A fleet-metier based approach of the small scale fishing activity in the French West Indies

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Abstract:

The development of the ecosystemic approach for fisheries supposes to improve integrated analysis of fisheries by considering the biological as well as the socio-economic dimensions of the exploitation. A prerequisite for integrated analysis is the improvement in the knowledge of fleets structure, fleet evolution and allocation of fishing effort in the different fisheries. However, small scale fisheries are often characterized by a lack of knowledge on the vessel fishing activity. This paper first presents a data collection methodology recently applied in the French West (Guadeloupe and Martinique) for the follow up of the whole vessel population. Based on a statistical analysis of these data sets, the paper develops a fleet-metier matrix giving the possibility to identify the structure of the fleet, the metier polyvalence of the vessels but also the origin of fishing mortality on the different exploited fishing resources. We then discuss the interest of this methodology for fisheries analysis and the perspective in terms of fisheries management at regional levels.

Key words: fleet, metiers, fishing activity, small scale fisheries, fisheries management

Resumen :

El desarollo del estudio del ecosistema de las pescas supone que hay que intensificar los análisis considerando a la vez las dimensiones biológicas y socio-económicas de la explotación. Esto supone un mejor conocimiento de las flotillas de pesca, de su evolucíon y de la atribución del esfuerzo de pesca en las diferentes pesquerías. Sabiendo que los conocimientos sobre la actividad de los buques de pequeña pesca son muchas veces limitados, este documento presenta la metodología de recolección de informaciones estadísticas dada en el caso de las islas de las antillas francesas (Guadeloupe y Martinique). Basándose en una recoleccíon de informaciones estadísticas mínima pero eschaustiva de la actividad de los buques, este documento propone el desarollo de un análisis de las matrices (flotillas-metiers) que permite caracterizar la estructura de las flotillas de pesca y de identificar su caracter polivalente en términos de metiers practicados. No solo permite discutir sobre el impacto de las políticas que tienden a reorientar el esfuerzo de pesca de las especies de los bancos insulares hacia las especies pelágicas, sino también permite discutir sobre el interés de generalizar este tipo de recolección de informaciones estadísticas en los sistemas de observación de las pesquerías a escala de las pequeñas Antillas o de otros espacios pertinentes para la gestión de las pescas.

Palabras llaves : flotillas, metiers, actividad de pesca, pequeña pesca, gestión de las pescas

Résumé:

Le développement de l'approche écosystémique des pêches suppose de renforcer les analyses couplant les dimensions biologiques et socio-économiques de l'exploitation. Cela passe en particulier par une meilleure connaissance des flottilles de pêche, de leur évolution et l'allocation de l'effort de pêche dans les différentes pêcheries. Dans un contexte de connaissance souvent très limitée sur l'activité de navires de petite pêche, ce papier présente la méthodologie de collecte de données utilisée, dans le cas des îles des Antilles françaises (Guadeloupe et Martinique). Sur la base d'une collecte de données minimale mais exhaustive de l'activité des navires, le papier propose le développement une analyse matricielle (flottilles-métiers) permettant de caractériser la structure des flottilles de pêche, d'identifier leur polyvalence en termes de métiers pratiqués et l'origine de la mortalité par pêche. On discute enfin l'intérêt de ce type d'approche pour l'analyse de pêcheries ainsi que les perspectives pour la gestion des pêches.

Mots clés : flottille, métiers, activité, petite pêche, gestion des pêches

Introduction

While the majority of small-scale fisheries (SSF) are found in developing nations, a considerable number exist in developed nations as well (Chuenpagdee *et al.* 2006). SSF are strongly represented in all European Union (EU) Member States, 81% and 87% of the EU 25 whole fleet is composed of vessels less than 12 and 15 meters long respectively, and approximately 100,000 crew are involved in small scale fleets in Europe (Ifremer 2007). Small-scale fleets are present all around the European coast, even in isolated and sensitive areas and especially in ultra-peripheral regions. The importance of fishing in the island context of the French West Indies, both in terms of employment, valorization of production and the perspectives for development has been highlighted in a context of the risk of over-capacity and over-exploitation of the resources of the island shelf (Gobert and Reynal 2002). The lack of information about the fishing fleet, fisheries and the conditions of exploitation of the resources has, until very recently, been a factor limiting the development of approaches aiming at sustainable management of the ecosystems and practices in this zone.

This situation is not limited to the French West Indies. As mentioned by Salas *et al.* (2007), fisheries research in Latin America and the Caribbean has mainly focused on bio-ecological aspects, with limited attention paid to socio-economic issues. Pauly and Agüero (1992) also stated that the focus of fishery science in the area has traditionally been on collecting data on total catches of the main fishery resources, and on fish stock evaluation based mainly on growth-mortality. However, several authors emphasize the need to go beyond the analysis of information from landings to explore the spatial distribution of catch and effort, as well as to assess fishing strategies and fleet dynamics (Seijo *et al.* 1994, Cabrera and Defeo 2001, Salas and Gaertner, 2004), and incorporate an ecosystem approach in their analyses (Pauly *et al.* 1998, Espana-Pérez *et al.* 2006).

