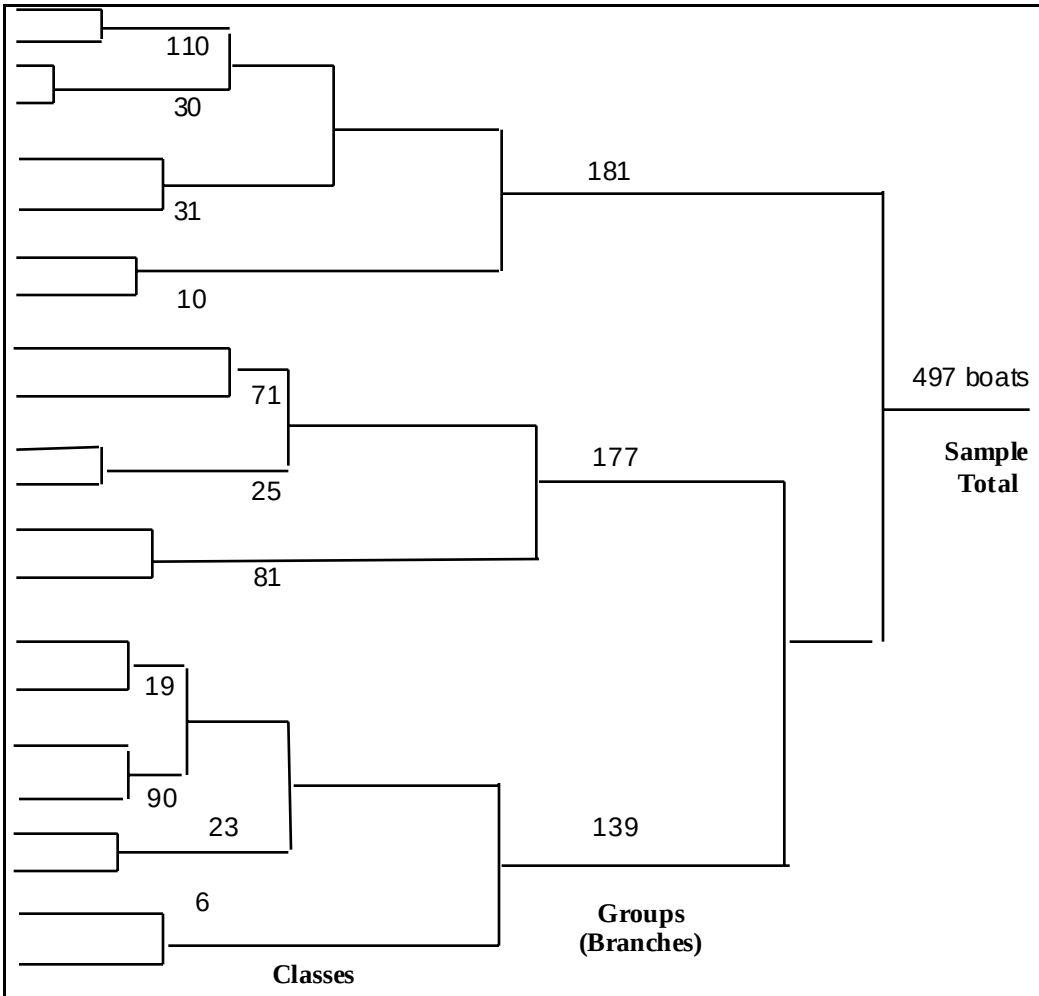
2.2 – The analysis of the group (or branch) II (177 boats with dominant activity of the type "sardine boat") produces 3 groups. The boats are either single-purpose sardine boats, or of mixed type which are mainly trawler-sardine boats and longliners-sardine boat. The dendrogram has three principal branches separating the units according to size:

- class 1 (71 boats) consists of boats with similar principal characteristics as follows: length = 15.5–19.6 m; gross tonnage = 24.3 tons; power = 156.8 hp (all less than average); relatively less well equipped from the electronic point of view than other groups (87% have a depth-sounder); 62% are equipped with a lamp; 14% do not have a hold and 80% use fish boxes for storage; a geographical component is noted since 100% of the boats of this group (the sardine boat) are from three ports (Cala Iris, Djebha and M'Diq).
- class 2 (25 boats) is exemplified by relatively large and powerful boats (58 tons and 372 hp), of which 72% are equipped with a lamp, and which have a better than the average storage capacity in fish boxes, with insulated holds (76%). It is observed that this class of sardine boat is common in different areas from the previous class (50% of the boats from Ras-Kebdana and 61% of the Al Hoceima boats are in class 2); the seine has a depth of 126m.
- class 3 (81 boats) consists of boats with characteristics above the overall mean, with an average length of 20.9 m (338 hp; 61 tons) and most of the units equipped with a video-sounder (96%), bulk-storage in non-insulated holds (2.4 holds/boat); in general these boats are better equipped for safety; the height of the net (depth of the seine) is on average less than the boats of

the preceding class (68.8 m); and the boats of this class tend to come from certain areas (Agadir and the Grand Sud: Safi, Laayoune, Tan-Tan).

2.3 – The typology of group (or branch) III (139 boats which are of the type "longliner") identifies 5 branches of which only 4 are relevant (one of the classes consists of only one boat):
- class 1 (19 boats), includes 47% longliner-sardine boat and 16% sardine boat, and covers mainly old boats (22.2 years with an engine acquired 16 years previously), all possessing a seine, mostly small (on average 289 m length and 74 m depth), with 60 % possessing a drift gillnet, with some having a fishing- lamp but not a line, and which are generally minimally equipped (the auxiliary bridge equipment is limited to a mechanical capstan, and approximately a fifth of the units do not even have a navigation compass. Three quarters do not have any particular means of fish conservation); this type of unit of fishing represents up to 75% of the fleet at a particular port (Ras-Kebdana);
- class 2 (90 boats) includes boats with dominant activity longliner of which 63% are liner-netters (practicing in particular bottom longline and hand line), of average technical specification: length = 10.6 m; cv=83; gross tonnage = 11 tons, rather lower than the normal, except for the units using surface longlines;
- a third class (23 boats) covers netters (17% are also liners), of average technical specification except for the use of trammel nets and ordinary gillnets of larger than average dimensions;
48% of the boats of this class have insulated holds, and this class of vessel is characteristic of certain ports (Larache, for 83% of the boats; Mohamedia for 75%);
- a final class includes 6 boats of rather higher technical specification whose principal activity is trawling or sardine fishing; but one of the characteristics of the boats of this last class was to give the response "not applicable" to questions concerning the compass: a response that was interpreted as meaning that the vessel did not have a compass. In this case, the correct interpretation of the data emerged after re-checking upon returning from the field, which suggested that the 6 boats of this group need to be the subject of case by case analysis and of a detailed study of the data, since their distinction from the other boats of apparently the same type is not obvious. This suggests data transcription errors, which would explain the grouping of these boats in the longliner group.

In order to summarize the structure of the sample of the Moroccan coastal fleet revealed by the analysis of technical specifications, it is possible to construct a dendrogram showing the 4 successive profiles: this tree enables us to visualize the sequence of the 11 classes ultimately retained.



- the separation of the 497 boats into 3 groups, of 181, 177 and 139 boats respectively, is made on the basis of a hierarchical tree obtained by performing a global profile (on all the boats); it should be noted that the first dichotomy separates the group of 181 (main activity: trawling) from the other boats. The separation of the sardine boats and longliners takes place at a lower level. This level (vertical bars correspond to a node) is defined by an index resulting from the classification algorithm, representing the degree of resemblance between the elements belonging to the same branch. Thus all of the 177 + 139 boats of groups II and III correspond to a group more heterogeneous than the whole of the 181 boats of group I (since the division of this group into sub-groups is done at a decidedly lower level (vertical division bars are more to the left of the figure);

- the successive stages of division of each of the three groups I, II and III, are then traced on the basis of the three dendrograms resulting from the sectoral profiles. The degree of heterogeneity in each resulting sub-group can thus be visualized (by the level of corresponding divisions, as well as by the level of the following division traced for each resulting sub-group). It can be seen, for example, that the sub-group of 31 boats in group I (181 vessels), which covers large, well-equipped fishing units, is more heterogeneous than the sub-group of 110 trawlers (the first branch at the top of the dendrogram) which, in spite of its greater manpower, is a relatively homogeneous group from the point of view of technical specifications.

The overall results of the Moroccan coastal fleet profile based on technical specifications are summarized in tables 1 and 2, presented at the end of this report (3.4. Presentation of results). Ultimately, only 9 classes prove significant, leaving aside 2 poorly represented classes that do not belong to the principal group that they are associated with, and represent artifacts (class 4 of the trawler group and 11 of the longliner group).

3.2.3. Exploitation strategies

The result of profiling fleet exploitation strategies is illustrated by the example of the Moroccan coastal fleet (see Figure 6). It may be recalled that the goal is to obtain a classification of the 497 boats for a representative sample of the fleet, according to the exploitation strategies implicit in their fishing operations (see Annex I and Annex III for the "fleet operations" heading of the questionnaire and the list of coded variables). The term "fishing operation" (or campaign) is used to label the ensemble of place, gear, time and target of fishing. A difference in one of these criteria (example, a different fishing zone) requires the coding of a new fishing operation, and each boat could carry out several fishing operations during the year prior to the investigation.

The first stage was to describe and characterize the fishing operations, given that the boats employed a maximum of 4 different types of fishing operation during the year prior to the investigation.

***Description of fishing operations**:*

- The 497 boats of the sample correspond to 1 064 fishing operations, an average of 2.15 operations per boat. 6.7% of the boats practiced a single identical type of fishing all the year (only one type of operation or campaign), whilst the majority (3/4) carried out two operations in 1995; the boats that carried out more than 2 campaigns belong to the category of the longliners.

- Fishing gear: 8 categories of gear were declared. In order of importance: seine (including tuna seine), trawl, drift net, longline, and simple net, trammel net and hand line, trap.

- 26 different fishing zones were visited (see the geography of Morocco, defined for the Atlantic coast according to latitudinal sections, and for the Mediterranean, according to longitude). Certain zones are visited more, or much more, than other zones (such as between Tan-Tan and Laayoune, towards Agadir or from Rabat to Essaouira and West of Al Hoceima). A single fishing operation can obviously cover several zones, whether contiguous or not. Single operations were found to cover a maximum of 12 zones (trawler) but the majority of the fishing trips take place in 2 to 3 zones at most. One can however observe very clearly that the trawlers are in the Atlantic, the longliners in the northern Atlantic, the multipurpose units in the eastern Mediterranean - and the sardine boats in the western Mediterranean and central and south Atlantic.

- Species: the majority of the fishing operations lead to the capture of several species (the diversity of the catch depends on the fishing method and the type of activity, from only 1 species in 15.1% of the cases (mainly longliners) to 2-4 species in 56% of the cases (notably sardine boats), and ultimately the trawlers which have the most species diversity in their catch (on average, 5 species). The species declared the most frequently change, of course, according to the type of activity: the horse mackerel and the hake for the trawlers, the swordfish and the sea bream for the longliners and obviously sardine for the sardine boats.

- Period: the majority of the operations cover one period from 2 to 7 months with average of 5.5 months: no difference is noted between the type of boats; only 16 % of the operations cover more than 7 months; every month includes some fishing operations fishing, the most frequent months being from June to September.

- Depth: the longliners, on average, operate in the greatest depths (139.5 m – 294.8 m) and the sardine boats in the least (35.9 m – 129.9 m); the trawlers operate in an intermediate depth range.

- Bottom type: 9 basic bottom types are distinguished: soft, silt, mixed silt, sand, sandy-muddy; hard sand; hard; rock and mixed rock. These categories will be ultimately condensed into 4 classes during the course of analysis: soft, hard, semi-hard/sand and semi-hard/silt. The "soft" and "hard" categories are most frequently encountered; the latter is more characteristic of longliners but is also reported during other types of activity.

- Destination of products: the majority of operations are associated with a primary destination (only 9% of the operations are associated with a secondary destination for the products). The main destination is the market (66.4%), then export (15.1%), the processing plant (10.6%) and fishmeal (3.5%). These percentages vary according to the dominant activity: fresh fish sales (market) being more characteristic of trawlers, export of longliners, and the processing plant and fishmeal being the destination of the catch of the sardine boats.

- Landing points: Principal ports for unloading are identified (Tan-Tan, Laayoune, Agadir, Casablanca, Tangier then Al Hoceima). Landing points are of course closely associated with the home port of the boat: a boat generally unloads at its home port.

- Average landing per trip: in the Moroccan example, the average landing is 7,192 kg; increasing from the longliners to the trawlers, then the sardine boats.

- Duration of trip: averages 2.4 days, decreasing from trawlers to longliners, then mixed and sardine boats.

- Number of gear sets per trip: 7.5; decreasing from trawlers to sardine boats to sardine boat-longliners, then longliners and longliner-sardine boats.

- Duration of set: 4.5 hours. The longest is observed for longliners, decreasing for the mixed fishing types, then the trawlers and, finally, the sardine boats.

Fishing operations are described by a very large number of variables and in certain categories, this number is much higher than in others (species = 73; month = 12, zones = 26). It is thus necessary from the start to make a synthesis under each category defining a single qualitative variable with an equivalent number of modalities: this is obtained by carrying out a classification by heading. For example, each fishing operation is characterized by the species captured. At maximum there are 8 species taken in an operation (certain trawlers) out of the total of 73 different species listed from the sample unit. The classification of fishing operations described by the presence or absence of the 73 species makes it possible to group the operations on the basis of the type of species caught. The number of the class corresponding to the type of species

captured during the operation is then given to each operation, and the result of the classification is thus equivalent to a new qualitative variable in which the number of modalities is equal to the number of classes. This process is applied 4 times, to the species caught, the zone, the period and the depth of fishing.

Analysis of captured species (1 064 operations x 73 species)
The classification tree exhibits a very clear structure with 5 branches: 2 important classes are distinguished (I: 329 operations and V: 482 operations) corresponding respectively to 79% of the operations of the sardine boats and 89.8% of the trawlers (this latter class does not however consist entirely of trawler operations but includes 14% others):
- class I (329 operations) corresponds to catches of pelagic species: sardine, anchovy, mackerel, scad; constituting 79 % of the sardine boat operations;
- class II (115 operations) is characterized by captures of tuna and tuna-like species: skipjack, bluefin tuna, frigate tuna, bonito; constituting 47% of longliner operations, 46% of sardine boats and 6% of mixed-purpose boats (sardine boat-longliner); the use of drift gillnets particularly … this class is unexpected and requires verification;
- class III (96 operations, characterized by the swordfish and gillnets, is composed of 75.7% of longliner operations and 10.2% of sardine boat-longliner; with the same comment as for the preceding class;
- class IV (42 operations) is characterized by: scorpion fish, spiny lobster, pandora, sea bass, sea bream, grouper, Couch's sea bream, conger eel, John Dory, lobster, moray eel, composed 66.8% from operations of longliners using longlines and trammel nets;
- finally class V (482 operations) corresponds to the demersal species: hake, sole, shrimp, octopus, mullet, cuttlefish, sea bream, John Dory, composed 89.8 % of trawlers.

The raw data suggests an identification problem in classes II and III: concerning drift gillnets used by longliners. Verification by field experts is necessary but it could also be a coding problem.

