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### Working Papers Series

N° D-02-2005

< Commercial fishing, recreational fishing and tourism : investigating the potential for developing a pluri-activity. The case of the Iroise Sea, Western Brittany, France >

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ISSN 1951-641X

AMURE Publications. Working Papers Series.

Online publications : [www.gdr-amure.fr](http://www.gdr-amure.fr)



# **Commercial fishing, recreational fishing and tourism : investigating the potential for developing a pluri-activity**

## **The case of the Iroise Sea, Western Brittany, France<sup>1</sup>**

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<sup>1</sup> This paper was presented at the XIth annual EAFE Conference, Dublin, 7-10 April 1999.

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# **Commercial fishing, recreational fishing and tourism : investigating the potential for developing a pluri-activity**

## **The case of the Iroise Sea, Western Brittany, France<sup>2</sup>**

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### **Abstract**

This paper investigates the possibility of lowering anthropic pressure on fish stocks by developing a pluri-activity in the inshore fishing industry, combining commercial fishing with boat-chartering for recreational fishing or / and tourism. The area under investigation is the Iroise Sea, Western Brittany, France. Several favourable conditions are met in this area, among which the planned creation of a national marine park in the management of which local fishermen are to be involved. On the basis of a sample survey, the paper first analyses the potential demand for guided boat-tours on commercial fishing boats, devoted to recreational fishing and / or discovering the area. It then deals with the economic incentives for fishermen to develop such a part-type activity.

### **Keywords**

Reduction of fishing effort, pluri-activity, boat-chartering, recreational fishing, ecotourism, Iroise Sea.

### **Introduction**

Even if they are favourable in the long run, standard methods designed to curb overcapacity in the fishing industry have immediate consequences which are either harmful to fishermen or costly to tax-payers. The example of agriculture suggests that, in some cases, an alternative solution could consist in developing a pluri-activity in the fishing industry, combining commercial fishing and boat-chartering for recreational fishing or / and tourism.

In some countries, this type of diversification is already a significant source of income for inshore fishermen (Kusakawa, 1992). In France it is not yet. The relation between commercial and recreational fishing is dominated by competition for the access to scarce fish stocks and, up to now, the well-known attractive effect of fishing harbours on tourists has mainly been considered by professional fishermen as an opportunity to develop the market for their traditional activity.

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<sup>2</sup> This paper was presented at the XIth annual EAFE Conference, Dublin, 7-10 April 1999.

The Iroise Sea (Western Brittany, France) is a good case for investigating the opportunities to develop a pluri-activity in the fishing industry, combining commercial fishing and boat-chartering. After presenting the reasons why it is so, the paper analyses the potential demand for boat-chartering by commercial fishermen on the basis of a sample survey which was conducted in the area, during the summer of 1998. Then it deals with the economic incentives for fishermen to develop such a part-type activity.

## **1. The case for developing a pluri-activity combining commercial fishing and boat-chartering in the Iroise Sea**

This first section is devoted to a brief presentation of the area under survey, and to the project of creating a marine national park in this area.

### **1.1 The Iroise Sea**

Bordering the west-end of Brittany (France), the Iroise is a coastal sea stretching from north to south between the islands of Ouessant and Sein on a distance of 60 km, and from east to west between mainland and the isobath of -100 metres, i.e. on a distance of approximately 35 to 40 km. The Iroise Sea is scattered with an important number of small islands, the three main of which are inhabited (Ouessant, Molène, Sein).

Due to the richness and variety of its ecosystems, in 1989 the Iroise Sea was registered by the UNESCO as a « natural reserve of biosphere » (MAB program). This biological richness is an attractive element for human activities.

Commercial fishing, seaweed harvesting and maerl extracting are traditional activities in the area. Nowadays, some 500 professional fishermen frequent the Iroise sea, most of them operating on boats under 16 metres with nets, pots and lines, and targeting such species as anglerfish, edible crab, pollack and bass. Scallop-dredging is also practised from October to May and, in the summer season, some 50 boats harvest seaweed (mainly *Laminaria digitata*) around the Molène archipelago, which is the principal area for this activity in France.