The development of the ecosystemic approach for fisheries means improving the integrated analysis of fisheries by considering the biological as well as the socio-economic dimensions of the exploitation. A prerequisite for integrated analysis is improvement in the knowledge of fleet structure, fleet evolution and allocation of the fishing effort in the different fisheries. However, SSF are often characterized by a lack of knowledge about vessels' fishing activity. As stated by Salas *et al.* (2007), quantitative information on SSF is relatively little covered in the literature and more information is available on large-scale commercial fleets. Information gathered by countries focus mainly on catch and effort data from the landings, sometimes on size frequency and there is a limitation on the evaluation of the actual fishing effort on the resource. More generally speaking, Chuenpagdee *et al.* (2006) argue that there has been little coordinated effort to address the lack of systematic data collection and integrated information on small-scale fisheries.

This paper first presents the data collection methodology recently applied in the French West Indies (Guadeloupe and Martinique) for the follow up of the whole vessel population. Based on a statistical analysis of these data sets (principal component analysis and hierarchical ascending classification), the paper develops a fleet-metier matrix giving the possibility of identifying at the time, the structure of the whole fleet in fleets, the metier polyvalence of the vessels but also the allocation of fishing effort on the different fishing resources exploited. We discuss the interest of this approach for fisheries analysis and management at regional and international levels.

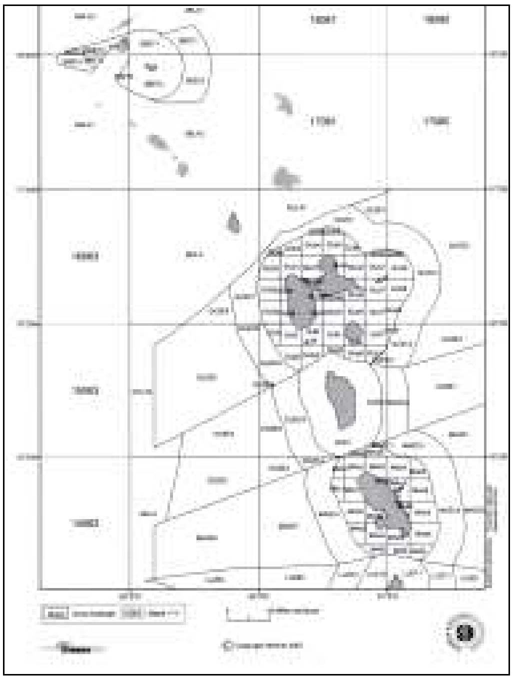
Materials and methods

The originality of this approach first lies in the fleet monitoring procedure, by census and by the type of data collected on the activity of the vessels in the small coastal fishing context where it is unfortunately impossible to have complete declarative information concerning the effort and production by species for all the vessels in a given population.

The Guadeloupe and Martinique fishing fleets

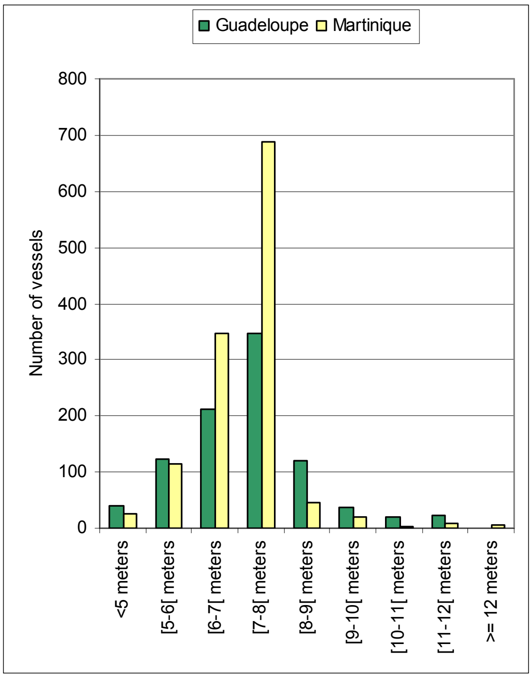
Situated in the Lesser Antilles (FAO zone 31, see figure 1), the islands of Guadeloupe and Martinique are the ultra-peripheral regions of the European Union and the management of the fisheries in the exclusive economic zones obeys the regulations fixed in the context of the Common Fishery Policy and national regulations. The fishing activity is marked by the insularity and the narrowness of the island shelf. The main species fished are large pelagic species, reef fishes and crustaceans. The context of the fishing activity is the high number of vessels, 2200 on the two islands, operating from numerous landing sites. The context is mainly small-scale vessels, as can be seen from figure 2, with a size-category distribution of the number of vessels on each island. Most of the vessels are open and are equipped with outboard motors, their size being less than 12 meters long. 60% and 80% of the vessels on Guadeloupe and Martinique are between 6 and 8 meters long, respectively. These units generally do one-day trips.

Figure 1. Martinique, Guadeloupe and related islands



Source: Ifremer-SIH

Figure 2. Structure in size categories of the fleet of Guadeloupe and Martinique



Source: Direction des Pêches Maritimes et de l'Aquaculture, Community Fleet Register

The Guadeloupe fleet is made up of a higher proportion of vessels between 8 and 12 meters long, some of which do longer trips, between 2 and 8 days. Even if the distributions are different, the mean size is around 7 meters long (7.2 and 7.0 meters on Guadeloupe and on Martinique, respectively) for an engine power of 125 and 60 kW and an average age of 10 and 15 years. Of course, the context of a small-scale fleet is of crucial importance in designing the data collection strategy.