Finally, each fishing operation is characterized by a new qualitative variable of 5 modalities (number of the class of membership from 1 to 5) summarizing the type of species caught.

Analysis of fishing zones visited (1 064 operations X 26 zones) A classification of the presence/absence of the 26 basic zones frequented shows that there are 7 principal geographical ranges exploited during the course of fishing operations: these results are illustrated in a graphic form as Figure 8. Two classes (II, III) correspond to operations taking place in the northern Atlantic, which covers the zone of the Straits; classes IV and V relate to operations in the western and eastern Mediterranean respectively, and classes VI and VII, of less significance, consist of groups of operations carried out in the southern and extreme southern Atlantic. Class I, the largest, includes within its group several "other operations" which correspond to a more restricted heterogeneity of range: Tan-tan / Laayoune, Agadir and/or Tangier. An automatic classification often gives a heteroclitic (anomalous) class which groups individuals which are different, but which do not fit into the other classes defined.

Analysis of the fishing period (1 064 operations X 12 months)
The classification tree leads to the definition of 4 very clear classes: The first semester of the year (January-June), the warm season from May to September, the cool period from October to March, and the second semester of the year (Figure 8).

<u>Analysis of bathymetric classes</u> (1 064 operations X 6 depths)
The same treatment is carried out on the depth-classes in order to define the bathymetric ranges fished during the course of operations. The classification tree reveals 8 classes (Figure 8): the first zone between 55 and 270 meters is more characteristic of the trawlers (64 percent, comprising 37 percent of the trawling operations), whereas the shallow depths (classes III, VII and VIII) are associated with the seine; classes IV, V and VI, characterized by higher bathymetry, and correspond more to the north Atlantic zone and the Mediterranean, associated with the trammel net, gillnet and pelagic longline (Annex V). It is important to note that for the depth-classes with a strong relationship to a particular gear-type, this variable will not be used in profiling operations; it will be only needed in the analysis as a supplementary variable.

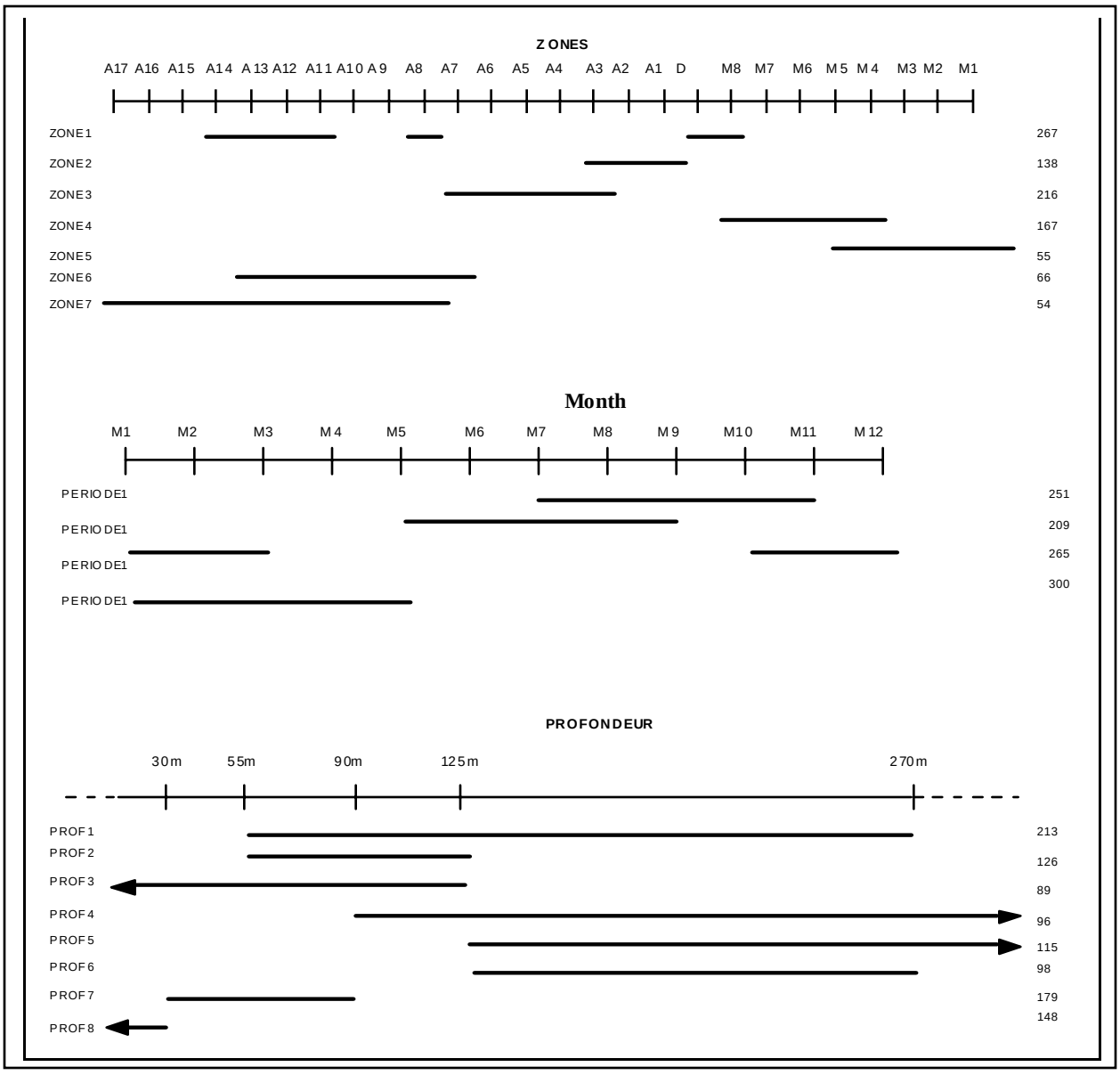


Figure 8: Graphical representation of the results of zonal classification: months and depths of fishing operations of the Moroccan coastal fleet sample (all gear-types). The number on the right of the figure corresponds to the number of statistical individuals in the class, in this case, the number of fishing operations in each class.

The next stage is to carry out a typological analysis of fishing operations described by 4 qualitative variables, in which the number of modalities is relatively balanced: species * zone * period * gear. The analysis is made starting from an analysis of multiple correspondences, followed by a Ward classification (see the scheme of analysis in Figure 6). All the other quantitative and qualitative variables associated with fishing operations are preserved as additional (supplementary) variables.

The 1 064 fishing operations of the 497 sampled boats of the Moroccan coastal fleet are described by the 4 qualitative variables resulting from preceding classifications, which correspond to a total of 22 modalities (species = 5 classes; zone = 7 classes; period = 4 classes, and gear = 8 classes). Automatic classification is carried out on the factorial coordinates of the fishing operations following an analysis of the multiple correspondences underlining the relations between the classes of species, period, zones and gear-types. The analysis reveals 16 campaign-types grouped in 4 principal branches:

1. seines capturing small pelagic species, characteristic of shallower depths (<125 m), of the geographical ranges 1, 4 and 5 (the central Atlantic and the Mediterranean zones), on hard and sandy bottoms, especially during first semester,
2. drift gillnets, targeting tunas and swordfish, in depth-ranges < 90 m, in summer;
3. longlines, trammel nets and simple gillnets: associated with rocky bottoms, covering all the depth-ranges, more characteristic of zone 2 (Al-Détroit), targeting "prime" species (sea bass, grouper, lobster, swordfish); no characteristic season;
4. trawls (84 %) covering a broad range of depths (30-270 m), in soft substrate, more characteristic of the south Atlantic zone; no characteristic species or seasons.

The division of the 4 principal branches into 16 classes, equivalent to 16 campaign-types, makes it possible to refine this very obvious classification. For example, in branch 1 (which covers 120 fishing operations) presented above, a model campaign-type (constituting class 1) can be subsequently described: seiners operating all year round, more characteristically in the second semester (and the first two months of the year), operating in the southern Atlantic zone, catching small pelagics: sardine > anchovy > mackerel > horse mackerel > bonito > bogue; the depth is between 33-101 m (2 characteristic classes: <30 and 30-90), over sandy soft bottoms; the most frequent product destination is the processing factory, then fertilizer, and the market. The average production is 23.8 tons for a trip of one day and there are 3.2 operations per trip lasting 2.3 hours. The campaign lasts 5.6 months. The ports of landing are: Tan-tan, Laayoune and/or Agadir.

The following step allows us to return to the original objective of the fleet profile by using boat information, such as the calendar of fishing, as a starting point. The fishing calendar, drawn up on the basis of the time spent on the various fishing operations and previously classified by campaign-types, makes it possible to understand exploitation strategies. Exploitation strategies can be defined in various ways. For example it can be a question of the fishing behaviour adopted by the boat over the medium or long term, in terms of gear used, fishing zones visited, species targeted, and fishing period. Such strategies can be studied from a dynamic point of view: the process is then the study of the choices made by fishers over the course of time, or based on a synthesis over a given period (e.g.: an annual calendar of fishing summarizing the number of days spent on the various tactics adopted during each trip, on the different fishing campaign-types adopted over several trips, or in the various methods (for the general-purpose vessels) adopted during the course of the year).

The typology of the 497 boats of the Moroccan coastal fleets, from the point of view of exploitation strategies, is based on fishing calendars constructed on the basis of the 16 categories of campaign-type with the addition of a "not fishing" category. Each column of the data-table is described by the number of months during the year spent on the corresponding variable (campaign-type or "not fishing"). Classification of the 497 boats leads to 16 classes again: the majority of the exploitation strategies are characterized by only one campaign-type: changes in fishing operations (75% of the boats took part in two operations) being taken into account in the variability appropriate to the campaign-type (variation in depth, the captured species or the individual zones visited within the same geographical range). Only 6 classes of strategies (a class of sardine boat, two classes of longliners and mixed, and three classes of obligate longliners) are characterized by several campaign-types, indicating important changes in exploitation strategies during the year. We provide here the example of strategy N°16, characteristic of general-purpose boats:

Strategy N°16 (n=33): longliner and mixed, characterized by the campaign type N°8 (5.4 months ± 2.1), campaign-type N°11 (2 months ± 1.9), campaign-type N°7 (0.9 months ± 1.5) and/or campaign-type N°9 (0.8 months ± 1.5); boats fully active from June to August (80% active in December); no specific zone, except for the extreme south Atlantic zone and zones frequented more than 40% : A1-A3 or M4-M5; the most reported species: swordfish > others > hake > sea bream = lobster > mottled bass.

These boats typically have nets aboard (in fact, many boats coded as type "longliner" possess nets): the number of simple gillnet and trammel net and a greater hold capacity compared to the reported longline vessel average.

3.3. Making use of the results

Fleet profiling can be carried out from several perspectives, and with various immediate objectives (managing the activities of the fishing sector, controlling its development, modernization or reorganization of production) as well as, generally, for the purposes of sustainable management and/or a precautionary approach to the exploitation of natural resources.

The results obtained from the analysis of the restricted sample of the fleet are then extrapolated to the whole population of vessels. The proportion of the fleet observed in different classes of the typology can be applied to the whole population, according to the rules of the sample design that

established the choice of sample. The identification and description of fleet types remains, though it is appropriate to analyse the structure of the fleet and to provide recommendations according to the objectives behind the typology of fleets. Profiling allows the fishing fleet to be partitioned according to various criteria, from the distribution of fishing vessels in the categories defined on the basis of the ensemble of variables describing an aspect of the fishery (boat equipment, the means by which it was established, fishing strategies). These segments can then be subject to specific measures through fishery and resource management programmes.

Conclusions drawn from the typology of Moroccan coastal fleets (Technical Report 14 of Programme UTF/MOR/017/MOR "Technical assistance to the programme of modernization and development of the maritime fisheries sector: technical options for modernization, and strategic implementation plan" (M. Taconet and O. Boumediene, October 1998).

"The typological survey, based on a sample of more than 500 vessels, was carried out by the STP team at INRH, between January and October 1996, with technical support from the FAO head office. A statistical expert was brought in to assist with data processing. The results of two typological analyses carried out ("Technical characteristics of the fleet" in May-June 1997, followed by "Strategies of exploitation" in July-August 1997) are as follows:

A typological database which offers rich potential for analysis. This information source can perhaps be used by many experts working on problems of development or management.

9 fleet segments: the statistical analyses carried out within the framework of the profile, in collaboration with Moroccan fishery specialists and, in particular, technical experts, made it possible to describe 9 fleet segments based on the technical specifications of the vessels. Within each of the three most dominant groups (trawlers, sardine boats and longliners); three classes were distinguished on the basis of the parameters: geographic location, age, technical capacities (power, gross tonnage) and/or gear used, standard of vessel equipment, and methods of handling the catch.

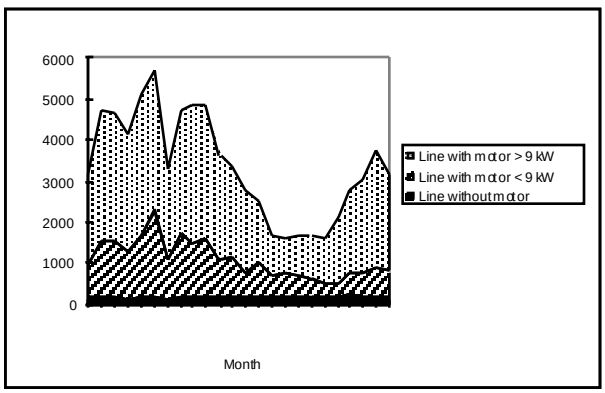
This segmentation provides qualitative and quantitative technical bases for the definition of criteria of eligibility for the modernization programme, and for the evaluation of the financial input necessary to carry out this program.

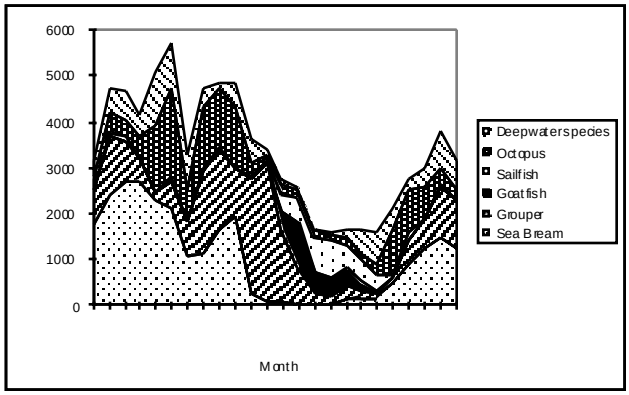
16 campaign types and 16 exploitation strategies: profiling the strategies of exploitation provided a snapshot of the various "coastal fleet exploitation systems" in 1996. Based on the variables describing the activity of the vessels, it was possible to describe 16 "campaign types", in terms of exploited zones, fishing period, targeted species and gear used. Each vessel might carry out from 1 to 3 of these campaign types during a single year of fishing. The way in which a vessel combines different campaign types identifies its exploitation strategy: 16 exploitation strategies were accordingly described.

The profile makes clear certain management and development parameters, such as the biogeographic limits of fishing (North-South and coastal-oceanic), seasonalities, species associations, and fleet interactions. The analysis of exploitation strategies provided, at that point in time, the decision-elements enabling the "exploitation systems" component of the management plan to be developed.

