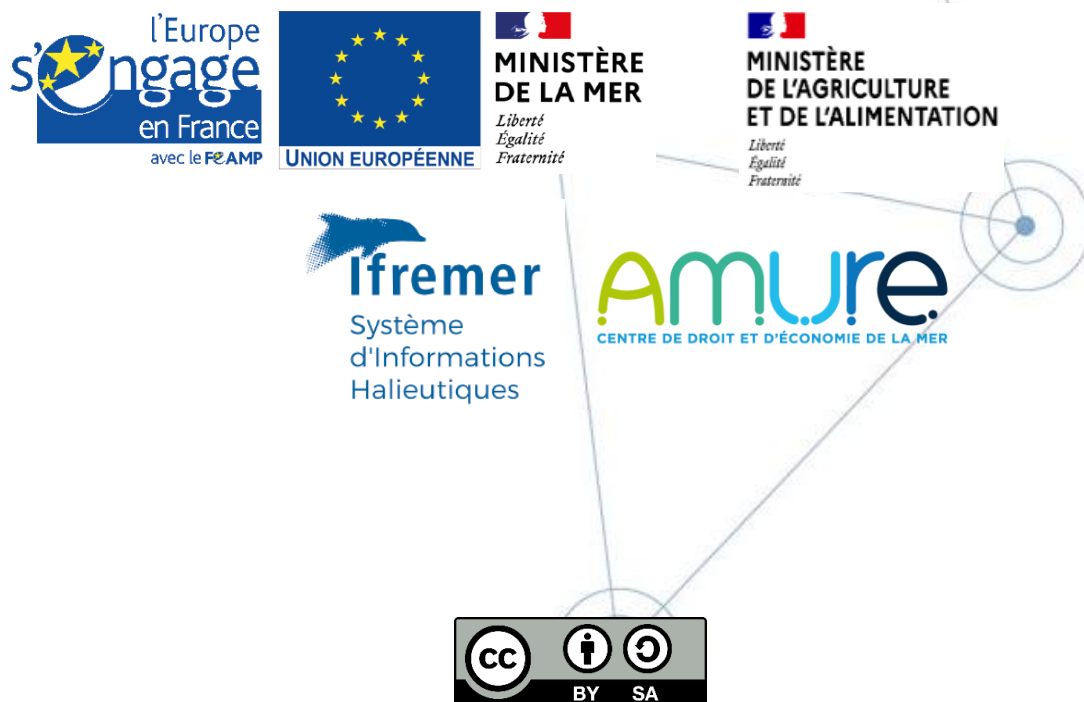


Construction of socio-economic indicators on commercial fishing fleets in mainland France: part 3 - validation method



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Résumé/ Abstract : Under the European Regulation known as the DCF (Data Collection Framework) regulation, member states are required to collect and provide socio-economic data on fisheries as a basis for advice on fisheries management and for other purposes. In metropolitan (mainland) France, the data producer is the Statistics and Prospective Service (SSP) of the Ministry of Agriculture and Food. For data collection, the SSP relies on its two partners: IFREMER (<i>Institut Français de Recherche pour l’Exploitation de la Mer</i> ; French Research Institute for Exploitation of the Sea), which conducts field surveys, and <i>Laboratoire d’Économie et de Management de Nantes-Atlantique</i> (LEMNA; Nantes-Atlantique Economics and Management Laboratory), which collects accounting data from management centres. This document presents the validation stage of the data collected by IFREMER. It, therefore, presents the third stage of the construction of socio-economic indicators carried out by IFREMER, which follows the building of the sampling plan (Stage 1) and collection of data (Stage 2).	
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1 Introduction

Under European Regulation (EU) 2017/1004 known as the DCF (Data Collection Framework)¹ regulation, member states are required to collect and provide socio-economic data on fisheries, as specified in the Commission Delegated Decision (EU) 2021/1167 of 27 April 2021², to provide a source of advice for fisheries management and other purposes.

In metropolitan (mainland) France, the data producer is the Statistics and Prospective Service (SSP) of the Ministry of Agriculture and Food. For data collection, the SSP relies on its two partners: IFREMER (*Institut Français de Recherche pour l'Exploitation de la Mer*; French Research Institute for Exploitation of the Sea), which conducts field surveys, and the Laboratoire d'Économie et de Management de Nantes-Atlantique (LEMNA; Nantes-Atlantique Economics and Management Laboratory), which collects accounting data from management centres.

To produce these data, fishing companies take part in annual surveys, the purpose being to calculate economic indicators per fleet segment, and, more generally, to evaluate the economic performance and development of different sub-fleets. The main topics covered in these surveys are income, costs, physical capital, physical investments and the financial situation, and jobs. These surveys have been endorsed by the *Conseil National de l'Information Statistique* (CNIS; National Council for Statistics) since 2012³, conferring a guarantee of rigorous methodology and full compliance with data and statistical confidentiality requirements.