Census of the vessel fishing activity per metier

The aim of collecting data about the activity of each boat is to have minimum but exhaustive information about the reference population. The vessels present in the Community Fleet Register for the year of reference, 2006, define this reference population that is the subject of this census. The aim of collecting the calendar of fishing activity of each boat is, for all the months of the year, to characterize the inactivity or activity of the boat and, in the latter case, the metiers used and the main fishing zones. By "metier", we mean the combination of a gear, a target or group of target species[1]. In the simplest case, one and the same gear can target a single species but different metiers can also target different fractions of the same stock. A same metier can simultaneously catch different species belonging to different stocks present in a zone and as a result, there could be technical interactions between operators. During the year, each fishing unit allocates a fishing effort to different stocks by using different metiers according to the strategy chosen, which can evolve depending on the biological, social-economic and institutional context.

The spatial distribution of the fishing effort is also documented systematically. For each month and each metier, the two main fishing zones (see figure 1) and the gradient -distance to the coast or depth of operation of the gear- associated with each zone are collected. The aim of the information about the main port from which the vessel operates, the size of the crew for each month of the year considered, as well as the technical characteristics of the fishing unit, is to quantify the means of production mobilized and their location. This latter point is important since the range of small fishing vessels is often limited, their port of operation defining the possibilities of access to resources available in the zone. This information can be completed by data about the nominal fishing effort (number of days at sea or the number of engine hours) (Berthou *et al*. 2003).

[1] Collecting data is based on a series of reference systems. The system of reference for "metier" is itself based on the international coding of gears, species and zones, allowing comparisons to be made between countries or between fishing zones of a single country. Non fishing activities using the vessel are also collected.

In cases where the information is available, data collectors can mobilize additional sources of information in order to conduct the survey of the fishermen. This can be information of an administrative origin about the characteristics of the vessels and of their owners, or again, it can be data collected by sampling or from declarations. Good knowledge on the part of the observers concerning the fishing activity and the fishermen is a key element for obtaining quality documentation about the activity calendar.

Multivariate analysis for fleet segmentation

Work already undertaken to analyze exploitation strategies shows that the strategies observed in a given exploitation area often appear to be stable over time and fishermen have difficulty in changing their strategy since the initial investment, but also the regulation of access conditions, condition the mainly productive choices (Berthou *et al.* 2003, Le Gallic 2000). Depending on fluctuations in abundance or in the market, the exploitation units will, within the strategy chosen, generally use one rather than another of the metiers. The notion of exploitation type or of fleet defines the groups of vessels having relatively homogeneous exploitation strategies or economic behaviour. These strategies that are expressed in the choice of a particular combination of gears used, greatly determine the means of production implemented but also the revenue and the costs of production. It is therefore of particular interest to characterize the fleets of a given region in order to be able to characterize the associated socio-economic and biological indicators.

The first step of the analysis involves implementing exploratory multivariate statistical methods (Berthou *et al*. 2003, Pelletier and Ferraris 2000). Principal component analysis (PCA) can process individual-variable tables when the latter are quantitative or continuous. It is therefore adapted to the analysis of vessels (individuals) depending on metric characteristics appropriate for their fishing activity, such as the number of months, days, etc of use per fishing gear during a reference period. It involves looking for the directions of the space that best represent the correlations between the N random variables (gears) from K joint realizations of these variables (vessels). The result is the production of synthesis variables or factorial axes which best synthesize all the variables involved in the analysis. This approach means looking for possible correlated variables or eliminating marginal variables. Interpreting the axes involves looking for variables that are strongly correlated with the axes, which enables groups of variables to be associated with each axis and an interpretation of the axes to be given by analyzing two elements: the level of correlation of the variable with the axis and the direction of the correlation (positive or negative)

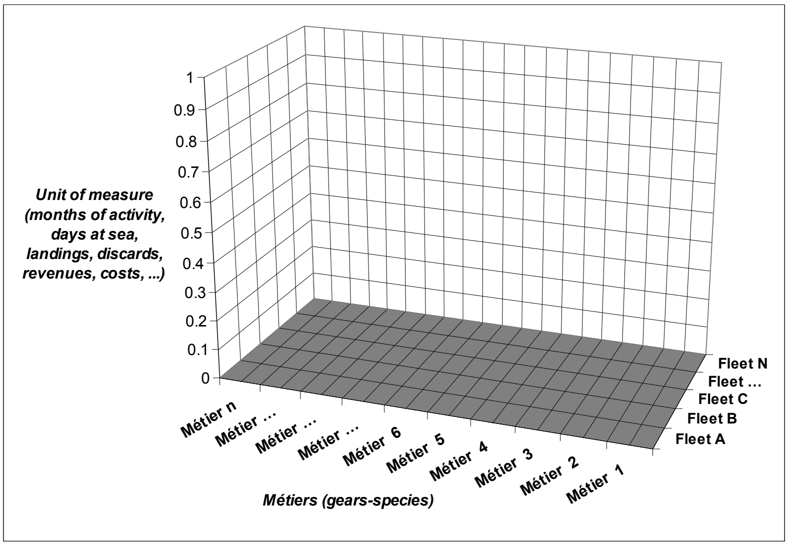
We then have for each individual their coordinates on the different factorial axes retained. Classification procedures can be then used in order to allocate each boat to one and only one fleet. These procedures always aim to segment a given population, with a twofold objective: on the one hand to ensure that the differentiation between the groups is maximum and, on the other hand, to form groups in which the elements are the most similar. Hierarchical ascending classification (HAC) is the method used, based on the coordinates coming from the PCA and the squared Euclidean distance. This method involves assembling the elements into a sequence of interlocking partitions by proceeding step by step. The hierarchical process is ascending; it starts with the objects and then forms classes. Then, the number de classes are chosen *a posteriori* by arbitration in order to have classes that group together the maximum information, while keeping internal pertinence. The evolution of the intra-class inertia during the successive groupings undertaken enables the best number of classes to be chosen and the classes will have to be kept whenever an important jump in the intra-class inertia is observed. Indeed, an important jump shows a great loss of inter-class inertia and therefore a high increase in the intra-class inertia, which is an indicator of a high heterogeneity of the classes merged together at this step. Interpreting the classes thus obtained involves the notion of test value, the basic idea of which is to compare the discrepancy observed for each variable between the value on the class and the value taken on the total. Ranking the test values then enables the most characteristic variables of each of the classes to be determined.