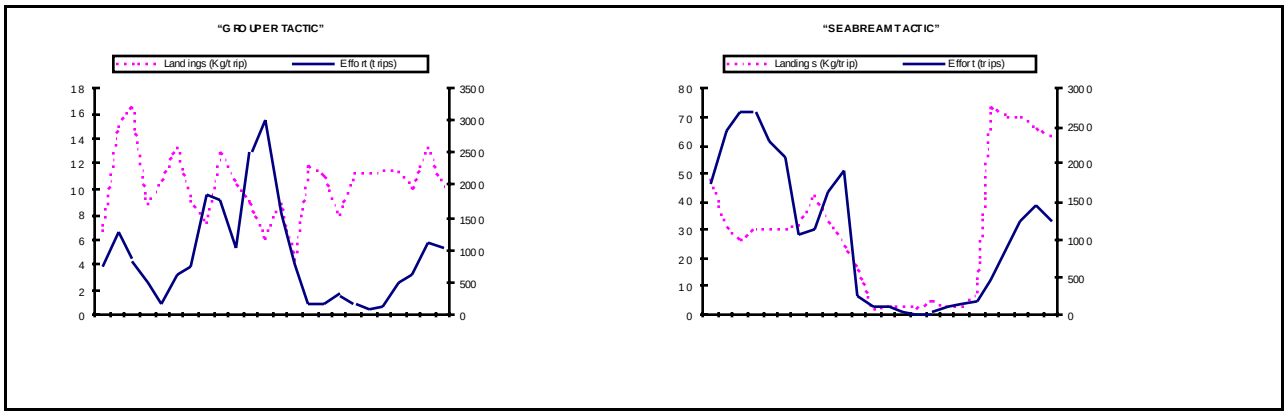
The fleet profile makes it possible to describe the composition of the fleet, whether it be from the point of view of technical characteristics, fishing activity or fishing behaviour, or fishing results. This information is essential for better appreciating the problems of fishery over-capacity and for making management decisions in connection with fishing effort (the number and types of boat), permitted zones or seasons. The evolution of fishing effort estimated on the basis of broad characteristics of vessels (for example: motorization) does not make it possible to determine the true dynamics of fisheries, notably in the case of composite or multispecies fisheries. To better understand the relationship between fishing effort and impact on the resource requires a better description of the fishing behaviour based on the strategic choices made by fishers.

Profiling the fishing tactics of the liners of the artisanal fishery in Kayar in Senegal (Figure 4) made it possible to disaggregate the evolution of fishing effort into categories finer than those used in the fishery statistics system: the number of trips classified according to the 6 types of fishing tactic. At the time of the survey, the effort for the liners was coded according to the type of engine of the boat: without engine, engine < 9 CV and engine > 9 CV. For fishing trips lasting less than 12 hours, effort was measured by the number of trips per category of boat. Illustrated below are the two types of temporal profiles obtained, with the number of trips per type of engine and the number of trips per fishing tactic. The dynamics of the fishery appear in all their complexity in the second case, reflecting a change of tactics by the fishers over the course of time.





For each tactic, it is possible to locate and track catches of the various targeted species, to better understand the interaction between tactics in terms of the zones visited or the type of boats, and to study the evolution of yields. Illustrated below are two different tactics for the effort-yield relationship: liners catching sea-bream and liners catching grouper. The temporal evolution of the sea-bream liners is very uneven, and yield tracks effort; this fleet is made up primarily of migrant fishermen from the north. Grouper line-fishing shows an increase in effort at the height of the grouper migration period, with a cycle defined by the cool and warm seasons as for sea-bream, but the yield remains stable overall. An increase in the effort devoted to the "grouper" tactic corresponds to a reduction in effort devoted to the "sea-bream" tactic, and reflects a change in fishing tactics.



3.4. Presentation of results

The presentation of the results of a profiling exercise can be of two types: with the goal of scientific analysis or for presentation to a general audience.

Example of results for the benefit of scientists:

The result of a fleet profile appears in general as a chart summarizing the characteristics of the fishing vessels which were grouped and classified. Only the variables which demonstrate a significant difference between each of the classes and the total population are retained and used in the profile. The characteristics of the table depend on the nature of the variables:

- qualitative variables: the frequency of the modalities of the variables which characterize the class is given. The degree of significance is evaluated as a function of two criteria: the homogeneity of the class (for example: where 80% of the boats of a class have the modality "sardine boat" for the variable " licence-type"); and the specificity of the class (for example: all the sardine boat-longliners in variable " licence-type" might be in the class).

- quantitative variable: the mean and the standard deviation make it possible to evaluate the relevance of the variable in characterizing the class (a variable will be retained as "characterizing" a class when it has a different mean from the total population (total number of boats) in the classification, taking into account the variability (standard deviation) observed between the elements.

Given below is the description of the first class obtained in the profile of the technical specifications of the Moroccan coastal fleet. The "V-Test", provided by the SPAD statistical software package, makes it possible to judge the degree of significance of the method or variable in order to characterize the class (an absolute value of the V-Test that is higher than 2 corresponds to a significant probability: the modality or the variable is retained to describe the class. The column headed "weight", on the right, indicates the number in the sample, here the number of boats, relating to the modality.

CHARACTERISATION BY MODALITIES

V.TEST	PROBABILITY	PERCENTAGES CLA/MOD	PERCENTAGES MOD/CLA	PERCENTAGES GLOBAL	CHARACTERISTIC MODALITIES	VARIABLES	WEIGHT
				36.42	CLASS 1		181
22.74	0.000	97.71	94.48	35.21	trawling	ACDO dominant activity	175
17.88	0.000	97.04	72.38	27.16	trawler	TYPE type of boat surveyed	135
12.00	0.000	61.69	84.53	49.90	iceP	CONS method of preservation	248
9.81	0.000	48.47	96.13	72.23	WOOD	STOCK Method of storage	359
9.55	0.000	60.87	69.61	41.65	insulation	Iso: insulated hold?	207
6.95	0.000	84.78	21.55	9.26	POLY	Revet: hold lining	46
5.48	0.000	54.55	46.41	30.99	ORD	Revet: hold lining	154
3.83	0.000	67.57	13.81	7.44	trawler-sardine boat	TYPE type of boat surveyed	37
2.98	0.001	60.53	12.71	7.65	Region 10 Laayoune	REGION	38
2.98	0.001	60.53	12.71	7.65	Laayoune	PORT Port of survey	38
2.91	0.002	72.22	7.18	3.62	Essaouira	PORT Port of survey	18
2.48	0.006	56.41	12.15	7.85	Casablanca	PORT Port of survey	39

CLA/MOD is a measure of the specificity of the class and MOD/CLA, a measurement of homogeneity. For example, there are 18 boats in the total sample from the port of Essaouira. Compared to the number in the class (181 boats), the latter does not represent homogeneity for this port (since only 7% of the boats of the class are from Essaouira), but since the majority of the boats from Essaouira are in the class; the latter is thus specific to this port.

CHARACTERISATION BY CONTINUUM

V.TEST	PROBA	MEANS		STANDARD DEV		CHARACTERISTIC VARIABLES
		CLASS	GENERAL	CLASS	GENERAL	NUMBER.LABEL
		CLASS 1		(WEIGHT = 181.00		NUMBER = 181)
20.84	0.000	0.94	0.35	0.23	0.48	11.TREU Presence of winch
20.82	0.000	0.94	0.35	0.24	0.48	35. Presence of trawl
16.61	0.000	11.96	5.71	5.60	5.98	18.AUTO Autonomy of boat
15.87	0.000	2.12	0.78	1.61	1.41	23.NBCA Number of trawls
14.89	0.000	751.37	357.12	410.99	422.02	46.STPC Storage capacity in boxes
14.88	0.000	2.61	0.98	2.19	1.84	22.NBCF Number of French trawls
13.28	0.000	10969.51	5480.79	6205.50	6598.35	47.STGL Ice storage capacity
10.96	0.000	43.60	26.68	22.85	24.74	117.PRDR Radar range
10.29	0.000	11161.93	7198.55	6469.88	6414.75	20.COMB Fuel capacity
9.89	0.000	0.72	0.43	0.45	0.49	49.ISO Presence/absence insulation
9.69	0.000	317.51	238.43	106.68	137.50	5.CV Power of engine
8.91	0.000	1.42	1.15	0.28	0.41	17.HEL Size of propeller
8.40	0.000	51.94	38.96	20.20	26.03	3.TJB Gross tonnage
8.22	0.000	2.36	1.85	0.88	0.97	112.NBEX Number of extinguishers
8.15	0.000	0.88	0.65	0.32	0.48	91.RDR Presence radar
7.33	0.000	0.33	0.12	0.73	0.47	24.NBCI Number of Italian trawls
7.20	0.000	0.19	0.08	0.39	0.27	93.GPS Presence GPS
7.15	0.000	1.54	1.32	0.51	0.52	107.NBRV Number radio and VHF
7.06	0.000	0.56	0.36	0.50	0.48	89.RDO Presence radio
6.97	0.000	9.22	5.43	12.05	8.84	16.CV+ Power of auxiliary engine
6.89	0.000	2997.78	1981.74	3201.03	2457.35	21.EAU Freshwater capacity
6.59	0.000	0.96	0.73	0.44	0.60	108.NBRD Number radar
6.07	0.000	0.63	0.45	0.48	0.50	9.MOTA Presence of auxiliary engine
5.91	0.000	399.51	310.77	238.54	239.69	113.PES1 Range of echo-sounder 1
5.78	0.000	0.36	0.13	1.07	0.67	25.NBC4 Number of 4-sided trawls
5.75	0.000	0.50	0.21	1.22	0.85	103.AGPS Age of the GPS
5.59	0.000	18.71	16.15	2.98	4.84	1.LONG Length
5.24	0.000	4.33	3.12	3.97	3.88	101.ARDR Age radar
5.19	0.000	0.08	0.03	0.28	0.17	10.TUYE Presence of pipe
4.60	0.000	2.80	2.18	2.36	1.46	2.CREU Water drawn
4.12	0.000	2.13	1.87	0.97	1.01	111.NBBO Number of buoys
3.59	0.000	308.47	240.87	339.74	314.07	115.PVS1 Range video-sounder 1
3.54	0.000	0.98	0.86	0.53	0.54	105.NBES Number of echo-sounders
3.22	0.001	3.59	2.64	4.79	4.98	99.ARDO Age of radio
3.17	0.001	1.00	0.97	0.00	0.18	92.CMP Presence of compass
2.86	0.002	0.85	0.78	0.36	0.41	85.ES1 Presence of Echo-sounder 1
2.84	0.002	58.88	36.51	173.29	131.94	114.PES2 Range of echo-sounder 2
2.49	0.006	1.11	1.04	0.38	0.46	109.NBCA Number of life-rafts

The equipment having been coded 0 or 1 (absence/presence), and therefore treated like the quantitative variables, the class mean indicates the percentage of the class possessing the equipment; for example, 94% of the boats in class 1 are equipped with a trawl and a winch, whereas only 35 % of the sample of boats have this equipment: these two variables are characteristic of the class.

The fleet profile by exploitation strategies, in addition to the tabular summary of the characteristics of the boats belonging to the various strategies, often demonstrates the specificities of strategies in relation to the fishing calendar. For example, one can graphically illustrate the time spent on each strategy in the various specializations, campaign-types or classes of fishing tactic. Figure 9 presents the results obtained from the identification of the exploitation strategies in a sample of 30 fishermen in Kayar (Senegal) (Ferraris in Rochet *et al.*, 1994). These strategies were identified by profiling the fishing calendars or schedules (the number of days spent on the various fishing trips pre-classified into 7 activity-types). The results are summarized in the table below.

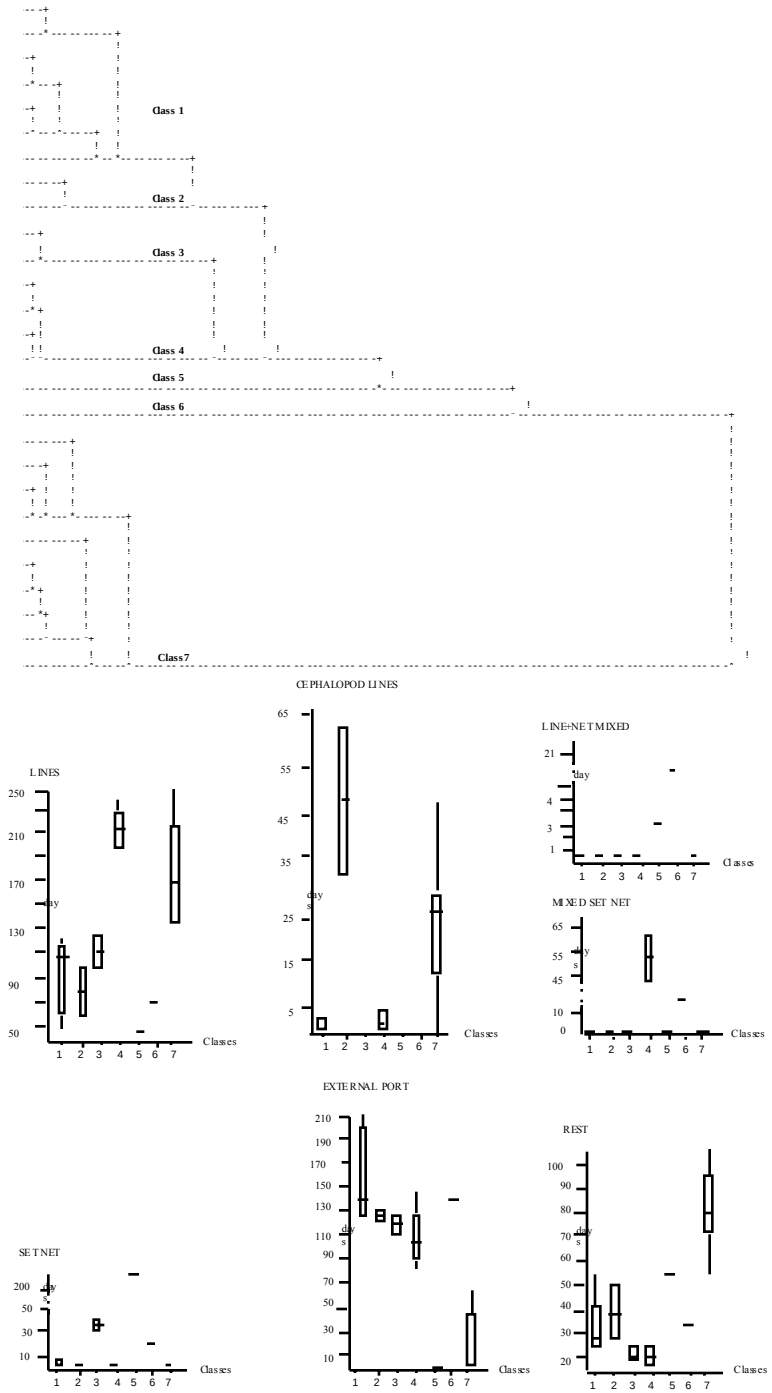


Figure 9: Diagram representing the fishing strategies of 30 Kayar (Senegal) fishermen analysed by profiling fishing calendars in 1992.