The quality of ecosystems in the Iroise Sea is also an attractive element for recreational activities. The little harbours bordering the area shelter some 2500 recreational boats (this figure does not include the recreational boats of the bay of Brest, which are approximately 3500) and, according to a recent IFREMER survey, 40% of these boats are used for sport fishing<sup>3</sup>. The Iroise Sea is frequented by approximately 5000 apnea divers practising underwater fishing, and by the members of 18 scuba-diving clubs. Each year, more than 100 000 tourists visit the islands of Ouessant, Molène and Sein.

In turn, the development of these various activities may become a threat for the equilibrium of ecosystems. For instance, attempts to develop the harvesting of *Laminaria Hyperborea* in complement of the exploitation of *Laminaria digitata* raise the issue of the protection of fish habitat. On the other side, the use of poorly selective gears by some recreative fishermen is a cause of environmental damage, and the development of tourism generates increasing pollution.

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<sup>3</sup> Data communicated by G. Véron (IFREMER, Brest).

## 1.2 The project of a marine national park

The concern for protecting natural environment has led to the proposal of creating a marine national park in the Iroise Sea (PNRA, 1993). If, according to law, environmental preoccupations are the *raison d'être* of national parks<sup>4</sup>, commercial considerations are also present because of the tourist frequenting which parks are liable to stimulate (and which may be a cause of contradictions in the process of park management). In the case of the Iroise Sea, the potential development of « ecotourism » is often regarded as high for several reasons, including the presence of marine mammals in the area and the importance of tourist frequenting in western Brittany : according to a recent survey, some 2.4 million tourists from outside Brittany have visited the department of Finistère (western Brittany) between April and September, generating locally a flow of expenditure estimated at 3.6 billion FF (ORTB, 1998)<sup>5</sup>.

Up to now, professional fishermen have displayed a rather favourable attitude towards the project. The local organisations of professional fishermen (*Comités locaux des pêches maritimes*) have started thinking of new management mechanisms for inshore fisheries of the area, and consider the project of a national marine park as an opportunity to implement these mechanisms with the help of the government (being suspicious of some environmental orientations such as a tendency to « overprotect » the seals, they also prefer to be insiders than opponents, as regards a project liable to receive important opinion support).

The reasons for the growing concern of local fishermen for management mechanisms are institutional (including the prospect of the CFP reform in 2002), but also economic : if the fisheries of the Iroise Sea and around behaved rather well during the crisis that shook the French fishing industry in the first half of the 90' (Boncoeur, 1997), increasing signs of overfishing have brought the executives of local organisations of fishermen to the conclusion that limiting the fishing effort in the area had become a priority. Some of them have put forward the idea that taking advantage of the tourist frequenting of the future marine park might help fulfilling that goal, by giving professional fishermen the opportunity to develop a pluri-activity, combining commercial fishing and boat-chartering. Testing the relevance of this idea was the starting point of the research presented in this paper.

## 2. Investigating the potential demand for recreational boat-trips on commercial fishing boats

In order to study the potential demand for recreational boat-trips on commercial fishing boats in the Iroise sea, a sample survey was undertaken in July 1998 in the Brest area. This section is devoted to the presentation of the survey and its main results.

### 2.1 The survey

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<sup>4</sup> *Loi du 22 juillet 1960, article L241-1* in the French case.

<sup>5</sup> For the sake of comparison, the total value of commercial fish landings in the harbours of Finistère (the first department in France as regards the fishing industry) was 1.469 billion francs in 1997 (DDAM, 1998), not including the value of tropical tuna caught by boats belonging to Finistère ship-owners (0.761 billion francs in 1997). While 3235 professional fishermen were in activity on 31.12.97 in the department of Finistère (ibid.), in this department, according to a survey by INSEE, tourism generates some 6700 wage jobs on an annual basis, a figure raising to 16400 during the months of July and August (INSEE, 1998).