The fleet-metiers matrix

The aim of identifying fleets is to group together vessels having fishing strategies and therefore relatively homogeneous economic behaviour which can be followed over time. This type of identification is necessary but not sufficient, however, to establish the links between the investment of the fleets studied, the allocation of their fishing effort to the different stocks, impacts and interactions on the resources exploited and returns in terms of economic performance of the fishing units. The development of a fleet-metier approach on the scale of a fleet or a set of fleets in different regions or countries must allow these relations to be established. The metier is an important criterion insofar as, depending on the gears used, the species targeted and the fishing zones exploited, the allocation of the effort between different metiers conditions the volume and the composition of the catches and of the discards, the revenue structure and variable costs.

Crossing the fleet criterion on the one hand, and the metier criterion on the other hand, enables a matrix of L×M dimensions (L fleets and M defined metiers) to be generated. Different fleets can do the same metier; according to strategies, it can be a basic structuring metier or, on the contrary, an extra or opportunistic metier. This state of affairs has certain consequences for fisheries management (divergent interest of the different fleets).

Figure 3. The fleet-metiers matrix



Source: Ifremer-sih

Different types of indicators can then be documented for all the fleets, the number of months of activity, the number of days at sea, the catches/value per unit of effort per metier, etc. In the context of this case study, only the number of months of activity per metier is documented and used in the analysis of the results.

Results

The results presented concern only the example of Guadeloupe, but the same type of approach has been used in the case of Martinique. Processing the data for activity per metier and per boat makes it possible, on the one hand, to characterize the diversity of the gears used and the intensity of their use on the scale of the fleet and, on the other hand, the degree of polyvalence of the fishing units.

Gears used and polyvalence of the fishing units

Figure 4 presents the percentage of vessels using the different gears, distinguishing - on the right-hand side of the figure - those used at sea for catching large pelagic species and, on the left-hand side, those used on or at the limit of the island shelf for catching mainly reef fishes and crustaceans. The gears that are used the most are pots with 52% of the vessels concerned, then trolling lines (38%) and hook and line around FADs (33%). Gillnets and trammel nets are used by 25% and 15%, respectively, of the fishing units while the use of longlines and hook and line concerns 23% and 18% of the vessels. Ring nets used to catch small pelagic species and purse seines, targeting reef fish, concern a smaller number of vessels. The eco-tourism activities still remain marginal.

Figure 4. Distribution of the vessels per type of gear used (Guadeloupe)

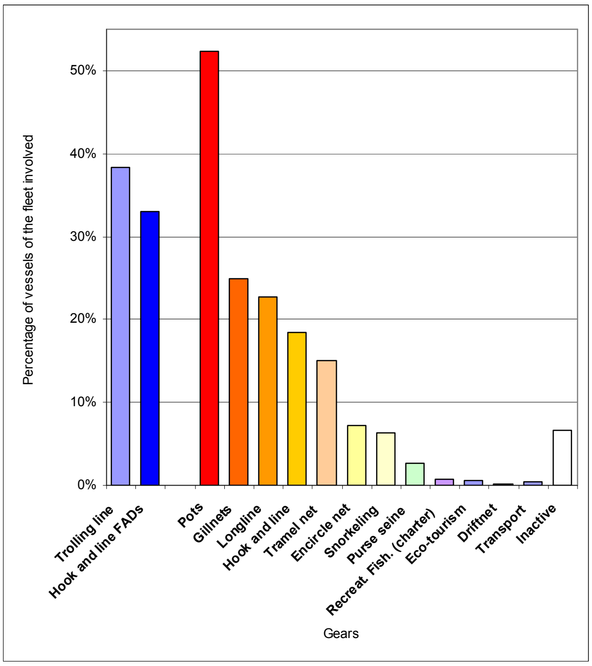
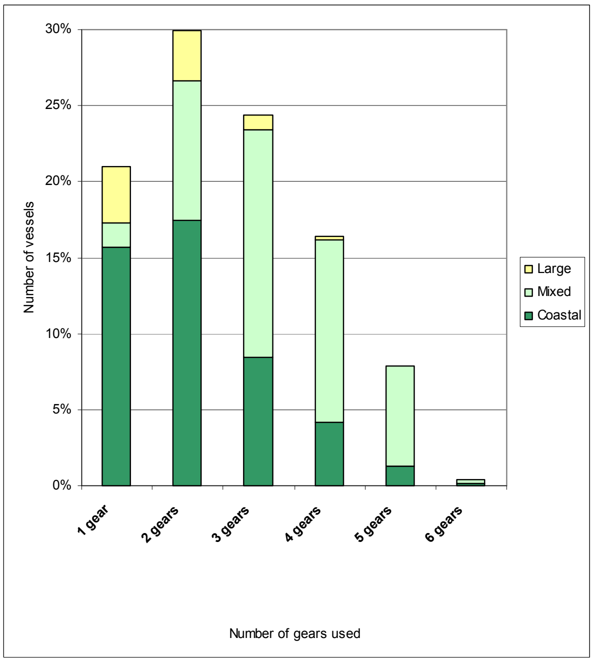