An analysis of the effort–profiles of 30 fishing units that were followed in Kayar over an annual cycle, from 15/12/91 to 15/12/92, was carried out in several stages. Fishing units were characterized according the number of days spent on the various types of activities: line fishing, squid jigging, netting, using mixed lines, mixed line + net, mixed nets, taking a short stop or rest, prolonged stop and travel to another port. The profiling exercise made it possible to demonstrate an interesting structure relating to the objective, highlighting behavioural strategies in respect of the criteria of mobility and the use of a mixture of fishing gears. The first dichotomy of the dendrogram separates class 7 from the fishing units that spend a period greater than 90 days outside Kayar. Class 7, composed 100% of canoes registered at Kayar, is characterized by an average of 80 rest-days over the course of the year. Classes 3 and 4, consisting of Saint-Louisians (migrants from the north of Senegal), are characterized by their practice of alternating "line and set net" mixed fishing, and by a lower than average number of rest-days, translating into intense activity during their stay at Kayar. Classes 1 and 2 are separated from each other by the use of a jig, or not, when fishing for octopus.

Example of results for the benefit of a non-scientific audience:

Results are presented in the form of graphs (Figure 10) and tables summarizing the principal points. These tables need to be constructed to present the classes obtained according to criteria required by the audience. For example: distribution of the sample number of the classes according to a geographical criterion, the fishing licence or the dominant activity (Table 1). They can also present simple statistics (average ± standard deviation) by class for variables of interest. For example, the variables relevant to a programme of fleet-modernization might be: age of the boats, length, tonnage, power and insulation of their holds (Table 2). A summary drawn from the analysis of these tables gives the principal results of the profile of fleet specifications, in the box below.

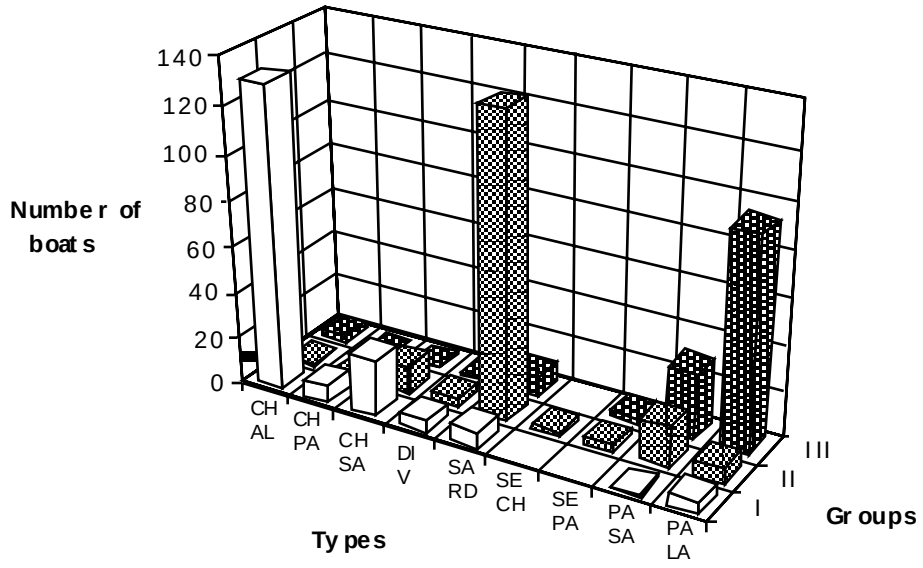


Figure 10: Distribution of boats in the Moroccan coastal fleets, by group, from the first profile of the technical specifications of the boats, and by type of boat (CHAL: trawler, CHPA: trawler-longliner, CHSA: trawler-sardine boat boat, DIV: various, SARD: sardine boat, SECH: seiner-trawler, SEPA: seiner-longliner, PASA: longliner-sardine boat, PALA: Longliner)

	DOMINANT ACTIVITY				
CLASSES of technical characteristics	**TRAWLER**	**SARDINE BOAT**	**SEINER-LONGLINER**	**LONGLINER-SARDINE BOAT**	**LONGLINER**
Number of boats in the sample	175	188	13	3	118
GROUP I					
1 = I.1	63%				
2 = I.2	17%				
3 = I.3	18%				
4 = I.4		5%			5%
GROUP II					
5 = II.1		36%	23%		
6 = II.2		28%			
7 = II.3		43%			
GROUP III					
8 = III.1		3%	73%	100%	
9 = III.2		<1%			75%
10 = III.4		<1%			19%
11 = III.5	2%	1%			

Table 1: Distribution of boats in the sample of Moroccan coastal fleets, classified by dominant activity according to the 11 sub-groups arising from the profile of technical specifications. This table shows the heterogeneity of boats associated with the same dominant activity but which are split amongst several flotillas (for example: the 118 longliners are separated into three groups: 75% in class 9, 19% in class 10 and 5% in class 4). Reading across the rows provides information on the dominant activity (or activities)) practiced by each flotilla.

CLASSES of technical specification	AGE	LENGTH (m)	POWER (HP)	GROSS TONNAGE (tons)	INSULATION (% of holds)
GROUP I	***12,8±9,0***	***18,7±3,0***	***317,5±107,0***	***51,9±20,3***	69%
1 = I.1	11,9 ± 7,8	18,9 ± 2,4	329,5 ± 72,9	52,8 ± 13,8	66%
2 = I.2	16,7 ± 13,0	***16,1 ± 1,8***	***173,1 ± 36,9***	***29,8 ± 9,7***	66%
3 = I.3	12,2 ± 7,7	***21,4 ± 2,1***	***432,9 ± 85,6***	***75,2 ± 21,0***	84%
4 = I.4	12,4 ± 9,3	***14,8 ± 4,4***	261,0 ± 122,4	***36,6 ± 18,7***	70%
GROUP II	***17,3±12,2***	18,6±3,8	270±118,8	45,8±25,1	25,4%
5 = II.1	19,4 ± 14,9	***15,5 ± 3,0***	***156,8 ± 68,3***	***24,3 ± 12,4***	***29%***
6 = II.2	17,7 ± 10,9	19,9 ± 1,5	***371,7 ± 93,2***	***57,9 ± 12,3***	***76%***
7 = II.3	14,6 ± 8,0	***20,9 ± 3,0***	***337,9 ± 71,3***	***61,0 ± 22,7***	***6%***
GROUPE III	*15,2±10,0*	***11,2±3,2***	***95,2±71,0***	***13,3±12,6***	*25,9*
8 = III.1	***22,2 ±11,9***	11,6 ± 2,4	77,1 ± 33,8	10,2 ± 8,8	***16%***
9 = III.2	14,9 ± 10,3	***10,6 ± 2,5***	***82,7 ± 36,6***	***11,0 ± 6,7***	***20%***
10 = III.4	12,5 ± 5,9	11,4 ± 3,3	86,6±40,2	12,5 ± 8,6	***48%***
11 = III.5	12,8 ± 9,5	***19,5 ± 1,7***	***373,3 ± 81,2***	***60,2 ± 13,9***	***66%***

Table 2: Mean and standard deviation by class of the profile carried out on the technical specifications of the Moroccan coastal fleet (11 classes) and 5 variables of interest for the programme of fleet modernization. The values indicated in bold and italics correspond to variables which show significant differences between the class and the whole sample of boats.

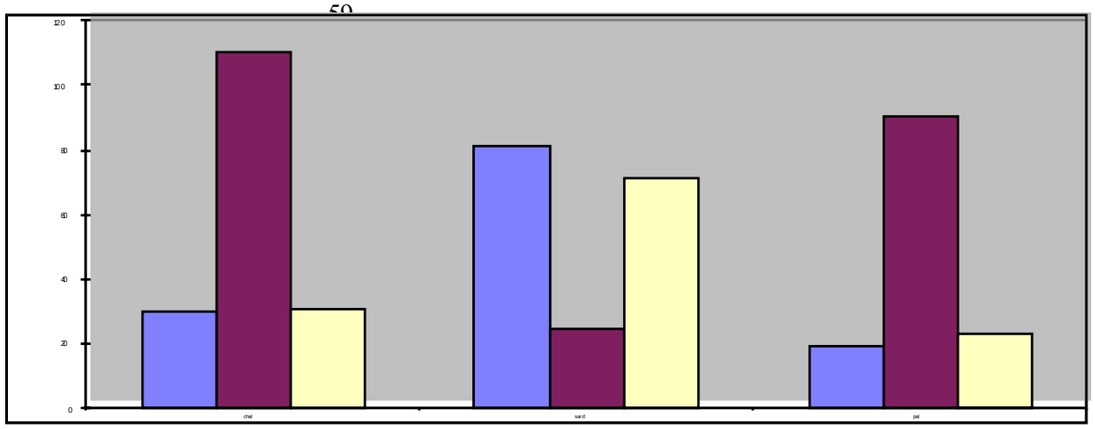
Summary of the results of profiling the technical characteristics of the boats of the Moroccan coastal fleet:

The classification of fishing vessels on the basis of vessel technical characteristics, expressed in terms of presence or absence of the equipment, then of their dimensions, makes it possible to globally determine the dominant activity of the boats.

Some anomalies however are noted: sardine boats and longliners grouped with trawlers and vice-versa, can appear to correspond with boats that are better equipped, younger and more powerful (greater autonomy, insulated holds with polystyrene coating) than boats of the same category, or conversely with less well-equipped boats. Every assumption remains to be confirmed and analysed individually, as the appearance of boats in a class not corresponding to their category can also result from errors in the data.

Taking into account the dimensions of their equipment distinguishes boats sharing the same primary activity according to size, whilst the type of equipment provides a qualitatively based profile. The classes obtained in each group distinguish the types of boats which should be associated with particular fishing strategies: the larger, well equipped trawlers; Mediterranean sardine boats with fishing lights, insulated holds and a large seine (larger than boats fishing in the Atlantic); Atlantic sardine boats without insulated holds (storage of fish is haphazard); Mediterranean sardine boats or longline-sardine boats (older) equipped with gillnet and a small seine; and longline netter/liner or netters with trammel nets and larger gillnets. The age of the boat appears significant only for class III.1, that is, the sardine boats and longline-sardine boats equipped with a small seine, which is smaller, so that fewer are equipped with holds.

The results can finally be presented in a very general way summarizing the principal points elucidated by the analysis. Figure 12 illustrates the presentation of the profile of the Moroccan coastal fleet according to technical characteristics that was included in the report produced within the framework of technical assistance to the programme of modernization and development of the marine fisheries sector (FAO Project UTF/MOR/017/MOR; Technical Report 14; Annex 4; Taconet and Boumediene, October 1998).



			TRAWLERS			SARDINE BOATS			LONGLINERS		
			class1	class2	class3	class1	class2	class3	class1	class2	class3
Usual zone			M'diq			North	Nador	Atlantic	RasKebd.		
Fishing gear	trawl										
	seine					62% lamp	72% lamp				
	line									Bottom Longline	
	net										gillnet + trammel
dimensions	very small	11m 80hp 11t									
	small	16m 160hp 26t	older motor								
	medium	19m 350hp 55t									
	medium large	21m 340hp 61t									
	large	21.5m 430hp 75t									
age	newer	12 yr									
	medium	15 yr									
	older	18 yr							22 years		
insulation	little	<30%						6% loose			
	medium	50%									
	good	>66%			84%		ice + hold				
electronics	poorly equ'ed										
	med. Equipped					1 echo-sounder	2 echo sounder				
	well equipped				GPS - pipe			2 video sounder			

Figure 11: General presentation of the results of a typology of Moroccan coastal fleets according to technical characteristics (adapted from Taconet & Boumedien, 1998).

4. DISCUSSION AND RECOMMENDATIONS

4.1. Means necessary for typological studies: personnel, cost and duration

This presentation of the methodology for carrying out a fleet profile has outlined all the skills that have to be drawn upon in this type of work. The means for producing a profile, from the human, financial and time point of view, depend of course on the extent of the task, bound on the one hand by the scale of the fisheries and, on the other, by the skills available to the organization in charge of the profile, and the cost of those human resources. Profiling can be carried out very adequately by only one person (for example within the framework of a thesis) who can undertake the collection, the analysis and the interpretation of data. It is possible to call upon various mechanisms for the collection or the preprocessing of the information, such as involving students within the framework of the school syllabus. Provided there is adequate follow-up, this provides a low-cost means for the collection of information that is difficult to obtain because of nature of the data themselves or their geographical distribution, for example: for investigations of subsistence fisheries (cf. FAO Fisheries Circular N°962, Hosch, G. 2000)

The principal competences necessary for a fleet profile are thus:

- field investigations, which may require the training of personnel to collect information and to transmit and centralize this information;
- capture and preprocessing of information (validation);
- statistical analysis of data;
- restitution of information (dissemination, popularization, public communication).

Such an enterprise requires a project supervisor who will take responsibility for carrying out the various steps presented in this report, from the identification of objectives and planning of activities, up to their completion. (The profile of the Moroccan coastal fleets was partly carried out by the *Institut National de Recherche Halieutique* which has research and analysis capabilities, having been the beneficiary of regular international assistance to install programmes of research and training for scientists. The typological survey itself was carried out under the responsibility of the *Service Technique des Pêches*. However external support proved necessary in certain areas, such as data processing).

As an example of the means necessary for a profiling study, the box below illustrates the procedure established in 2000 to produce a profile of non-commercial fishers (subsistence and sport fishing) of a South Pacific archipelago (New Caledonia).

An investigation into subsistence and sport fishing in New Caledonian lagoons was carried out in 1999-2000 within the framework of the ZoNéCo (Evaluation of the resources of the Exclusive Economic Zone of New Caledonia) Programme. The objective of this study was to evaluate the requirements of the fishery through an investigation of the population and, more particularly, to estimate the scale of fishing activity, to itemise the fishing methods used, to understand the social and economic impact of subsistence fishing activities and to make clear the perceptions of users concerning lagoon resources and their management. The operation was carried out in several phases:

- developing the population sampling strategy;
- developing and validating the questionnaire;
- administering the questionnaire;
- treatment and analysis of data;
- recommendations.

All of these tasks were carried out by state service providers. The sampling of the New Caledonian population (approximately 200 000 people) was on the basis of polling by quotas, according to ethnic community - Melanesian, European, Polynesian or other - and geographical area). The study aimed to sample 1 000 practicing subsistence or sport fishers. The plan of investigation, including the project resource requirements study and the development and validation of the questionnaire, were carried out through a preliminary consultancy. The questionnaire comprised 54 questions divided into 4 topics: fishing activities, social and economic impact (in respect of the fishery product), perceptions, and supplementary data relating to the administration of the analysis, in particular to check the representativity of the sample compared to the total population (community, sex, age, social and economic category, zone and habitat). The questionnaire survey was implemented by calling upon advanced vocational diploma students preparing for the "management assistant" course at a local senior secondary school. The field work involved 24 pupils, from the 22nd to 27th May 2000, who were sent to all the local regions of New Caledonia (the Northern, Southern and Islands Provinces, and Greater Noumea). The students were monitored by a team composed of their teacher and 4 supervisors. The data was captured and compiled in the weeks following the field work using SPHYNX software. The cost of the investigation included the students' traveling expenses, the production of the questionnaires and report (production of all the frequency tables from the 54 questions and certain cross tabulations) and a grant intended to contribute to a study trip for the students at the end of their course. The statistical analysis itself, carried out by a second consultant, involved multivariate treatment with the aim of establishing profiles of the fishers according to fishery parameters (resources, fishing gear), social and economic variables (related to the products of fishing) and the perceptions of the fishers concerning the environment and regulations. All of the stages necessary to establish the profile of subsistence and sport fisheries of New Caledonia cost a total of 242 000 French Francs (the high cost of living in New Caledonia should be borne in mind when considering relative costs). This consisted of 25% for the planning of the investigation and preparation of the questionnaire, 14% for the administration of the questionnaire, the capture and the pre-processing of data, 52% for the analysis of the data and the restitution of the results (reporting) and 9 % for consumables and general overheads.