Three places were selected so as to meet people interested in the sea for various recreational purposes :

- a car park near a marina and an aquarium-maritime museum in Brest (*Océanopolis*)
- the piers of a small fishing harbour attracting many tourists in the summertime (Le Conquet)
- a boat carrying passengers between the mainland and Ouessant, the largest island of the Iroise Sea (over 90% of these passengers are tourists in the months of July and August)

The questionnaire that was built up aimed at :

- describing the age, sex and social characteristics of people frequenting these places, and the type of their personal relation to the sea (recreational fishing, water sports, holidays, « family link »...)
- testing their potential interest in half-day or one-day recreational boat-tours, and more specifically guided tours on commercial fishing boats

The questionnaires were filled up by direct interviewing of the persons met in the three selected places<sup>6</sup>. A total of 159 questionnaires were filled, representing approximately 70% of the total number of persons who were asked to answer the questionnaire. The main reasons given for refusing to answer were lack of time and lack of interest for the subject.

Two types of tours on commercial fishing boats were investigated :

- half-day or one-days trips for recreational fishing with a guide
- half-day trips for discovering the area with a guide, without fishing

The potential interest for these types of tours was investigated as follows :

- Different performances were described (without their price), and for each a general question concerning a possible interest was asked.
- In case of a positive answer, a list of prices was presented and the interviewed person was asked to indicate what is, to her or his mind, the approximate usual price level.
- At the following step, the actual approximate price was announced<sup>7</sup>, and then the interviewed person was asked if she or he would accept to pay the price.
- In case of a positive answer, some complementary questions were asked, among which the number of persons of the family (if any) who were liable to attend the tour with the interviewed person.

As no major differences were detected, for most of the answers, between the various places where the interviews were realised, the results will be presented for the whole sample taken as a lump.

## **2.2 Main characteristics of the sample**

The following table summarises, as percentages of the total number of answers ( $n = 159$ ), the main characteristics of the sample :

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<sup>6</sup> The interviews were realised by Frédérique Alban, with the help of Bertrand Le Gallic, Lionel Prigent and Nicolas Roncin. Only persons over 15 years old were interviewed.

<sup>7</sup> This price was calculated as an average of the 26 answers given by previously interviewed fishing guides and charter boat operators.



Table 1. Sample description

		Whole sample = 100%
<b>Sex</b>	Female	45%
	Male	55%
<b>Age</b>	under 20	9%
	20 to 30	36%
	31 to 55	39%
	over 55	16%
<b>Living place</b>	Brest district	41%
	Other places	59%
<b>Household size</b>	1 person	14%
	2 persons	21%
	3 persons	14%
	4 persons	29%
	over 4 persons	22%
<b>Profession</b>	Farmers	1%
	Entrepreneurs	4%
	Blue collars and employees	34%
	Senior and non-wage white collars	36%
	No professional activity	25%
<b>Type of relation to the sea*</b>	Recreational fishing	47%
	Water sports	32%
	Visiting maritime museums, fishing harbours...	74%
	Walking on the shore	86%
	Family origin (fishermen, sailors...)	42%
	Holidays on the seaside	89%
	Other	7%

\* Possibility of simultaneous answers.

The percentage of people in the sample living in or around the city of Brest (41%) may at first look important if one compares it to the proportion of tourists among the visitors of the Brest maritime museum and aquarium *Oceanopolis* in July-August (an average of 94%<sup>8</sup>), or among the passengers of the boat-line *Pen-ar-Bed* between mainland and Ouessant during the same season (an average of 91%<sup>9</sup>). This apparent gap may be explained by the following elements :

- Only part of the people interviewed on the parking lot near *Oceanopolis* were visitors of the aquarium-museum. The other part is composed of visitors of the neighbouring marina, a group of persons including a high proportion of Brest dwellers (the majority of the boats in the marina belong to people who live in or around the city).
- Many people living in or around the city of Brest spend their summer vacation (or part of it) in the coastal area of Western Brittany, not far from Brest. Consequently, a significant proportion of people recorded as « tourists » on the boats between mainland and the Iroise Sea islands come from the area of Brest.