Figure 5. Degree of polyvalence of the vessel and gradient of operation



Note: The annual range of operation of each vessel is calculated regarding the cumulative monthly fishing activity in the different statistical rectangles. By definition, "coastal" vessels spend more than 75% of their activity inside the 12 nautical miles, "mixed" vessels spend between 25 and 75% of their activity inside the MS 12 nautical miles and "Large-offshore" vessels spend more than 75% of their activity outside the MS 12 nautical limits.

Source: Ifremer-sih

Whether expressed in terms of number of vessels or in months of activity, these results show the diversity of the metiers used and the polyvalence of the vessels in terms of gears used. The average number of gears used reaches 2.6 on the scale of the Guadeloupe fleet but there is heterogeneity in use. Figure 5 enables the degree of polyvalence of the units to be given by characterizing the number of vessels according to the number of gears used. Around 20% of the vessels use only one gear while the mode, situated at 2 gears, concerns 30% of the fishing units. The percentage of vessels using 3 gears is 24% of the active fleet. This rate then decreases to 16% and 8% for 4 and 5 gears, respectively, and it is almost null for 6 gears. The least polyvalent vessels are those that either perform their activity exclusively in the coastal zone (within 12 nautical miles), or go out to sea mainly to catch large pelagic species. The more mixed an activity the units have, coupling sea zones with coastal zones, the higher the polyvalence. These results show the range of possibilities of choice of gear and the fact that, according to their strategies, fishermen can combine different gears in their activity, to various degrees.

Fleet segmentation

Eleven gears were implemented by the Guadeloupe fleet during the year 2006, making up the eleven active variables of the analysis in the main components carried out using the software SPAD ®. The first step in the analysis means looking for the factorial axes that best resume the eleven variables involved. The first two axes explain 40% of the total inertia; this figure reaches 75% for the first five axes. As the following figure shows, factorial axis 1 thus clearly opposes the two main practices of the fleet, that is, hook and line around FADs (DCL), and pots (FPO). For some vessels, the former are associated with trolling lines (LT_) whereas the latter are sometimes associated with fixed gillnets (GNS). Factorial axis 2 thus opposes these two main practices (FPO-DCL) and other important practices of the vessels in the fleet, that is, hooks and lines (LHP) and fixed gillnets (GNS).