4.2. Follow-up activities necessary and/or desirable, complementary activities

The fleet profile, and thus the classification of fishing vessels in various segments of the fishery, does not constitute an end in itself. Profiling, as has been emphasized on several occasions, depends on the one hand on statistical methods used and, on the other hand, the fishing vessels or units on which the analyses are carried out. Hence it is necessary to set up complementary actions to confirm and validate the resulting profile. The process of statistical analysis in itself fulfils the purpose of an heuristic procedure (*"a searchlight for the researcher")* that help scientists or managers better grasp the complex phenomenon that is the "fishery system". Those classes whose existence was intuitively obvious will be defined in a quantitative (number of boats) and qualitative (type of boats) sense. Those classes which were not suspected will challenge the assumptions of the people concerned with the objectives of the profile. The hypotheses generated during the interpretation of results will have to be verified eventually by means of new studies.

A profile of the overall characteristics of the fishery, following an initial questionnaire, will be able to provide the foundation for a follow-up study of representative fishing vessels (type-examples or paragons) typifying the various segments defined in the fishery. Such a follow-up on a few cooperative fishers will make it possible to more precisely define the dynamics of the fishery and to address different aims from those of the first profile.

Lastly, the dynamics and the complexity of the "fishery system" require the definition of indicators useful for decision makers. Two types of indicator make it possible to assess trends in the evolution of a fishery:

- indicators concerning the resource
- indicators concerning the system of exploitation

Profiles constitute a first step in exploring these phenomena, and help to define indicators useful for understanding and managing fisheries.

5. CONCLUSION

This methodological guide for profiling fishing fleets presents the basic principles for carrying out a reliable and rigorous typology. The various stages are illustrated by various specific examples, but no matter what fisheries or fishing units are concerned, the same basic statistical techniques are required, whether for the collection of information or its processing.

The principal objective in producing a profile is to analyse a complex set of data characterized by a great number of individuals (here, the fishing vessels/units or fishing operations) and variables. Precise rules exist for the analysis of data, and the power of these methods to extract relevant information from complex data, relevant to the questions posed, should not blind users to the fact that technical competence is necessary to apply them properly. The availability of user-friendly analytical software often leads to abuses in the application of these techniques, and a certain minimum of knowledge in the theoretical basis of these methods is necessary. Specific practical (not theory-oriented) training courses make it possible to avoid misusing these techniques. The methods presented here on "Data Analysis" are particularly adapted to the exploration of the structure of data on environmental or human systems; they make it possible to clarify their complexity and lead to syntheses useful in understanding and decision-making. Implementing a fleet profile helps in understanding the dynamics of the fishery system and provides the elements relevant to its management.

Modern approaches to fisheries management require full consideration of the interactions between the natural environment, resources and associated species exploited, and their uses, and thus the behaviour of the various actors (the Nature-Society relationship). Quantitative and more ecosystemic indicators must be defined in order to answer the new challenges inherent in taking a precautionary approach to the exploitation of renewable resources, and to ensure the continued economic viability of fisheries. The profiling of fishing fleets contributes to the definition of these indicators and leads to a better understanding of the interactions between Nature and Society.

ANNEXES

ANNEX I: Survey questionnaire for the Moroccan coastal fleet profile

Survey questionnaire

Port……
Date of survey……
Surveyed……

TECHNICAL AND FISHING EQUIPMENT OF COASTAL FISHERY VESSELS

Name of boat…… …… Licencing port……
Number of associate owners……
Type of boat C: Trawler □ S: Sardine boat □ Other □
P: Longliner □ Mixed ……
Specify main activity …… ……

Boat characteristics
Hull Material Wood □ Stainless Steel □ Other □
Date of Acquisition……

	Hull	Initial Motor	Equipment	TOTAL
Cost of Acquisition				
Actual cost				

Mode of payment for boat Cash □ Credit □ Interest ……
Has the boat been the object of reclamation Yes □ No □
If (yes), the interest on reclamation …… % Date of reclamation ……

Propulsion
Main Engine: Make of engine…… Type of engine……
Horsepower…… rpm ……
Gear…… Ratio……
Engine specification (on installation) New □ Used □
Date of installation …… Age…… Expected running life……
Cost of engine on installation…… Current value……
Method of payment Cash □ Credit □ Interest……

Auxiliary Engine: Make…… Horsepower……
Age……
Cost of auxiliary Engine and its installation …… Current value……
Method of payment Cash □ Credit □ Interest……

Propellor diameter…… Variable pitch? Yes □ No □
Nozzle? Yes □ No □

Capacity Boat range…… days
Fuel capacity…… litres
Fresh water capacity…… litres
Fresh water usage……

Deck Equipment

	Winch (T)	Net hauler (F)	Line hauler (L)	Other ……
Number				
Make				
Type				
Position (mark on sketch)				
Age				
Number of warping heads				
Capacity of cable drum (in m/diameter of cable)				
Actual length and diameter of cable				
Type of drive				
Horsepower				
Expected remaining working life				
Cost of acquisition				
Method of payment				
Repair costs				
Most frequent repairs				
……				
……				

Fishing gear

1. Trawl

Type	Trawl	Atomic	Italian	Other……
Number of trawls on board				
Age and date of acquisition				
Length of trawl				
Length of head rope				
Length of strake				
Mesh size of trawl bag				
Nature and diameter of thread of bag (denier)				
Number of trawls in store				
Quantity of netting in store				
Cost of netting Price/unit or kg				
Netting requirement/year (quantity in kg or in price)				
Gear components needing frequent replacement				
Cost of repairs				

2. Purse Seine

Type	A	B	C
Number seines on board			
Age / date of acquisition			
Length			
Depth of fall			
Mesh size of bag/denier of line			
Mesh size of body/denier of line			
Purchase cost of gear			
Cost of line (price/unit or kg)			
Cost of netting (price/unit or kg)			
Quantity of netting in stock			
Netting requirement/year (quantity in kg or in price)			
Gear components needing frequent replacement			
Cost of repairs			

Lamps

Make of motor…….. Type……
Horsepower……..
Fuel used…….. Fuel capacity……
Age/Date of acquisition……

	a. boat	b. motor	c. electrical equipment	Total
Purchase price				
Current value				

Method of payment for the boat: cash □ loan □ interest……..

3. Gillnet

Type	Normal (Simple)	Trammel	Combined	Drift net
Length or weight of netting				
Number of parts combined				
Depth of fall				
Mesh size				
Nature and denier of the net				
Weights / price per kg				
Number of floats/ price each				
Price of netting /unit or kg				
Purchase price of gear				
Quantity in store				
Netting requirement/year (quantity in kg or in price)				
Repair cost				

4. Other

	Longline	Basket trap	Trap	Other……
Total length of lines				
Number of units				
Unit characteristics*				
Acquisition cost per unit				
Quantity in store				
Requirements per year				
Repair cost				

**Specify the dimensions (D), the length of branch lines (L) and the distance between the branches (DA)*

Bridge equipment

	Make	Range (Frequency)	Age/date of acquisition	Cost New (N) Used (U)	Cost of repair	Method of payment Credit (+) Cash (-)	Amort-isation period
Echo-sounder 1							
Echo-sounder 2							
Video-sounder 1							
Video-sounder 2							
Radio							
VHF							
Magnetic compass							
GPS							
Other……							

On-board Security

	Number	Unit price	Type/Material
Life raft			
Life jackets			
Life buoys			
Fire extinguishers			
Other……			
……			

Fleet operations

Gear Type	Period of activity Strong (S) Medium (M)	Fishing zone	Depth Metres (M) Fathoms (F)	Nature of sea bed*	Species caught	Yield Average/ species or Size/ species	Destination	Trip duration	Number of operations/ trip**	Port of landing

* V: Silt
S: Sand
R: Rock

** Trawler: No of hauls
Sardinier: No of sets
Longliner: No of sets

Catch preservation

Hold — Number…… Location……. FOR □ MID □ AFT □
Maximum catch storage capacity……..
Maximum ice storage capacity……..

Method of storage — Loose
In boxes: Wood □ Plastic □ Other □
Other……

Method of preservation: 1. Salting
2. On ice Crushed □ Flaked □
Unit cost of ice (by kg of fish or by box):
(a) In summer…… (b) In winter……
3 .Freezing
4. Other……

Insulated hold — Yes □ No □ If "Yes", What type……..……?
Detailed description of the hold lining……..
……..
Processing of catch on board: ……..
……..

Cost of fishing

	Consumption	Unit price	TOTAL	Observations
Fuel:				
--Main engine				
--Auxiliary engine				
--Fishing lamp engine				
Lubricant				
--engine				
--servicing				
Ice				
Sounder paper				
Fish Boxes				
Supplies				
Bait……				
……				
……				
……				
……				
Insurance ……				
……				
……				
Net bonus				
……				

Share system

Type of fishing * * 1……
2……
3……
Number of people leaving on each trip ……..

	Crew share			Owner share		
Type of fishing*	1…… %	2…….. %	3…… %	1…… %	2……%	3……%
Crew aboard	……	……	……	……	……	……
Skipper	……	……	……	……	……	……

	Crew share			Owner share		
	.	.	.	.	.	.
Mate	…………….	…………….	…………….	…………….	…………….	…………….
Engineer	…………….	…………….	…………….	…………….	…………….	…………….
Second Engineer	…………….	…………….	…………….	…………….	…………….	…………….
Deckhands	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
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………………….…	…………….	…………….	…………….	…………….	…………….	…………….
Shore Personnel	…………….	…………….	…………….	…………….	…………….	…………….
Net mender	…………….	…………….	…………….	…………….	…………….	…………….
Apprentice	…………….	…………….	…………….	…………….	…………….	…………….
Watchman	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
Other beneficiaries	…………….	…………….	…………….	…………….	…………….	…………….
Net	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….
………………….…	…………….	…………….	…………….	…………….	…………….	…………….

Boat and Equipment Maintenance (1995)

Type of Repair	Duration of one operation	Frequency of maintenance	Cost of each operation	Where work done	Comments*
Dry Dock	……	……	……	……	……
Hull:	……	……	……	……	……
--Painting	……	……	……	……	……
--Carpentry	……	……	……	……	……
--……..	……	……	……	……	……
--……..	……	……	……	……	……
Engine	……	……	……	……	……
--……..	……	……	……	……	……
--……..	……	……	……	……	……
Auxiliary	……	……	……	……	……
--Fishing lamp	……	……	……	……	……
--……..	……	……	……	……	……
TOTAL					

* *Advice on:* *-Are spare parts easily available?*
-Quality of repair work done
-Breakdown frequency

Port……
Type of fishing……..
Name of boat/Registration number……..
Date of survey
Surveys

Crew questionnaire

I Skipper

..
Nationality/Origin……..……. Place of residence……
Age……. Level of training……
Family situation (number of dependents)……..
Is the skipper also the boat owner Yes □ No □
If "Yes" then part-owner □ complete owner □ If part-owner, what percentage ……..%

Professional activity
Do you do this work by dispensation? Yes □ No □ If (Yes), for how long

Experience	Type of fishing	Position
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……

Period of activity in this type of fishing 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you do other types of fishing? Yes □ No □ If "Yes" then which type……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you have any other job Yes □ No □ If "Yes" then what ……..……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Skipper's list of problems:
……..
……..
……..
……..
……..
……..
……..

II Mate

..
Nationality/Origin……..……. Place of residence……
Age……. Level of training……
Family situation (number of dependents)……..
Is the skipper also the boat owner Yes □ No □
If "Yes" then part-owner □ complete owner □ If part-owner, what percentage ……..%

Professional activity
Do you do this work by dispensation? Yes □ No □ If (Yes), for how long

Experience	Type of fishing	Position
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……

Period of activity in this type of fishing 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you do other types of fishing? Yes □ No □ If "Yes" then which type……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you have any other job Yes □ No □ If "Yes" then what ……..……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

III **Engineer**

..
Nationality/Origin…….....……. Place of residence.……
Age…….. Level of training..……
Family situation (number of dependents)..……..
Is the skipper also the boat owner Yes □ No □
If "Yes" then part-owner □ complete owner □ If part-owner, what percentage ……..%

Professional activity
Do you do this work by dispensation? Yes □ No □ If (Yes), for how long

Experience	Type of fishing	Position
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……

Period of activity in this type of fishing 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you do other types of fishing? Yes □ No □ If "Yes" then which type……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

IV **Second Engineer**

..
Nationality/Origin…….....……. Place of residence.……
Age…….. Level of training..……
Family situation (number of dependents)..……..
Is the skipper also the boat owner Yes □ No □
If "Yes" then part-owner □ complete owner □ If part-owner, what percentage ……..%

Professional activity
Do you do this work by dispensation? Yes □ No □ If (Yes), for how long

Experience	Type of fishing	Position
…….years	……..	……
…….years	……..	……
…….years	……..	……
…….years	……..	……

Period of activity in this type of fishing 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

Do you do other types of fishing? Yes □ No □ If "Yes" then which type……..
Specify the period 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 /10 / 11 / 12 /

V **<u>Deckhands</u>**

Number……

Number of indigenous deckhands……..		Number of expatriate deckhands……	
Age range:	Minimum……	Maximum……..	
Education of deckhands:	Primary……	Secondary……..	University……..
Number of deckhands	Married……..	Single……...	Other……..

In your opinion what are the requirements for modernization:*

Boat	□	Type……
Equipment	□	Type……
Auxiliary equipment	□	Type……
Training	□	Which type……
Help/Assistance	□	How……..
Credit	□	Method……
Others	□	Specify……

……...
……...
……...