<sup>8</sup> Visitors living outside the *Communauté Urbaine de Brest*. Source : *Oceanopolis*.

<sup>9</sup> Total number of passengers, less passengers living or working on the island. Source : *Pen-Ar-Bed*.

Differences according to the geographic origin were found to be statistically significant for the following characteristics :

Table 2. Sample description : characteristics with statistically significant differences\* between people living in and out of the Brest district (percentages of each subset)

	Brest district ( $n_1 = 65$ )	Other living places ( $n_2 = 94$ )
<b>Profession</b>		
Senior and non-wage white collars	23%	45%
No professional activity	32%	19%
<b>Type of relation to the sea**</b>		
Recreational fishing	69%	31%
Family origin (fishermen, sailors...)	54%	34%
Holidays on the seaside	82%	94%

\* Probability over 95% that the two main populations are different as regards the considered characteristics ( $t > 1,96$ , with  $t = d / \sigma_d$ ,  $d$  the distance between the two percentages and  $\sigma_d$  the standard-deviation of this distance in the case of one main population). \*\* Possibility of simultaneous answers.

### 2.3 Interest and willingness to pay for guided tours on commercial fishing boats

The following table sums up the results of the survey concerning the interest exhibited by people in the sample for guided boat tours, and more specifically tours on commercial fishing boats for recreational fishing and / or visiting the area :

Table 3. Sample survey : interest in a boat tour with a guide for visiting the area and / or recreational fishing (percentages of the whole sample)

<b>1. Any type of boat</b>	
Persons declaring they are interested in a one-day or a half-day boat tour with a guide	75%
<b>2. Commercial fishing boats only</b>	
Persons declaring they are interested in :	
– a one-day or half-day guided recreational fishing tour	22%
– a half-day guided discovery tour	30%
– at least one of the two above mentioned performances	41%
Persons declaring they would accept to pay the announced price* for :	
– a one-day or half-day recreational guided fishing tour	19%
– a half-day guided discovery tour	28%
– at least one of the two above mentioned performances	38%

\* FF220 for a half-day recreational fishing trip, FF350 for a one-day recreational fishing trip, FF80 for a two-hour discovery trip.

The table displays a high percentage of people declaring a general interest for boat tours with a guide (75%). The percentage is still high enough if only tours on commercial fishing boats are considered (41% of the whole sample). Among the subset of people declaring they are interested in tours on

commercial fishing boats, more people are interested in visiting the area (73% of the subset) than in fishing (54%), but these two types of performances do not necessarily exclude each other (27% of the subset are interested by both).

A total of 38% of the persons in the whole sample declared they would accept to pay the announced price for a one-day or half-day guided tour with on a commercial fishing boat. This ratio is only slightly below the percentage of people simply declaring they are interested (41%), a phenomenon which may be explained by two different types of considerations :

- the knowledge of actual prices is rather good among the persons of the sample, as show the answers concerning the lists of prices that were presented to the interviewed persons (in particular, few people heavily underestimated the actual prices)
- the acceptance of payment is only virtual, since no actual transaction was, of course, proposed during the survey. Quite possibly, actual payments would be lower. This so-called « hypothetical bias » is inherent in all surveys about the willingness to pay for a hypothetical good or service and, more generally, in surveys where people are asked to imagine what they would do if they were in a different situation from the actual one. All that can be done is to minimise this bias, by avoiding to ask questions on subjects people are really unfamiliar with. This condition may be considered as reasonably fulfilled in the present case, due to the characteristics of the people in the sample (see table 1 above) and to the explanations given in the course of the interview concerning the performances under investigation.