Figure 6. Representation of the factorial axes 1 and 2

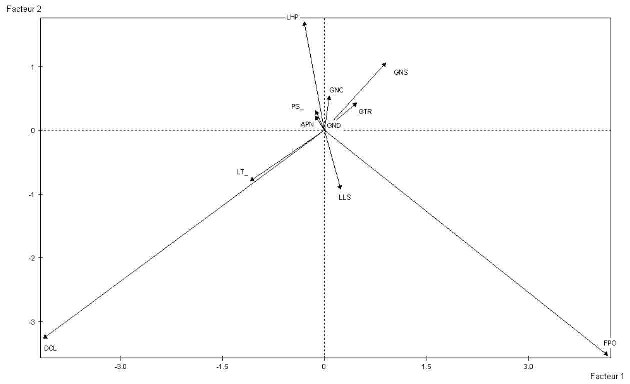


Figure 7. Representation of the factorial axes 3 and 4

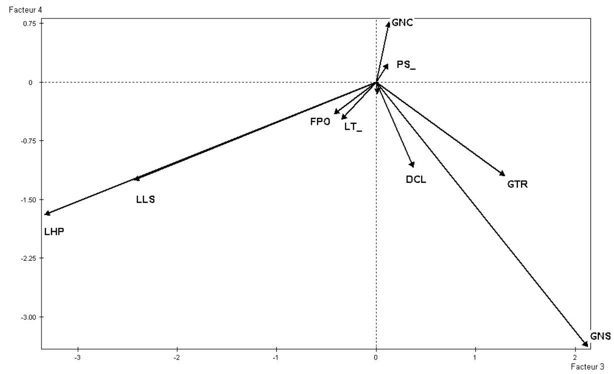


Figure 8. Projection of individuals, by class, on the factorial axes 1 and 2

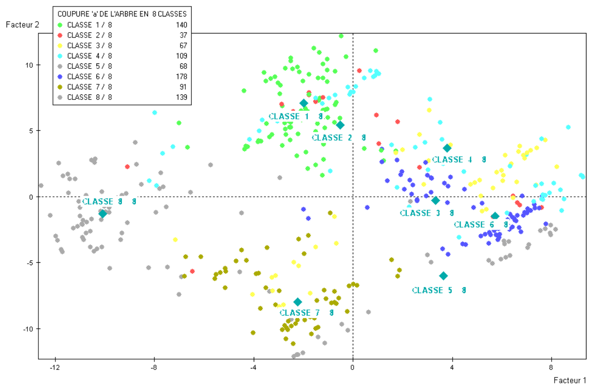
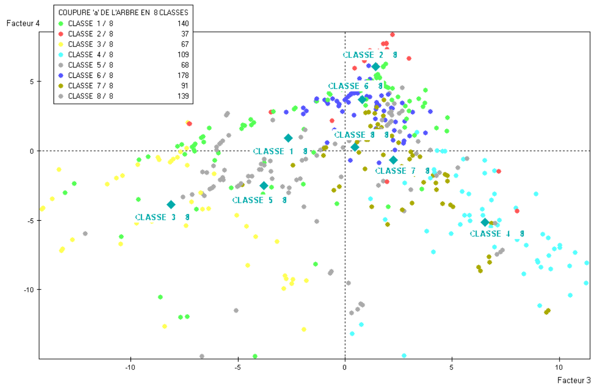


Figure 9. Projection of individuals, by class, on the factorial axes 3 and 4



Source: Ifremer-SIH

The other practices have less influence on the analysis, at least for the first two axes of the analysis. A succinct analysis of the following axes, however, shows that the fourth axis (12% of the total explained inertia) opposes the less common practices of purse seines (PS) and ring nets (GNC) with more common practices of gillnets (GNS-GTR) and hooks and lines (LHP).

This first step in the analysis shows the existence of attraction or of opposition between variables as well as the main features contained in the data. Individuals can thus be represented on the same factorial axis as variables, their position on the graph indicating the existence of homogeneous sub-groups in terms of dominant fishing strategy. However, the cloud shows several gradients of points and the distribution cannot be done on sight. Recourse to different ascending CAH by using the different statistical indicators (explained inertia, test value) enable the best distribution into classes to be defined. A first distribution into 8 classes explains almost 55 % of the total inertia of the cloud observed[2].

Figures 8 and 9 synthesize graphically this distribution on the factorial 1×2 and 3×4 planes. This figure is to be compared to the previous figure that represented the position of the active variables of the within this factorial plane. Class 8, which groups vessels specializing in the practice of trolling line and hook and lines around FADs is perfectly represented on the first factorial axis. The individuals in this class all show highly negative coordinates. Combining the technique of pots, hook and lines around on FADS, the vessels in class 7 are also well represented on the factorial plane. Classes 1 and 2 are the closest to the origin of the plane and therefore the least well represented on this plane. Class 2 concerns uncommon practices but is well characterized in the analysis, in particular for ring nets (GNC – test associated test value of 24.3) but also purse seines (PS_) or more marginally driftnets (GND). It therefore has a specific identity and can, in particular, be compared with the fourth factorial axis. As is often the case in this kind of analyse,

[2] A consolidation phase for the distribution was observed here. This involved reiterating the attribution of all the individuals to the closest class, several times (distance of the individual from the different barycentres), even if, as a result, the individual changed the class to which it was attributed. This consolidation phase explains the final extra 3% of inertia.

one class (1/8) presents a set of more heterogeneous activities for which we do not have a very significant positive test value. The same methodology as that described above is then implemented in order to break down the individuals of this class into different classes. In the end, five extra classes were kept: four with a specific identity that had not been able to express itself in the first analysis, and a fifth one, that groups a set of fairly inactive vessels.

The following table synthesizes all the analyses that were undertaken and the groups of individuals that could thus be constituted.A set of dominant strategies appear, some groups or fleets involving a specialization in one and only one practice, like pots (#6/8), apneists (#2/5) or purse seines (#4/5), whereas others (#7/8) combine several distinct practices: pots on the one hand and, on the other hand, hook and line around FADs. For this fleet these gears are combined 11 months each during the year on average, whereas the fleet of gillnetters use the gillnets for 11 months of the year on average, and the trammel nets only 4.4 months of the year on average.

Table 1. Segmentation of the fleet in fleets (Guadeloupe) and main gears combined

Class Number #	**Name of the group**	**Number of vessels**	**Average number of months per main gear used**
2/8	**Ring-purse seiners**	37	**GNC (11.8)** – PS (2.4) – GND (0.2)
3/8	**Potters – hook and liners**	67	**LHP (11.8) – FPO (11.4)** – LLS (3.8)
4/8	**Gillnetters**	109	**GNS (10.9) – GTR (4.4)**
5/8	**Poters – longliners**	68	**LLS (11.8) – FPO (11.6)**
6/8	**Potters**	178	**FPO (11.1)**
7/8	**Potters – hook and line FADs**	91	**DCL (11.6) – FPO (10.9)**
8/8	**Trollers – hook and line FADs**	139	**DCL (11.6) – LT (4.4)**
1/8, 1/5	**Hook and liners-gillnetters**	36	**LHP (11.6) –** GNS (2.9)
1/8, 2/5	**Apneists**	13	**APN (11.7)**
1/8, 3/5	**Métiers de l'hameçon fixe**	25	**LLS (11.3) – LHP (8.9)**
1/8, 4/5	**Purse-seiners**	9	**PS (11)**
1/8, 5/5	**Low active vessels**	57	
	Non active vessels	130	

Source: Ifremer-SIH

For each boat, crossing the fleet it belongs to with the metiers used enables the fleet-metier matrix to be built, as presented above, and a certain number of aggregated indicators associated with this matrix to be produced. At this stage, only the months of activity can be filled in.