**Question aimed only at qualified professionals*

ANNEX II: Follow-up questionnaire for artisanal fishing boats in Senegal

Investigator:_____
Date of Survey: Year____Month____day_____
Port:_____ category of fisher _____
Usual Name (list of efforts): _____

Date: Year____Month____day_____ **Day d0**
Trip? Yes ___ No ___
If *no*, why? Rest:_____ Breakdown:_____ holiday:_____
Weather:_____ Other: _____
If *yes*, why? Routine trip:_____ Order (from who?)_____
Subsistence:_____ Other: _____
Fishing area:_____ Duration of trip:_____
Captain present? Yes____ No____ Number of crew _____
Motors aboard 1____ 2____ 3____ 4____
Motors used 1____ 2____ 3____ 4____
Species targeted 1_____ 2_____
3_____ 4_____
Species landed 1_____ 2_____
3_____ 4_____
Species sold 1_____ 2_____
3_____ 4_____
Selling point at port of landing? Yes____ No____

Destination of Product	*exporter:* *subsistence:*	*local market:* *reject:*	*processing:* *other:*

Degree of satisfaction:

1 – fishing, resource:	poor	average	good
2 – environment, sea:	poor	average	good
3 – market, price:	poor	average	good

Date: Year____Month____day_____ **Day d-1**
Trip? Yes ___ No ___
If *no*, why? Rest:_____ Breakdown:_____ holiday:_____
Weather:_____ Other: _____
If *yes*, why? Routine trip:_____ Order (from who?)_____
Subsistence:_____ Other: _____
Fishing area:_____ Duration of trip:_____
Captain present? Yes____ No____ Number of crew _____
Motors aboard 1____ 2____ 3____ 4____
Motors used 1____ 2____ 3____ 4____
Species targeted 1_____ 2_____
3_____ 4_____
Species landed 1_____ 2_____
3_____ 4_____
Species sold 1_____ 2_____
3_____ 4_____
Selling point at port of landing? Yes____ No____

Destination of Product	*exporter:* *subsistence:*	*local market:* *reject:*	*processing:* *other:*

Degree of satisfaction:

1 – fishing, resource:	poor	average	good
2 – environment, sea:	poor	average	good
3 – market, price:	poor	average	good

Date: Year____Month____day_____ **Day d-2 or d+1 of the last survey**
Trip? Yes ___ No ___
If *no*, why? Rest:_____ Breakdown:_____ holiday:_____
Weather:_____ Other: _____
If *yes*, why? Routine trip:_____ Order (from who?)_____
Subsistence:_____ Other: _____
Fishing area:_____ Duration of trip:_____
Captain present? Yes____ No____ Number of crew _____
Motors aboard 1____ 2____ 3____ 4____
Motors used 1____ 2____ 3____ 4____
Species targeted 1_____ 2_____
3_____ 4_____
Species landed 1_____ 2_____
3_____ 4_____
Species sold 1_____ 2_____
3_____ 4_____
Selling point at port of landing? Yes____ No____
Destination of| *exporter:* *local market:* *processing:*
Product | *subsistence:* *reject:* *other:*
Degree of satisfaction:
1 – fishing, resource: poor average good
2 – environment, sea: poor average good
3 – market, price: poor average good

Plans: Day d+1

Date: Year____Month____day_____
Trip? Yes ___ No ___
If *no*, why? Rest:_____ Breakdown:_____ holiday:_____
Weather:_____ Other: _____
If *yes*, why? Routine trip:_____ Order (from who?)_____
Subsistence:_____ Other: _____
Fishing area:_____ Duration of trip:_____
Captain present? Yes____ No____ Number of crew _____
Motors aboard 1____ 2____ 3____ 4____
Motors used 1____ 2____ 3____ 4____
Species targeted 1_____ 2_____
3_____ 4_____

General comments

Medium-term plans: date of question: year__month__day__

ANNEX III: Description of the database structure for the 8 data-sets used in the typological profile of the Moroccan coastal fleets

-1- General characteristics and deck equipment (497 entries)

Variable name	Description
NUM_POR	Survey card number
PORT	Port at which boat surveyed
NOM_BAT	Name of the boat
MATRICULE	Registration number of the boat
PORT_ATT	Home port
NB_ASSOCIE	Number of associates
TYPE	Type of boat
ACT_DOMIN	Dominant activity
MAT_COQUE	Construction material of the hull
DATE_ACQUI	Date boat acquired
PX_ACQ_COQ	Hull acquisition price
PX_ACQ_MOT	Engine acquisition price
PX_ACQ_EQU	Equipment acquisition price
PX_ACQ_TOT	Total acquisition price
PX_ACT_TOT	Total current price
MD_PAY_BAT	Mode of payment for the boat
TX_CRED	Interest rate on credit
RETAPE	Is boat repaired?
TX_RETAPE	Frequency of repair
DATE_RETAP	Date of last repair
MRQ_MOT_AC	Make of current engine
CV_MOT_AC	Current engine output (hp)
RAPP_REDUC	Ratio of reduction
ET_MOT_INS	State of the engine at installation
DATE_INSTA	Date of installation of engine
AGE_MOT	Age of engine
PX_MOT_INS	Purchase price of installed engine
PX_MOT_ACT	Current value of installed engine
MD_PAY_MOT	Mode of payment for the installed engine
TX_CRD_MOT	Interest rate on credit for the installed engine
MRQ_MOT_AX	Make of auxiliary engine
AGE_MOT_AX	Age of the auxiliary engine
CV_MOT_AX	Auxiliary engine output (hp)
PX_MOT_AX	Purchase price of auxiliary engine
MD_PAY_AX	Mode of payment of the auxiliary engine
DIM_HELICE	Diameter of propeller
HELICE_VAR	Variable speed propellor?
TUYERE	Has the boat a Kort nozzle?
AUT_BAT	Boat endurance/range in days
CAP_CMB	Fuel tank capacity in litres
CAP_EAU	Fresh water capacity in litres
UTILI_EAU	Rate of fresh water use
MRQ_TRL	Make of winch
NB_POP_TRL	Number of warping ends on winch
CAP_TB_TRL	Capacity of winch drum

DIM_CB_TRL	Gauge of cable used with the winch
LG_CB_TRL	Length of cable used with the winch
MD_ENT_TRL	Method of driving the winch
ET_ACQ_TRL	State of winch on acquisition
ACQ_TRL	Date of winch acquisition
PX_ACQ_TRL	Cost of winch
MD_PAY_TRL	Mode of payment for the winch
MRQ_CAB	Make of capstan
ACQ_CAB	Date of capstan acquisition
MD_ENT_CAB	Method of driving the capstan
FOR_CAB	Power of capstan drive
NB_POP_CAB	Number of warping ends on the capstan
ET_ACQ_CAB	State of capstan when acquired
PX_ACQ_CB	Cost of the capstan
MD_PAY_CB	Mode of payment for the capstan
MRQ_VF	Make of net-hauler
DAT_ACQ_VF	Date of acquisition of net-hauler
MD_ENT_VF	Method of powering the net-hauler
ET_ACQ_VF	State of net-hauler on acquisition
PX_ACQ_VF	Cost of acquisition of net-hauler
MD_PAY_VF	Mode of payment for net-hauler
MRQ_PB	Make of power-block
DAT_ACQ_PB	Date of power-block acquisition
MD_ENT_PB	Method of driving the power-block
ET_ACQ_PB	State of power-block on acquisition
PX_ACQ_PB	Purchase price of power-block
MD_PAY_PB	Mode of payment for power-block
MRQ_VL	Make of line-hauler
AGE_VL	Date of acquisition of line-hauler
MD_ENT_VL	Method of powering line-hauler
ET_ACQ_VL	State of line-hauler on acquisition
PX_ACQ_VL	Purchase cost of line-hauler
MD_PAY_VL	Mode of payment for line-hauler
PX_TOT_REP	Cost of repairs for hauling/lifting equipment
MRQ_MOT_LP	Make of the generator for the fishing lamps
CV_MOT_LP	Output of generator for the lamps
TYP_CMB_LP	Type of fuel used
CAP_CMB_LP	Fuel capacity of the lamps
DAT_ACQ_LP	Date of acquisition of the lamp
PX_EMB_LP	Purchase cost of the lamp bodies
PX_MOT_LP	Purchase cost of the lamp generator
PX_EQUI_LP	Purchase cost of the bridge equipment
PX_TOT_LP	Total purchase cost of the lamps
MD_PAY_LP	Mode of payment for the lamps
TX_CRD_LP	Rate of interest on credit for the lamps
TOT_REP_LP	Total cost of repairs of the lamps

-2- Fishing Gear (497 observations)

Variable name	**Description**
NUM_POR	Survey card number

PORT	Port at which boat surveyed
NOM_BAT	Name of the boat
MATRICULE	Registration Number
PORT_ATT	Home port
TYPE	Type of boat
ACT_DOMIN	Dominant activity
LG_TOT_FMS	Total length of ordinary gillnet
CHT_FMS	Depth of ordinary gillnet
PX_ACQ_FMS	Purchase price of ordinary gillnet
PX_REP_FMS	Repair cost of ordinary gillnet
LG_TOT_FT	Total length of trammel net
CHT_FT	Depth of trammel net
TOT_ACQ_FT	Total purchase cost of trammel net
TOT_REP_FT	Total price of repairs of trammel net
LG_TOT_FMD	Total length of drift net
CHT_FMD	Depth of drift net
PX_ACQ_FMD	Purchase cost of drift net
PX_REP_FMD	Cost of repairs to drift net
LG_TOT_PLS	Total length of pelagic longline
NB_HAM_PLS	Number of hooks (pelagic longline)
PX_ACQ_PLS	Purchase cost of pelagic longline
PX_REP_PLS	Cost of repairs to pelagic longline
LG_TOT_PLF	Total length of bottom longline
NB_HAM_PLF	Numbers hooks (bottom longline)
PX_ACQ_PLF	Purchase cost of bottom longline
PX_REP_PLF	Cost of repairs of bottom longline
NB_HAM_LM	Number of hooks (handline)
PX_ACQ_LM	Purchase cost of handlines
PX_REP_LM	Cost of repairs of handlines
NBR_NAS	Numbers traps
LG_TOT_NAS	Length total of trap lines
PX_ACQ_NAS	Purchase cost of traps
PX_REP_NAS	Price of repairs to traps

-3- Fishing gear: Trawl + Seine (497 observations)

Variable name	**Description**
NUM_POR	Survey card number
PORT	Port at which boat surveyed
NOM_BAT	Name of the boat
MATRICULE	Registration number
PORT_ATT	Home port
TYPE	Type of boat
ACT_DOMIN	Dominant activity
NB_CH_FR	Number of trawl nets
TOT_ACQ_FR	Total purchase cost of trawl nets
NB_CH_AT	Number of atomic trawls
TOT_ACQ_AT	Total purchase price of atomic trawls
NB_CH_IT	Number of Italian trawls
TOT_ACQ_IT	Total purchase price of Italian trawls
NB_CH_4F	Number of four-face trawls
TOT_ACQ_4F	Total purchase cost of four-face trawls
NB_CH_SM	Number of semi-pelagic trawls
TOT_ACQ_SM	Total purchase price of semi-pelagic trawls
CST_RP_CH	Cost of repairs to trawls

CST_RP_ACH	Cost of repairs to auxiliary trawls
NB_SN	Numbers of seines
LG_SN1	Length of seine 1
CHT_SN1	Depth of the senne1
PX_ACQ_SN1	Purchase cost of seine 1
LG_SN2	Length of seine 2
CHT_SN2	Depth of seine 2
PX_ACQ_SN2	Purchase cost of seine 2
CST_REP_SN	Total cost of repairs to seines
CST_RP_ASN	Total cost of repairs to auxiliary seines

-4- Fishing gear: Net + Other (497 observations)

Variable name	**Description**
NUM_POR	Survey card number
PORT	Port at which boat surveyed
NOM_BAT	Name of the boat
MATRICULE	Number
PORT_ATT	Home port
TYPE	Type of boat
ACT_DOMIN	Dominant activity
LG_TOT_FMS	Total length of ordinary gillnet
CHT_FMS	Depth of the ordinary gillnet
PX_ACQ_FMS	Purchase cost of ordinary gillnet
PX_REP_FMS	Repair cost of ordinary gillnet
LG_TOT_FT	Total length of trammel net
CHT_FT	Depth of trammel net
TOT_ACQ_FT	Total purchase cost of trammel net
TOT_REP_FT	Total price of repairs to trammel net
LG_TOT_FMD	Total length of drift net
CHT_FMD	Depth of drift net
PX_ACQ_FMD	Purchase cost of drift net
PX_REP_FMD	Cost of repairs to drift net
LG_TOT_PLS	Total length of pelagic longline
NB_HAM_PLS	Number of hooks (pelagic longline)
PX_ACQ_PLS	Purchase cost of pelagic longline
PX_REP_PLS	Cost of repairs to pelagic longline
LG_TOT_PLF	Total length of bottom longline
NB_HAM_PLF	Number of hooks (bottom longline)
PX_ACQ_PLF	Purchase cost of bottom longline
PX_REP_PLF	Cost of repairs to bottom longline
NB_HAM_LM	Cost of repairs to bottom longline
PX_ACQ_LM	Purchase cost of handlines
PX_REP_LM	Cost of repairs to handlines
NBR_NAS	Number of traps
LG_TOT_NAS	Total length trap lines
PX_ACQ_NAS	Purchase cost of traps
PX_REP_NAS	Cost of repairs to traps

-5- Fleet Operations (497 observations)

Variable name	**Description**
NUM_POR	Survey card number
PORT	Port at which boat surveyed

NOM_BAT	Name of boat
TY_EG_P1	Type of gear uses during period 1
D_P1	Beginning of period 1
F_P1	End of period 1
ZN_P1	Fishing zone for period 1
FB_PR_P1	Shallowest depth for period 1 (in fathoms)
HT_PR_P1	Greatest depth for period 1 (in fathoms)
NT_FD_P1	Bottom-type for period 1
ESP1_P1	species 1 captured during period 1
ESP2_P1	species 2 captured during period 1
ESP3_P1	species 3 captured during period 1
ESP4_P1	species 4 captured during period 1
ESP5_P1	species 5 captured during period 1
ESP6_P1	species 6 captured during period 1
ESP7_P1	species 7 captured during period 1
ESP8_P1	species 8 captured during period 1
RD_GB_P1	Total average landings for period 1 (in kg)
DES1_P1	Destination 1 of the catch from period 1
TX_DES1_P1	Percentage of catch to destination 1 from period 1 (in %)
DES2_P1	Destination 2 of the catch from period 1
TX_DES2_P1	Percentage of catch to destination 2 from period 1 (in %)
DES3_P1	Destination 3 of the catch from period 1
TX_DES3_P1	Percentage of catch to destination 3 from period 1 (in %)
DR_MR_P1	Duration of trip in period 1 (number of days)
NB_OP_P1	Number of fishing operations during period 1
TP_OP_P1	Actual time per operation in period 1 (number of days)
POR1_P1	First port of unloading for period 1
POR2_P1	Second port of unloading for period 1
POR3_P1	Third port of unloading for period 1
POR4_P1	Fourth port of unloading for period 1
TY_EG_P2	Type of gear uses during period 2
D_P2	Beginning of period 2
F_P2	End of period 2
ZN_P2	Fishing zone for period 2
FB_PR_P2	Shallowest depth for period 2 (in fathoms)
HT_PR_P2	Greatest depth for period 2 (in fathoms)
NT_FD_P2	Bottom-type for period 2
ESP1_P2	species 1 captured during period 2
ESP2_P2	species 2 captured during period 2
ESP3_P2	species 3 captured during period 2
ESP4_P2	species 4 captured during period 2
ESP5_P2	species 5 captured during period 2
ESP6_P2	species 6 captured during period 2
ESP7_P2	species 7 captured during period 2
ESP8_P2	species 8 captured during period 2
RD_GB_P2	Total average landings for period 2 (in kg)
DES1_P2	Destination 1 of the catch from period 2
TX_DES1_P2	Percentage of catch to destination 1 from period 2 (in %)
DES2_P2	Destination 2 of the catch from period 2
TX_DES2_P2	Percentage of catch to destination 2 from period 2 (in %)
DES3_P2	Destination 3 of the catch from period 2
TX_DES3_P2	Percentage of catch to destination 3 from period 2 (in %)
DR_MR_P2	Duration of trip in period 2 (number of days)
NB_OP_P2	Number of fishing operations during period 2
TP_OP_P2	Actual time per operation in period 2 (number of days)