The people declaring they would accept to pay the announced price for a guided tour on a commercial boat for recreational fishing or / and visiting the area were asked some additional questions concerning their attitude towards this type of performance. This attitude varies according to the performance considered. In particular, the number of persons per household liable to be involved is not the same for recreational fishing tours and discovery tours : 71% of the persons declaring they would accept to pay the price for a 2-hour guided tour devoted to the visit of the area said that they would come « with their family » (average household size of the sample : 3.4 persons), while the corresponding percentage is only 35% for the people declaring they would accept to pay the price for a one-day or half-day recreational fishing trip.

The table below compares the subset of the sample made up with people declaring they would accept to pay the announced price for a guided tour on a commercial fishing boat with the rest of the sample :

Table 4. Sample survey : comparing the subset of people declaring they would accept to pay the announced price for a tour on a commercial fishing boat with the rest of the sample (percentages of each subset)

	Subset 1 (accepting the price)* ( $n_1 = 61$ )	Subset 2 (other)** ( $n_2 = 98$ )	
<b>Sex</b>			
Female	39%	49%	
Male	61%	51%	
<b>Age</b>			
under 20	7%	10%	
20 to 30	39%	34%	
31 to 55	46%	35%	
over 55	8%	21%	s
<b>Living place</b>			
Brest district	31%	47%	s
Other places	69%	53%	s
<b>Household size</b>			
1 person	11%	16%	
2 persons	23%	19%	
3 persons	15%	13%	
4 persons	23%	33%	
over 4 persons	28%	18%	
<b>Profession</b>			
Farmers	2%	1%	
Entrepreneurs	7%	3%	
Blue collars and employees	28%	38%	
Senior and non-wage white collars	51%	27%	s
No professional activity	13%	32%	s
<b>Type of relation to the sea***</b>			
Recreational fishing	43%	49%	
Water sports	36%	30%	
Visiting maritime museums, fishing harbours...	75%	72%	
Walking on the shore	87%	85%	
Family origin (fishermen, sailors...)	33%	48%	
Holidays on the seaside	93%	86%	
Other	8%	6%	

\* People declaring they would accept to pay the announced price for a one-day or a half-day tour on a commercial fishing boat for discovering the area and / or recreational fishing. \*\* Rest of the sample. \*\*\* Possibility of simultaneous answers. s = statistically significant gap between subset 1 and subset 2 (Probability over 95% that the two sets are extracted from different main populations as regards the considered characteristics).

The above table does not display major differences between the two subsets as regard sex, household size and type of personal relation to the sea. It should be recalled here that the places selected for implementing the survey were such that the probability of interviewing « sea oriented » people was intended to be high.

Statistically significant differences between the two subsets concern the geographic origin, the age structure and the profession. In the subset of people declaring they would accept to pay the announced price, the proportion of people living in or around Brest is significantly lower than in the rest of the sample. So are the proportion of people over 55 years old and the proportion of persons without professional activity. On the contrary, the proportion of senior white collars is higher than in the rest of the sample. These differences are interconnected. An important proportion of the people in the sample who live in or around Brest have their own boat. They frequently use it for recreational fishing, and few of them are willing to pay for a guided tour on a commercial fishing boat. These

people are often retired, hence the important proportion of persons over 55 and without professional activity in the subset of people unwilling to pay the announced price for a guided tour on a commercial fishing boat. On the contrary, a high proportion of people declaring they would accept to pay the announced price do not live in the Brest area, where they spend their holidays. They are interested in fishing and / or « ecotourism », but usually do not own a boat. The over-representation of senior white collars in tourists visiting Western Brittany has been depicted by a recent survey<sup>10</sup>, and this phenomenon is emphasised in the present case.

Evaluating the potential demand for guided tours on commercial fishing boats in the Iroise Sea raises the question of the possibility of extrapolating the results of the survey.