Discussion

We can then use this matrix to illustrate the way this tool can be used and answer different questions. As an example, managers are interested in the development of large pelagic fishing on FADs during the last few years and in the dependency of the Guadeloupe fleet on this activity as well as the development of complementary metiers on the island shelf. The selection of the metier concerned first makes it possible to characterize the spatial distribution of this activity and the allocation of the fishing effort, mainly in the 12-24 nautical mile zone and, to a lesser extent, beyond (figure 10). The approach enables 319 fishing units to be identified, totaling an activity expressed in terms of month-metiers, assessed at 3400 months, that is, around 15% of the month-metiers carried out by the Guadeloupe fleet. Use of this metier is distributed as follows in the different fleets. 139 vessels, that is, 100% of the vessels in fleet #8 (Metiers of hook and line FAD-Troll) do this activity practically the whole year and account for 50% of the months of activity dependent on this metier, the complementary metier being seasonal troll fishing (December-May). All of the ships in fleet #7 (91 vessels) also target large pelagic fish under FADs but the complementary activity of these vessels is pots for various reef fish.

Figure 10. Allocation of the FAD activity in months within the French Fishing areas (Guadeloupe and Martinique)

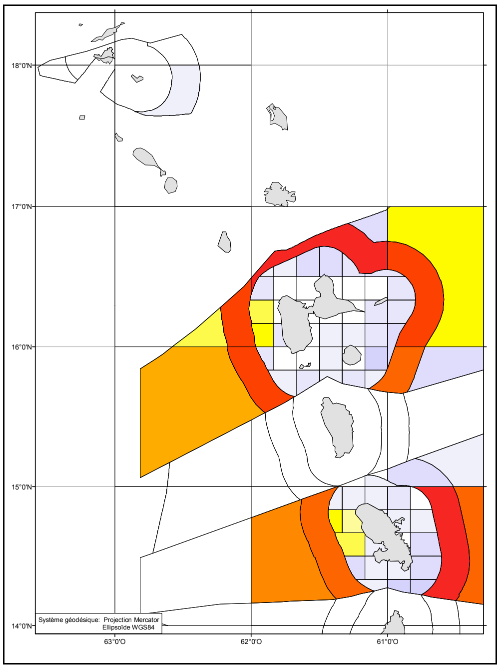
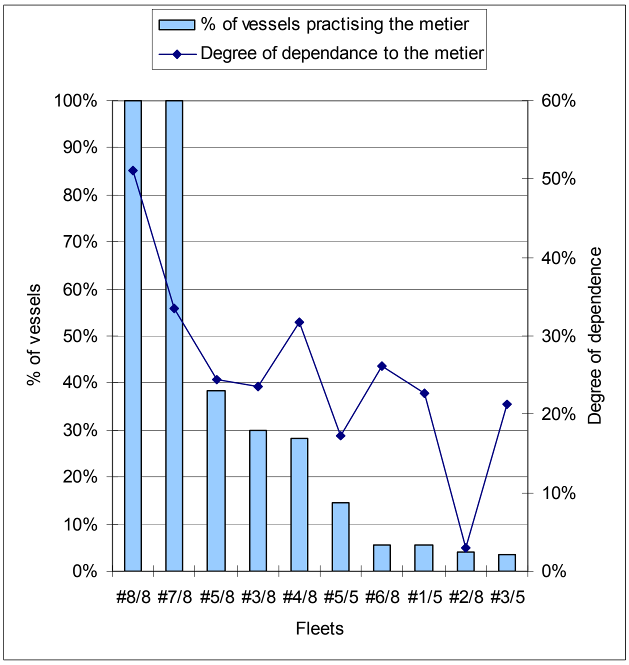


Figure 11. FAD metier within the different fleets (Guadeloupe)



Source: Ifremer-SIH

The dependency on the FADs metier is lower (33%) but practicing this metier is carried out continuously throughout the year. Other fleets are less concerned by metiers, fleet #4 having only 15% of its number practicing this metier and, on average, 6 months of the year. Only one part of the fleet is therefore dependent on this metier and is concentrated in a few fleets, a significant number of vessels having complementary fishing activities.

The fleet entry makes it possible to finely study the activity expressed in terms of metiers of a group of vessels having similar gear combinations and coming from a given country, region or port. As an example, the figure 12 presents the different metiers practiced by the potters-longliners fleet as well as the number of months-metiers carried out.