POR1_P2	First port of unloading for period 2
POR2_P2	Second port of unloading for period 2
POR3_P2	Third port of unloading for period 2
POR4_P2	Fourth port of unloading for period 2
TY_EG_P3	Type of gear uses during period 3
D_P3	Beginning of period 3
F_P3	End of period 3
ZN_P3	Fishing zone for period 3
FB_PR_P3	Shallowest depth for period 3 (in fathoms)
HT_PR_P3	Greatest depth for period 3 (in fathoms)
NT_FD_P3	Bottom-type for period 3
ESP1_P3	species 1 captured during period 3
ESP2_P3	species 2 captured during period 3
ESP3_P3	species 3 captured during period 3
ESP4_P3	species 4 captured during period 3
ESP5_P3	species 5 captured during period 3
ESP6_P3	species 6 captured during period 3
ESP7_P3	species 7 captured during period 3
ESP8_P3	species 8 captured during period 3
RD_GB_P3	Total average landings for period 3 (in kg)
DES1_P3	Destination 1 of the catch from period 3
TX_DES1_P3	Percentage of catch to destination 1 from period 3 (in %)
DES2_P3	Destination 2 of the catch from period 3
TX_DES2_P3	Percentage of catch to destination 2 from period 3 (in %)
DES3_P3	Destination 3 of the catch from period 3
TX_DES3_P3	Percentage of catch to destination 3 from period 3 (in %)
DR_MR_P3	Duration of trip in period 3 (number of days)
NB_OP_P3	Number of fishing operations during period 3
TP_OP_P3	Actual time per operation in period 3 (number of days)
POR1_P3	First port of unloading for period 3
POR2_P3	Second port of unloading for period 3
POR3_P3	Third port of unloading for period 3
POR4_P3	Fourth port of unloading for period 3
TY_EG_P4	Type of gear uses during period 4
D_P4	Beginning of period 4
F_P4	End of period 4
ZN_P4	Fishing zone for period 4
FB_PR_P4	Shallowest depth for period 4 (in fathoms)
HT_PR_P4	Greatest depth for period 4 (in fathoms)
NT_FD_P4	Bottom-type for period 4
ESP1_P4	species 1 captured during period 4
ESP2_P4	species 2 captured during period 4
ESP3_P4	species 3 captured during period 4
ESP4_P4	species 4 captured during period 4
ESP5_P4	species 5 captured during period 4
ESP6_P4	species 6 captured during period 4
ESP7_P4	species 7 captured during period 4
ESP8_P4	species 8 captured during period 4
RD_GB_P4	Total average landings for period 4 (in kg)
DES1_P4	Destination 1 of the catch from period 4
TX_DES1_P4	Percentage of catch to destination 1 from period 4 (in %)
DES2_P4	Destination 2 of the catch from period 4
TX_DES2_P4	Percentage of catch to destination 2 from period 4 (in %)
DES3_P4	Destination 3 of the catch from period 4
TX_DES3_P4	Percentage of catch to destination 3 from period 4 (in %)

DR_MR_P4	Duration of trip in period 4 (number of days)
NB_OP_P4	Number of fishing operations during period 4
TP_OP_P4	Actual time per operation in period 4 (number of days)
POR1_P4	First port of unloading for period 4
POR2_P4	Second port of unloading for period 4
POR3_P4	Third port of unloading for period 4
POR4_P4	Fourth port of unloading for period 4

-6- Share system (497 observations)

Variable name	**Description**
NUM_POR	Survey card number
PORT	Port at which boat surveyed
NOM_BAT	Name of the boat
MATRICULE	Registration number
TYPE	Type of boat
ACT_DOMIN	Dominant activity
NB_ENGIN	Number of gear-types used
ENGIN1	Name of gear-type 1
P_EQ_E1	crew (gear-type 1) share
EF_EMB_E1	number of vessel-based people (gear-type 1)
NB_MR_E1	number of vessel-based workforce(gear-type 1)
P_PR_E1	skipper’s share (gear-type 1)
P_SPR_E1	fishing-master’s share (gear-type 1)
P_MC_E1	engineer’s (gear-type 1) share
P_SM_E1	second engineer’s (gear-type 1) share
PM1_E1	number of deckhands receiving 1 share each (gear-type 1)
PM1_25_E1	number of deckhands receiving 1.25 share each (gear-type 1)
PM1_5_E1	number of deckhands receiving 1.50 share each (gear-type 1)
PM1_75_E1	number of deckhands receiving 1.75 share each (gear-type 1)
PM2_E1	number of deckhands receiving 2 shares each (gear-type 1)
PM2_5_E1	number of deckhands receiving 2.50 shares each (gear-type 1)
PM3_E1	number of deckhands receiving 3 shares each (gear-type 1)
P_NBM1_E1	shore-based personnel (gear-type 1)
EF_NEMB_E1	shore-based workforce (gear-type 1)
P_RMD_E1	gear-mender’s share (gear-type 1)
NB_GRD_E1	numbers of watchmen (gear-type 1)
P_GRD_E1	watchmen’s share (gear-type 1)
P_GRD_ME1	watchmen’s wages in cash (after sale/trip) (gear-type 1)
NBR_AUT_E1	numbers of other beneficiaries of sale/trip (gear-type 1)
P_AUTR_E1	other’s share (gear-type 1)
P_ARM_E1	ship-owner’s (gear-type 1) share
A_PR_E1	share granted by owner to skipper (gear-type 1)
A_SPR_E1	share granted by owner to fishing-master (gear-type 1)
A_MC_E1	engineer’s wages from the ship-owner (gear-type 1)
A_SM_E1	share granted by owner to second engineer (gear-type 1)
A_SM_ME1	second engineer’s wages from the ship-owner (gear-type 1)
A_MAR_E1	share granted by owner to deckhands (gear-type 1)
A_RMD_E1	share granted by owner to gear-repairer (gear-type 1)
A_RMD_ME1	gear-repairer’s wages in cash (gear-type 1)
A_GRD_E1	share granted by owner to watchmen (gear-type 1)
A_AUR_E1	share granted by owner to others (gear-type 1)
A_AUR_ME1	remuneration of others by ship-owner in cash (gear-type 1)
ENGIN2	Name of gear-type 2
P_EQ_E2	crew (gear-type 2) share

EF_EMB_E2	number of vessel-based people (gear-type 2)
NB_MR_E2	number of vessel-based workforce(gear-type 2)
P_PR_E2	skipper's share (gear-type 2)
P_SPR_E2	fishing-master's share (gear-type 2)
P_MC_E2	engineer's (gear-type 2) share
P_SM_E2	second engineer's (gear-type 2) share
PM1_E2	number of deckhands receiving 1 share each (gear-type 2)
PM1_25_E2	number of deckhands receiving 1.25 share each (gear-type 2)
PM1_5_E2	number of deckhands receiving 1.50 share each (gear-type 2)
PM1_75_E2	number of deckhands receiving 1.75 share each (gear-type 2)
PM2_E2	number of deckhands receiving 2 shares each (gear-type 2)
PM2_5_E2	number of deckhands receiving 2.50 shares each (gear-type 2)
PM3_E2	number of deckhands receiving 3 shares each (gear-type 2)
P_NBM1_E2	shore-based personnel (gear-type 2)
EF_NEMB_E2	shore-based workforce (gear-type 2)
P_RMD_E2	gear-mender's share (gear-type 2)
NB_GRD_E2	numbers of watchmen (gear-type 2)
P_GRD_E2	watchmen's share (gear-type 2)
P_GRD_ME2	watchmen's wages in cash (after sale/trip) (gear-type 2)
NBR_AUT_E2	numbers of other beneficiaries of sale/trip (gear-type 2)
P_AUTR_E2	other's share (gear-type 2)
P_ARM_E2	ship-owner's (gear-type 2) share
A_PR_E2	share granted by owner to skipper (gear-type 2)
A_SPR_E2	share granted by owner to fishing-master (gear-type 2)
A_MC_E2	engineer's wages from the ship-owner (gear-type 2)
A_SM_E2	share granted by owner to second engineer (gear-type 2)
A_SM_ME2	second engineer's wages from the ship-owner (gear-type 2)
A_MAR_E2	share granted by owner to deckhands (gear-type 2)
A_RMD_E2	share granted by owner to gear-repairer (gear-type 2)
A_RMD_ME2	gear-repairer's wages in cash (gear-type 2)
A_GRD_E2	share granted by owner to watchmen (gear-type 2)
A_AUR_E2	share granted by owner to others (gear-type 2)
A_AUR_ME2	remuneration of others by ship-owner in cash (gear-type 2)

-7- Operating accounts (497 observations)

Variable name	**Description**
NUM_POR	Survey card number
NOM_BAT	Name of boat
MATRICULE	Registration number
PORT_ATT	Home port
TYPE	Type
ACT_DOMIN	Dominant activity
PORT	Name of the port surveyed
NB_CALE	Number of holds
CP_SK_P_CS	Catch storage capacity in boxes
CP_SK_P_KG	Catch storage capacity in kilogrammes
CAP_STK_GL	Ice storage capacity in kilogrammes
MD_STK	Method of storage
MOY_CONS	Means of preservation
TX_GL_T_KG	Rate of ice usage in summer per kilogramme of fish
TX_GL_T_CS	Rate of ice usage in summer per box
TX_GL_H_KG	Rate of ice usage in winter per kilogramme of fish
TX_GL_H_CS	Rate of ice usage in winter per case
CALE_ISOTH	Is the hold insulated?

NAT_RV_CAL	Nature of the lining of the hold
TRAIT_CP	Type of treatment of catch on board
CSM_MOT_CB	Engine fuel storage capacity (litres)
DUR_CSM_CB	Duration of engine fuel load (in working days)
CST_CB_CSM	Cost of a full load of engine fuel
CST_MPARO/	Cost of fuel for lamp generator
CSM_LB_MOT	Consumption of lubricant (litres)
DUR_CSM_LB	Duration of lubricant load (in working days)
CST_LB_CSM	Cost of a full load of lubricant
QU_LB_VDG	Lubricant consumption per service (litres)
DUR_VDG_J	Duration of service (in days)
DUR_VDG_H	Duration of service (in hours)
CST_VDG	Cost of lubricant consumption per service (in hours or days)
CSM_GL_MR	Consumption of ice per trip
CST_GL_MR	Cost of the ice consumed per trip
QU_GL_HIVE	Rate of consumption of ice in winter
DUR_CM_GLH	Duration of ice load in winter
CST_GL_HIV	Cost of ice used in winter per load
QU_GL_ETE	Rate of consumption of ice in summer
DUR_CM_GLT	Duration of ice load in summer
CST_GL_ETE	Cost of ice used in summer per load
DURE_MAR	Duration of fishing trip
JP_EF_MY	Average number of fishing days
QU_CSM_PS	Rate of consumption of sounder paper (units)
DUR_CSM_PS	Duration of a load of sounder paper
CST_PS_CSM	Cost of sounder paper consumed per load
NB_CS_CSM	Number of fish boxes loaded
DUR_CSM_CS	Duration of the fish box load
CST_CS_CSM	Cost of the a load of fish boxes
CM_VV_MR	Cost of the food consumed per trip
CM_AP_AN	Annual cost of consumption of perishable food
CST_ASS_BA	Annual cost of vessel insurance
CST_ASS_EQ	Annual cost of crew insurance
ASS_EQ_CD	Rate of crew insurance
TOT_AUTRE	Total cost of other repairs
CST_ENT_MT	Annual maintenance cost of engine
GR_REP_MOT	Cost of major repairs to engine
FR_GR_REP	Period between two major repairs
DURE_CAREN	Repair dock duration
FR_CARE_AN	Frequency of repair docking
CST_ENT_CQ	Annual cost of hull maintenance
CST_ENT_AX	Annual cost of maintenance of boat auxiliaries
TOTAL_ENTR	Total annual cost of vessel maintenance

-8- Crew (222 observations)

Variable name	**Description**
NUM_POR	Survey card number
PORT	Port at which boat surveyed
NOM_BAT	Name of boat
MATRICULE	Registration number
PORT_ATT	Home port
TYPE	Type of fishing
ACT_DOMIN	Dominant activity

INQUIRE	Survey
ORG_PR	Origin of skipper
RESID_PR	Place of residence of skipper
AGE_PR	Age of skipper
NV_INST_PR	Educational level of skipper
ST_FAM_PR	Marital status of skipper
PRS_CHG_PR	Persons under the charge of the skipper
PR_ARM_BAT	Is skipper also the vessel owner?
PR_ASS_BAT	Is skipper also a vessel associate owner?
TX_ASS_BAT	Level of associate ownership by the skipper
DRG_PR	Does the skipper carry out activities by dispensation?
TMP_DRG_PR	Duration of skipper’s dispensation
EXP_PR_PR	experience of the skipper as skipper
EXP_PR_SP	experience of the skipper as fishing master
EXP_PR_MC	experience of the skipper as engineer
EXP_PR_MR	experience of the skipper as deckhand
PER_ACV_PR	length of time by skipper in this type of fishing
A_P_PR	other fishing activities of the skipper
NOM_A_P_PR	names of the other fishing activities of the skipper
PER_A_P_PR	duration of the other fishing activity of the skipper
C_P_PR	other activities of the skipper
NOM_C_P_PR	names of other activities of the skipper
PER_C_P_PR	period of other activities of the skipper
PRES_SP	Presence of fishing master?
OR_SP	Origin of fishing master
RESID_SP	place of residence of fishing master
AGE_SP	age of fishing master
NV_ISRT_SP	educational level of fishing master
ST_FAM_SP	marital status of fishing master
PRS_CHG_SP	persons under the charge of the fishing master
DRG_SP	Fishing master carries out activities by dispensation?
TMP_DRG_SP	duration of dispensation of fishing master
EXP_SP_PR	experience of the fishing master as skipper
EXP_SP_SP	experience of the fishing master as f/master
EXP_SP_MC	experience of the fishing master as engineer
EXP_SP_MR	experience of the fishing master as deckhand
PER_ACV_SP	length of time by the fishing master in this type of fishing
A_P_SP	other fishing activities of fishing master
NOM_A_P_SP	names of other fishing activities of fishing master
PER_A_P_SP	duration of other fishing activities of fishing master
C_P_SP	other activities of fishing master
NOM_C_P_SP	names of the other activities of fishing master
PER_C_P_SP	duration of the other activities of fishing master
PRES_MC	presence of engineer?
OR_MC	origin of engineer
RESID_MC	place of residence of engineer
AGE_MC	age of engineer
NV_INST_MC	educational level of engineer
ST_FAM_MC	marital status of engineer
PRS_CHG_MC	persons under the charge of the engineer
DRG_MC	does the engineer carry out activities by dispensation?
TPM_DRG_MC	duration of dispensation of the engineer
EXP_MC_PR	experience of the engineer as skipper
EXP_MC_MC	experience of the engineer as engineer
EXP_MC_MR	experience of the engineer as deckhand