Several reasons make this type of operation hazardous, the first one being due to the fact that, as often in this type of survey, it is difficult to quantify the main population of the sample. A precautionary approach might consist in taking as a basis the average number of people visiting the aquarium-museum of *Océanopolis* during the months of July and August<sup>11</sup>, which amounts approximately to 140 000 persons (a figure to be compared with the 2.4 million persons coming from outside Brittany and visiting Finistère between April and September, according to a recent survey<sup>12</sup>).

Extrapolating the survey results also makes it necessary to account for the persons who refused to answer the questionnaire (approximately 30% of the total number of persons with whom the interviewers got in touch). The reasons for this attitude are various and, by definition, uneasy to characterise precisely. However, it seems reasonable to consider that few persons who refused to participate were interested in the subject of the survey, and the above mentioned « precautionary approach » leads to integrate them in the set of people unwilling to pay for a guided tour on a commercial fishing boat. Therefore, the proportion of people declaring they would accept to pay the announced price is lowered from 38% of the whole sample to ( $38\% \times 70\% \approx 27\%$ ) after integrating the refusals to participate in the survey.

On this basis, one may estimate very roughly that about ( $140\ 000 \times 0,27 \approx 37\ 000$ ) summer visitors of *Océanopolis* are in the mood of declaring they would accept to pay the announced price for a guided tour on a commercial fishing boat<sup>13</sup>. For reasons mentioned above, this estimation is to be regarded as a minimum. Its interpretation in terms of potential demand is not straightforward, for several reasons :

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<sup>10</sup> During the period between April and September 1997, people belonging to this category represented 24% of the total of tourists coming from outside Brittany and visiting the *département* of Finistère (ORT de Bretagne, 1998), while they represent only 12% of the « active population » and 7% of the total population over 15 years old in France (INSEE, 1998).

<sup>11</sup> No major difference according to the place of the interview was detected in the results of the survey, and thus the whole sample may be regarded as reasonably representative of the population strolling in the summer on the parking-lot near *Océanopolis*. However, this population is not restricted to visitors of *Océanopolis* (see above), which results in a higher proportion of Brest inhabitants in the sample as compared with *Océanopolis* summer. For this reason, there would be a case for *ex post* correcting the structure of the sample. However, we refrain from doing so here, and this is consistent with our « precautionary approach », since *ex post* reducing the proportion of Brest inhabitants in the sample would mechanically induce a higher proportion of people accepting to pay the announced price. Therefore, we may be reasonably confident in the fact that using the gross results of the sample survey does not lead to overestimate the interest of *Océanopolis* summer visitors in guided tours on commercial fishing boats.

<sup>12</sup> ORT de Bretagne, 1998. Summer visitors of *Océanopolis* are characterised by an important rate of renewal each year, which means that the potential flow of demand could be sustained.

<sup>13</sup> Unlike the people in the survey sample, not all the visitors of *Océanopolis* in July and August are over 15 years old. But a majority of persons declaring they would accept to pay the announced price for a guided tour on a commercial fishing boat said they would like to attend the tour « with their family ».

- It is difficult to delineate precisely the area where the demand would apply : people who were interviewed have a clear connection with the Iroise (either because they live in the area or because they visit it), but it does not follow that their demand is limited to this particular area.
- It is difficult to estimate the time-frequency of the demand : the majority of persons declaring they would accept to pay the announced price also said that they would be interested in repeated performances, but this may be unrealistic due to the fact that many of them have not yet experienced that type of activity.
- And, last but not least, it is necessary to recall that the demand evaluated through the survey is purely virtual : there is no evidence that people would act in conformity with what they declared when answering the questionnaire.

For these reasons, the results of the survey, as regards willingness to pay for guided tours on commercial fishing boats in the Iroise Sea, should not be interpreted as indicating more than a substantial amount of (economically realistic) interest of the public in that type of performance. This interest should logically grow in the future with the creation of a marine national park in the Iroise Sea.