Figure 12. Number of months per metiers for the potters-longliners fleet

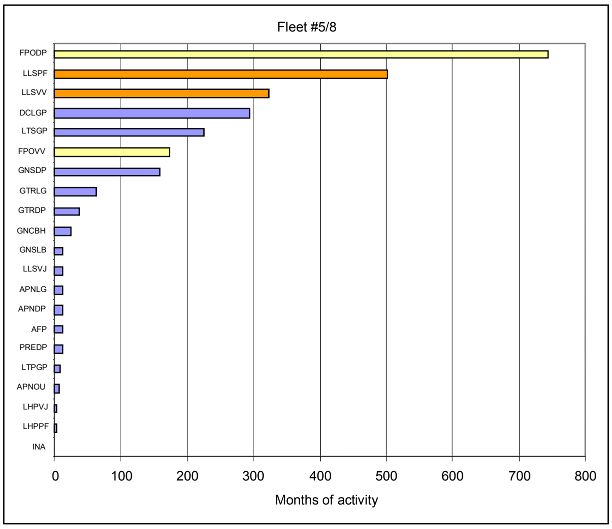
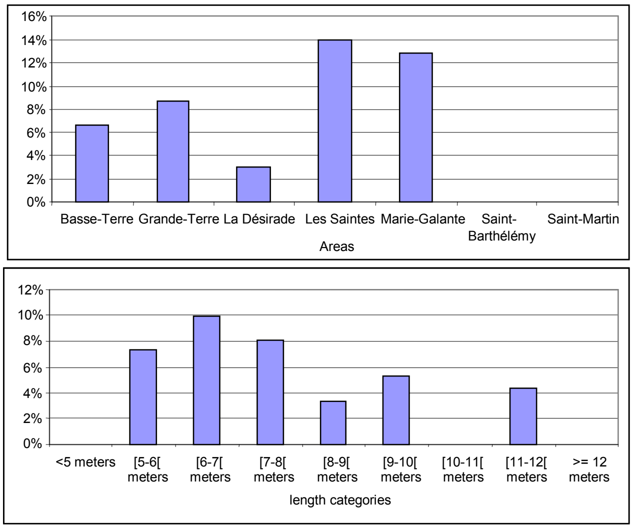


Figure 13. Percentage of the whole fleet per area and size



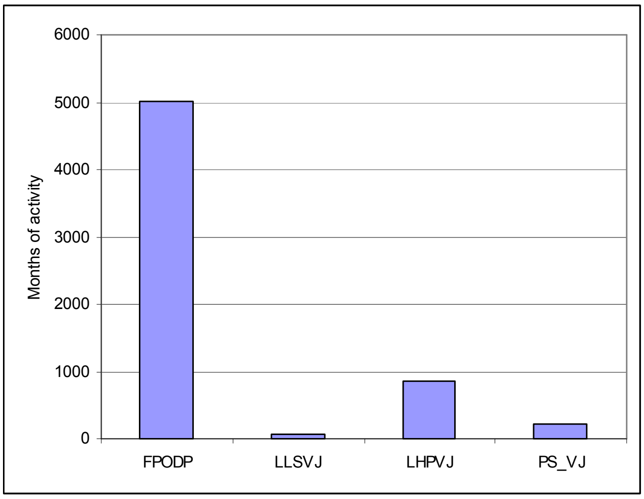
Source: Ifremer-SIH

The metiers using pots are mainly distributed over various fish (FPODP) and; to a lesser extent, for snappers (FPOVV) with 28% and 7% of all the months of activity of this fleet, respectively. The bottom longline metiers target both deep-sea fish, in particular groupers (LLSPF) and snappers (LLSVV) with 19% and 12% of the months of activity. Using pots and longlines account for 66% of the total activity of the fleet, the other main metiers being FADs and trolling for large pelagic fish (20%), nets for fish and lobster (10%), the remaining metiers being marginal.

With around 7% of the active vessels in the fleet, the average crew of this fleet is 1.8 men par boat, compared to 2.1 on the scale of the whole Guadeloupe fleet. This can partly be explained by the fact that these vessels are on average smaller in size. The distribution into classes by length of this fleet is presented below. It shows that the classes 5 to 8 meters long are over-represented by the Guadeloupe fleet, whereas vessels over 10 meters long are under-represented. From the vessels' ports of exploitation, it is also possible to better localize the vessels of this fleet, which are over-represented in the islands of the Saintes and Marie-Galante, and under-represented in the islands in the north and Désirade. Representation in Guadeloupe (Grande-Terre and Basse-Terre) is in the average.

As mentioned above, the fleet-metier approach also makes it possible to better identify the interactions between activities on the spatial level or on the level of the resources exploited. The example used in this paper is that of Yellowtail snapper (*Ociyurus Chrysurus*) fishing, which is targeted by some gears and the subject of bycatches by other gears. As shown in figure 14, the species is targeted both by hook and line (LHPVJ) for around 900 months, and to a more limited degree by bottom longlines LLSVJ (70 months) and by purse seines (225 months).

Figure 14. Months of activity per metiers for yellowtail snapper as a target species or a bycatch



Source: Ifremer-SIH

This species is a bycatches catch of pot fishing, which totals almost 5000 months' activity. At this stage in the study, it is difficult to estimate the mortality by fishing associated with the different metiers, but monitoring the landings shows that juveniles are caught by the pot and purse seine techniques, whereas larger individuals are caught by hook and line and longlines. There is therefore an interaction via the stock between these activities, the latter probably suffering from the impact of the mis-exploitation of the stock by the pot and purse seine techniques. Additional work should detail, on the one hand, the knowledge necessary to assess these interactions, and on the other hand the possibilities of developing a management system based both on measures to preserve the resource but also on systems to regulate access.

With this perspective in view, it should be highlighted, in conclusion, that the fleet-metier matrix is thanks to its exhaustivity, an interesting bases for establishing biological data (discards-catches) sampling strategies and socio-economic strategies. It thus offers possibilities in terms of developing a data collection programme whose results can be integrated into a set of data, for disciplinary or multi-disciplinary uses (Guyader *et al.* 2007).

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