PER_ACV_MC	time spent in this type of fishing by engineer
A_P_MC	other activities of engineer
NOM_A_P_MC	names of the other activities of engineer
PER_A_P_MC	period of the other activities of engineer
PRES_SM	presence of second engineer?
OR_SM	origin of the second engineer
RESID_SM	place of residence of second engineer
AGE_SM	age of second engineer
NV_INST_SM	educational level of second engineer
ST_FAM_SM	marital status of second engineer
PRS_CHG_SM	persons under the charge of the second engineer
EXP_SM_MC	experience of second engineer as engineer
EXP_SM_MR	experience second engineer as deckhand
PR_ACV_SM	time spent in this type of fishing by s/engineer
A_P_SM	other fishing activities of second engineer
NOM_A_P_SM	names of the other fishing activities of second engineer
PER_A_P_SM	period of the other fishing activities second engineer
NBR_MR	number of deckhands
NBR_MR_AUT	number of indigenous deckhands
NBR_MR_ALL	number of immigrant deckhands
AGE_MIN_MR	minimal age of the deckhands
AGE_MAX_MR	maximum age of the deckhands
NBR_MR_PRM	number of deckhands having primary education
NBR_MR_SCD	number of deckhands having secondary education
NBR_MR_UNV	number of deckhands having university education
NBR_MR_MRE	number of deckhands married
NBR_MR_CLB	number of deckhands unmarried
NBR_MR_AUR	number of deckhands other ...
MOD_ENGIN	modernization of gear?
TYP_ENGIN	type of gear
MOD_BAT	modernization of vessel?
TYP_BAT	type of vessel
MOD_EQP_AUX	modernization of auxiliary equipment?
TYP_EQP_AUX	type of auxiliary equipment
MOD_FORM	modernization by training?
TYP_FORM	type of training
MOD_ASSIS	modernization by assistance?
TYP_ASSIS	type of assistance
MOD_CRD	modernization through credit scheme?
TYP_CRD	type of credit
MOD_AUT	modernization by other means?
TYP_AUT	type of other means

ANNEX IV: List of active and additional variables for the profile of technical characteristics of Moroccan coastal fleets

First profile (498 boats)

8 ILLUSTRATIVE QUESTIONS	65 ASSOCIATED MODALITES
7. TYPE Type of boat under investigation	(11 MODALITES)
8. PORT Port of survey	(18 MODALITES)
40. AREA	(12 MODALITES)
42. STOCK Mode of storage	(3 MODALITES)
43. CONS means of preservation	(5 MODALITES)
44. Iso: insulated hold	(4 MODALITES)
45. Revet: hold lining	(6 MODALITES)
50. ACDO dominant Activity	(6 MODALITES)

29 ACTIVE VARIABLES	
5. CV engine power	(CONTINUOUS)
10. TUYE Presence of nozzle	(CONTINUOUS)
11. TREU Presence of winch	(CONTINUOUS)
12. CAB Presence of capstan	(CONTINUOUS)
13. BLOCK Presence of power-block	(CONTINUOUS)
14. LAMP Presence of lamp	(CONTINUOUS)
15. VIRF Presence of net hauler	(CONTINUOUS)
16. CV+ power of auxiliary engine	(CONTINUOUS)
17. HEL Diameter of propeller	(CONTINUOUS)
20. COMB fuel capacity	(CONTINUOUS)
21. WATER fresh water capacity	(CONTINUOUS)
35. trawl presence	(CONTINUOUS)
36. seine presence	(CONTINUOUS)
37. net presence	(CONTINUOUS)
38. line presence	(CONTINUOUS)
46. STPC capacity storage in boxes	(CONTINUOUS)
47. STGL capacity storage of ice	(CONTINUOUS)
48. STPK capacity storage in kilogrammes	(CONTINUOUS)
49. ISO presence of insulation	(CONTINUOUS)
92. CMP presence compass	(CONTINUOUS)
93. GPS presence GPS	(CONTINUOUS)
105. NBES Numbers depth-sounder	(CONTINUOUS)
106. NBVS Numbers video-sounder	(CONTINUOUS)
107. NBRV Numbers radio and VHF	(CONTINUOUS)
108. NBRD Numbers radar	(CONTINUOUS)
109. NBCA Numbers lifeboat	(CONTINUOUS)
110. NBGI Numbers waistcoat	(CONTINUOUS)
111. NBBO Numbers buoys	(CONTINUOUS)
112. NBEX Numbers extinguishers	(CONTINUOUS)

51 ILLUSTRATIVE VARIABLES	
1. LONG length	(CONTINUOUS)
2. CREU water drawn	(CONTINUOUS)
3. TJB gross tonnage	(CONTINUOUS)
6. AGE age of the boat	(CONTINUOUS)
9. MOTA Presence of auxiliary engine	(CONTINUOUS)
18. CAR Autonomy of boat	(CONTINUOUS)
22. NBCF Numbers French trawl	(CONTINUOUS)
23. NBCA Numbers atomic trawl	(CONTINUOUS)
24. NBCI Numbers Italian trawl	(CONTINUOUS)

25.	NBC4 Numbers trawl 4 faces	(CONTINUOUS)
26.	NBCS Numbers semi-pelagic trawl	(CONTINUOUS)
27.	NBSE Numbers seine	(CONTINUOUS)
28.	NBFS Numbers ordinary gillnet	(CONTINUOUS)
29.	NBFT Numbers trammel net	(CONTINUOUS)
30.	NBFD Numbers driftnet	(CONTINUOUS)
31.	NHPS Number hooks pelagic longline	(CONTINUOUS)
32.	NHPF Number hooks trawl benthic longline	(CONTINUOUS)
33.	NHLM Number hooks hand line	(CONTINUOUS)
34.	NBNA Numbers trap	(CONTINUOUS)
39.	trap presence	(CONTINUOUS)
41.	FIX number of holds	(CONTINUOUS)
51.	AGEM engine age	(CONTINUOUS)
52.	AGM+ age of the auxiliary engine	(CONTINUOUS)
53.	RETA numbers year since refitting	(CONTINUOUS)
54.	PROP number of years owned	(CONTINUOUS)
55.	IMOT numbers year since installation engine	(CONTINUOUS)
56.	NBAS number associates	(CONTINUOUS)
57.	TRET Rate of repairs	(CONTINUOUS)
85.	ES1 presence echo sounder 1	(CONTINUOUS)
86.	ES2 presence echo sounder 2	(CONTINUOUS)
87.	VS1 presence video-sounder 1	(CONTINUOUS)
88.	VS2 presence video-sounder 2	(CONTINUOUS)
89.	RDO radio presence	(CONTINUOUS)
90.	VHF presence VHF	(CONTINUOUS)
91.	RDR radar presence	(CONTINUOUS)
94.	ELEC other electronics	(CONTINUOUS)
95.	AES1 age sonic depth-finder 1	(CONTINUOUS)
96.	AES2 age sonic depth-finder 2	(CONTINUOUS)
97.	AVS1 age video-sounder2	(CONTINUOUS)
98.	AVS2 age video-sounder 2	(CONTINUOUS)
99.	ARDO radio age	(CONTINUOUS)
100.	AVHF age VHF	(CONTINUOUS)
101.	ARDR age radar	(CONTINUOUS)
102.	ACMP age compass	(CONTINUOUS)
103.	AGPS age GPS	(CONTINUOUS)
104.	EFTA other electronics age	(CONTINUOUS)
113.	PES1 Range sonic depth-finder 1	(CONTINUOUS)
114.	PES2 Range sonic depth-finder 2	(CONTINUOUS)
115.	PVS1 Range video-sounder 1	(CONTINUOUS)
116.	PVS2 Range video-sounder 2	(CONTINUOUS)
117.	PRDR Range radar	(CONTINUOUS)

Second profile (Group I, 181 boats)

31 ACTIVE VARIABLES

5.	CV engine power	(CONTINUOUS)
16.	CV+ auxiliary engine power	(CONTINUOUS)
17.	HEL Dimension of the propeller	(CONTINUOUS)
20.	COMB capacity fuel	(CONTINUOUS)
21.	WATER capacity water	(CONTINUOUS)
22.	NBCF Numbers French trawl	(CONTINUOUS)
23.	NBCA Numbers atomic trawl	(CONTINUOUS)
24.	NBCI Numbers Italian trawl	(CONTINUOUS)
25.	NBC4 Numbers trawl 4 faces	(CONTINUOUS)
26.	NBCS Numbers semi-pelagic trawl	(CONTINUOUS)
41.	FIX number of holds	(CONTINUOUS)
46.	STPC capacity storage in boxes	(CONTINUOUS)
47.	STGL capacity storage of ice	(CONTINUOUS)
48.	STPK capacity storage in kilogrammes	(CONTINUOUS)
49.	ISO absence presence of insulation	(CONTINUOUS)
64.	POPT Number heads on the winch	(CONTINUOUS)

65. TAMT Capacity of the winch drum (CONTINUOUS)
66. CADT Dimension of the winch cable (CONTINUOUS)
67. CALT Length of the winch cable (CONTINUOUS)
68. POPC Number heads on the capstan (CONTINUOUS)
69. FORC Power of the capstan (CONTINUOUS)
93. GPS presence GPS (CONTINUOUS)
109. NBCA Numbers lifeboat (CONTINUOUS)
110. NBGI Numbers waistcoat (CONTINUOUS)
111. NBBO Numbers buoys (CONTINUOUS)
112. NBEX Numbers extinguisher (CONTINUOUS)
113. PES1 Range depth-sounder 1 (CONTINUOUS)
114. PES2 Range depth-sounder 2 (CONTINUOUS)
115. PVS1 Range video-sounder 1 (CONTINUOUS)
116. PVS2 Range video-sounder 2 (CONTINUOUS)
117. PRDR Range radar (CONTINUOUS)

Third profile (Group II, 177 boats)

29 ACTIVE VARIABLES

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5. CV engine power (CONTINUOUS)
16. CV+ auxiliary engine power (CONTINUOUS)
17. HEL Dimension of the propeller (CONTINUOUS)
20. COMB capacity fuel (CONTINUOUS)
21. WATER capacity fresh water (CONTINUOUS)
41. FIX number of holds (CONTINUOUS)
46. STPC capacity storage in boxes (CONTINUOUS)
47. STGL capacity storage of ice (CONTINUOUS)
48. STPK capacity storage in kilogrammes (CONTINUOUS)
49. ISO absence presence of insulation (CONTINUOUS)
68. POPC Number heads on the capstan (CONTINUOUS)
69. FORC Power of the capstan (CONTINUOUS)
70. MOTL Output of lamp generator (CONTINUOUS)
71. COML Fuel capacity of lamp system (CONTINUOUS)
76. LFMD Length of driftnet (CONTINUOUS)
77. CFMD Depth of driftnet (CONTINUOUS)
81. LSE1 Length of seine 1 (CONTINUOUS)
82. CSE1 Depth of seine 1 (CONTINUOUS)
83. LSE2 Length of seine 2 (CONTINUOUS)
84. CSE2 Depth of seine 2 (CONTINUOUS)
109. NBCA Number lifeboats (CONTINUOUS)
110. NBGI Number lifejackets (CONTINUOUS)
111. NBBO Number buoys (CONTINUOUS)
112. NBEX Number extinguishers (CONTINUOUS)
113. PES1 Range depth-sounder 1 (CONTINUOUS)
114. PES2 Range depth-sounder 2 (CONTINUOUS)
115. PVS1 Range video-sounder 1 (CONTINUOUS)
116. PVS2 Range video-sounder 2 (CONTINUOUS)
117. PRDR Range radar (CONTINUOUS)

Fourth profile (Group I II, 139 boats)

43 ACTIVE VARIABLES

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5. CV engine power (CONTINUOUS)
16. CV+ auxiliary engine power (CONTINUOUS)
17. HEL Dimension of the propeller (CONTINUOUS)
20. COMB fuel capacity (CONTINUOUS)
21. WATER fresh water capacity (CONTINUOUS)
27. NBSE Numbers seine (CONTINUOUS)
28. NBFS Numbers ordinary gillnet (CONTINUOUS)
29. NBFT Numbers trammel net (CONTINUOUS)

30.	NBFD Numbers driftnet	(CONTINUOUS)
31.	NHPS Number hooks pelagic longline	(CONTINUOUS)
32.	NHPF Number hooks benthic longline	(CONTINUOUS)
33.	NHLM Number hooks handline	(CONTINUOUS)
34.	NBNA Number traps	(CONTINUOUS)
41.	FIX number of holds	(CONTINUOUS)
46.	STPC capacity storage in boxes	(CONTINUOUS)
47.	STGL capacity storage of ice	(CONTINUOUS)
48.	STPK capacity storage in kilogrammes	(CONTINUOUS)
49.	ISO absence presence of insulation	(CONTINUOUS)
65.	TAMT Capacity of the winch drum	(CONTINUOUS)
68.	POPC Number heads on the capstan	(CONTINUOUS)
69.	FORC Power of the capstan	(CONTINUOUS)
70.	MOTL Output lamp generator	(CONTINUOUS)
71.	COML Fuel capacity of lamp	(CONTINUOUS)
72.	LFMS Length of gillnet	(CONTINUOUS)
73.	CFMS Depth of gillnet	(CONTINUOUS)
74.	LFT Length of trammel net	(CONTINUOUS)
75.	CFT Depth of trammel net	(CONTINUOUS)
76.	LFMD Length of drift net	(CONTINUOUS)
77.	CFMD Depth of drift net	(CONTINUOUS)
78.	LPLS Length of pelagic longline	(CONTINUOUS)
79.	LPLF Length of bottom longline	(CONTINUOUS)
80.	LNAS Length of traps line	(CONTINUOUS)
81.	LSE1 Length of seine 1	(CONTINUOUS)
82.	CSE1 Depth of seine 1	(CONTINUOUS)
109.	NBCA Number lifeboats	(CONTINUOUS)
110.	NBGI Number lifejackets	(CONTINUOUS)
111.	NBBO Number buoys	(CONTINUOUS)
112.	NBEX Number of extinguishers	(CONTINUOUS)
113.	PES1 Range depth-sounder 1	(CONTINUOUS)
114.	PES2 Range depth-sounder 2	(CONTINUOUS)
115.	PVS1 Range video-sounder 1	(CONTINUOUS)
116.	PVS2 Range video-sounder 2	(CONTINUOUS)
117.	PRDR Range radar	(CONTINUOUS)

A fishing fleet profile aims to assist in understanding the complexity and structure of fisheries from the technical and socio-economic points of view, or from the point of view of fishing strategies. A profile consists of analysing the characteristics of individual units of the fleet, for example the boats, in order to classify these units and summarize the heterogeneity of the whole through a description of the component elements and their interrelationships. The identification of the various qualitative and quantitative parameters describing a fishing fleet, together with the characteristics of the boats associated with these parameters, constitutes a profile of the fleet. This document describes the steps necessary to produce such a profile, from planning and the implementation of the fleet survey, through data processing to the presentation of the results.

The processes of analysis, classification and description require the application of specific statistical methods in order to extract the items of information that are fundamental and relevant to the objectives of the profile from a data-set consisting of the variables describing the units of the fleet. Various methods of data analysis are presented here in order to demonstrate their potential uses and relevance to different situations. The aim is to make them intuitively comprehensible without elaborating upon their theoretical basis. The Moroccan inshore fishery and the Senegalese small-scale fisheries have been used as examples in this document.