### **3. The question of economic incentives**

The likely existence of a significant demand for guided tours on commercial fishing boats in the Iroise Sea does not imply that it would meet a corresponding supply. Fishermen may be unwilling to diversify their activity, for various reasons among which economists are prone to privilege the lack of economic incentives.

Investigating the attitude of professional fishermen of the Iroise Sea towards developing a pluri-activity calls for a special survey relying on interviews of these fishermen. This survey has not yet been undertaken, and the analysis presented here mainly relies on indirect arguments. Clearly, it is a very imperfect substitute. In order to test the potential profitability of boat-chartering on commercial fishing boats, a simple simulation model was built up. This model relies on a scenario of diversification taken just as an illustration. After describing it, we will present and discuss the results of some simulations.

#### **3.1 A diversification scenario**

The scenario built up for testing the profitability of pluri-activity consisted in :

- Defining a type of performance to test
- Evaluating the direct costs incurred by a professional fisherman who would supply that type of performance
- Evaluating the opportunity cost of diversification
- Calculating, under several hypothesis concerning activity, the global balance for the fisherman

The first phase consisted in defining the performance to test. The following characteristics were selected for that purpose :

- half-day guided tour on a commercial fishing boat, for recreational inshore fishing
- fishing gear and bait provided

- during July-August, with an average of 50 trips during the season
- on a potter or netter, 10 to 12 metres in length, operated by the owner, with a maximum capacity of 9 passengers
- price : FF220 per customer (i.e. the price used as a basis for testing customers willingness to pay)

The annual revenue (in thousands of French francs) generated by boat chartering under these conditions may be written as a function of the average occupancy rate of the boat ( $x \in [0, 1]$ ) :

$$(1) \quad R = 50 \times 0,22 \times 9 \times x = 99.x$$

The costs specific to boat-chartering for recreational fishing were evaluated on the basis of information provided by 9 professional fishing guides of Brittany (Alban, 1998). The other costs were derived from the results of a sample survey of the French fleets operating the English Channel fisheries (Boncoeur and Le Gallic, 1998). For the purpose of the scenario, a set of 26 boats operating in the Western part of the English Channel, and presenting the characteristics assumed in the scenario, was selected among the 160 boats forming the sample of the survey.

The evaluation of the direct annual cost (*DC*) generated by chartering in the conditions assumed above is summed up in the following table<sup>14</sup> :

Table 5. Scenario analysis : estimation of direct annual cost of diversification (unit : 1000 French Franc)

Safety material (depreciation + maintenance)	5
Insurance (additional cost)	2
Fishing gear and other supplies	15
Advertising	10
Fuel and lubricant	5
Total	37

Diversification generates not only direct costs, but also an opportunity cost. This cost is due to the fact that when fishermen are busy with chartering, they do not get money from commercial fishing (the scenario assumes that both activities cannot be exerted in the same period, and that catches due to sport fishing are not sold). The opportunity cost of diversification is therefore equal to the gross margin usually realised by commercial fishing during the period dedicated to chartering according to the scenario. The table below presents the annual average gross margin of the set of 26 commercial fishing boats used as a reference for cost calculation in the scenario :

Table 6. Scenario analysis : annual gross margin of commercial fishing boats used as a reference (Year : 1997. Unit : 1000 French Francs)

	Mean	Standard deviation
Net sales	1352	652
Variable costs*		
– Fuel and lubricant	65	33
– Bait	62	72
– Fishing gear (maintenance and replacement)	131	97
– Miscellaneous	5	14
Total	263	110

<sup>14</sup> All other costs (boat maintenance for instance) were supposed to be independent of the diversification decision.

The survey used as a basis for calculating the costs and earnings presented in the table above does not give any information about the intra-annual distribution of activity. Consequently, the average opportunity cost of diversification may be written as :

$$(2) \quad OC = 1089.y$$

where  $y$  is the assumed share of the annual gross margin usually realised during the months of July and August ( $y \in [0, 1]$ ). The average balance for a fisherman who would decide to diversify his activity according to the above described scenario may thus be written as :

$$(3) \quad \Pi = R - DC - OC = 99.x - 37 - 1089.y$$

### 3.2 Results and discussion

The above expression presents the profitability of diversification as a direct function of the average occupancy rate ( $x$ ) and a decreasing function of the share of annual gross margin realised in commercial fishing during July and August ( $y$ ). This expression may be used for different types of simulation.

According to the hypothesis of the scenario, direct costs  $DC$  generated by diversification are balanced by the corresponding revenue  $R$  as soon as ( $x > 37 / 99$ ), i.e. for a minimum occupancy rate of 37%.

But a positive gross margin is not a sufficient incentive to diversification. Diversification will be regarded as profitable by fishermen only if its gross margin overrates its opportunity cost, a condition which, under the hypothesis of the scenario, seems uneasy to fulfil. Taking an optimistic occupancy rate of 100% over the whole season, overall profit will be positive only if :

$$y < (99 - 37) / 1089$$

i.e. if fishermen usually realise during July and August less than 6% of their annual gross margin (generated by commercial fishing).

Therefore, the scenario suggests that diversification may be profitable only if commercial fishing is low during the summer season. At first this seems to contradict the objective assigned to diversification, which is to reduce the anthropic pressure on fish stocks. But this negative conclusion could be balanced by several elements :

1. The calculation of the annual gross margin in commercial fishing (table 6) does not account for labour costs. However, the average crew (skipper included), which is around 3 persons on the fishing boats taken as a basis for the scenario, could be reduced to 1 person when the boat is used for chartering, according to interviewed fishing guides. This would improve the profitability of diversification for the skipper-owner, by lowering its opportunity cost (on the other side, it might be regarded as negative because of its possible harmful consequences on employment).
2. The opportunity cost of diversification in equation (2) is purely private, i.e. it does not account for externalities due to the fact that several fishermen exploit a common stock.. If part of the boats operating the fishery are provisionally decommissioned, this creates for other fishermen a positive



externality which makes the social opportunity cost of decommissioning lower than its private cost. Therefore, if commercial fishing is important during the summer season, accounting for the positive externality due to part of the fleet reducing its fishing effort could significantly improve the overall economic balance of diversification. A system internalising this positive externality could be introduced, in order to translate it into private profit for fishermen practising pluri-activity.

3. If fishing activity is low during the summer season, the net private incomes generated by chartering could be used as an argument inducing fishermen to decrease their fishing effort during the rest of the year.

## Conclusion

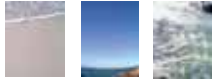
In this paper, pluri-activity combining commercial fishing and boat chartering was considered as a possible answer to overfishing. The relevance of this answer is conditioned by several factors, including demand for chartering on commercial fishing boats and costs of diversification. These two factors were investigated subsequently in the paper, in the case of the Iroise Sea fishery. Due to the characteristics of the area, potential demand seems fairly important, according to the results of a sample survey realised in the summer 1998. As regards costs, conclusions based on a simple simulation model are not so positive. But the empirical inputs of the simulation are incomplete and may be partly inaccurate since the boats used as a basis are merely an ersatz and not the genuine article. This limit obviously calls for a detailed economic survey of commercial fishing in the Iroise Sea.

However, the main impediment to diversification might rely in the institutional framework. According to French law, rules concerning commercial fishing, sport fishing and boat chartering make it very difficult to combine these three activities (Alban, 1998). If the institutions in charge of fisheries management regard diversification as a possible answer to overfishing, they will have to tackle with this problem first.

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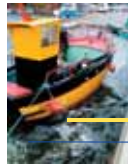
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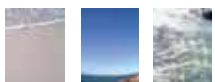


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