This document presents the validation stage of the data collected by IFREMER. It therefore presents the third stage of the construction of socio-economic indicators carried out by IFREMER and should be considered in conjunction with the following documents:

1. Merzéréaud M., Daurès F., Guyader O., Le Grand C., Leonardi S., Macher C., Spagnol C. 2021. Construction of socio-economic indicators on commercial fishing fleets in mainland France: part 1 - sampling plan
2. Spagnol C., Le Grand C., Guyader O., 2021. Construction of socio-economic indicators on commercial fishing fleets in mainland France: part 2 - data collection

¹Regulation (EU) 2017/1004 of the European Parliament and Council of 17 May 2017: <https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELEX:32017R1004&from=EN>

²See Table 7 of Commission Delegated Decision (EU) 2021/1167 of 27 April 2021: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32021D1167&rid=2>

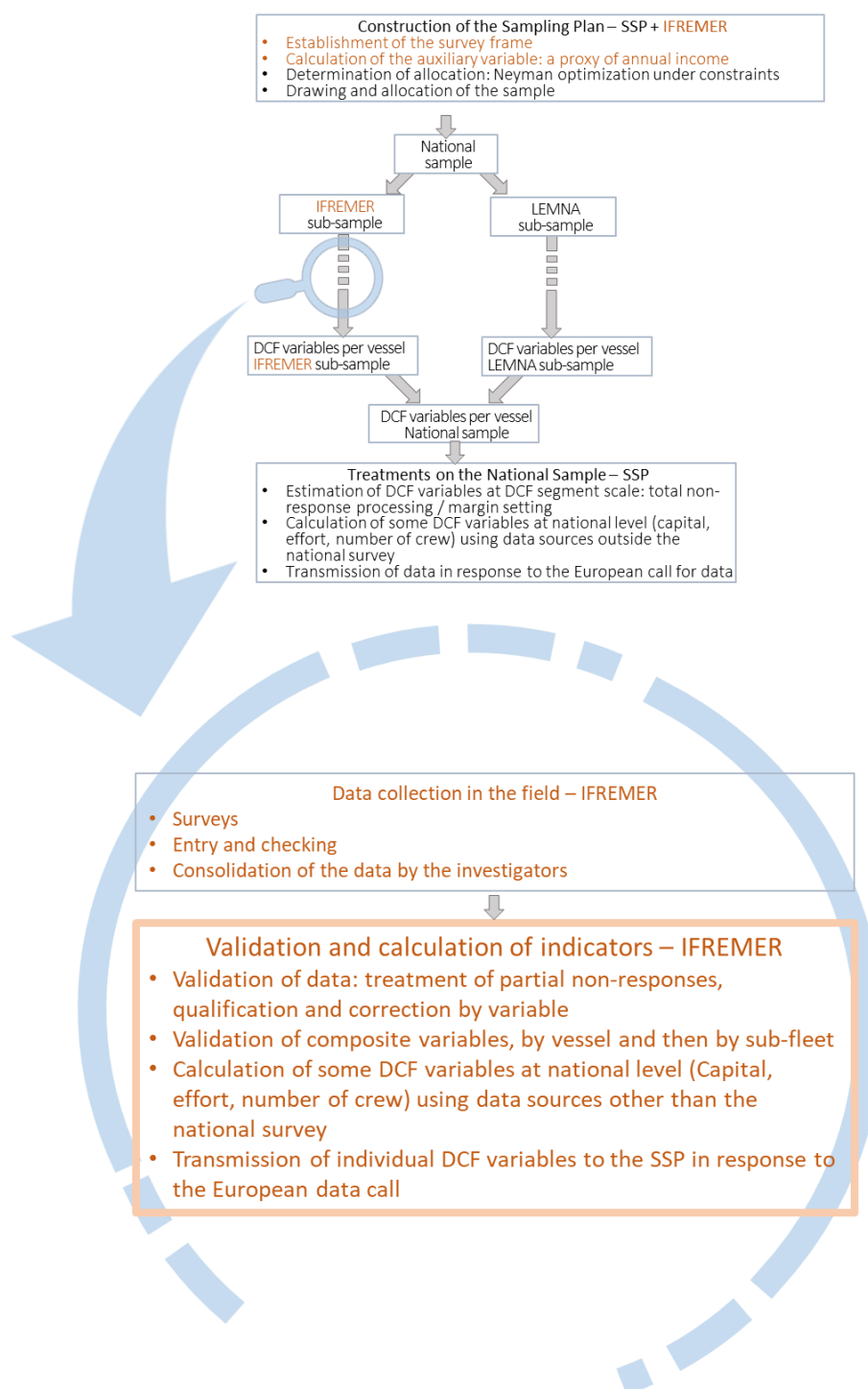
³Economic data production in the marine fisheries sector (Survey for) (2021A704AG) - <https://www.cnis.fr/enquetes/enquete-pour-la-production-de-donnees-economiques-dans-le-secteur-des-peches-maritimes-2021a704ag/>

2 Validation method

This section details the validation steps implemented by IFREMER up to the reporting of the DCF variables at the vessel scale for the sub-sample assigned to IFREMER.

This work is part of a more comprehensive validation process (see Figure 1) that extends from the collection and monitoring carried out by the investigators to the reporting of the aggregated indicators by the SSP in response to the European Commission call for data (Gitton et al., 2020).

Figure 1. Process of construction of DCF variables at the national level (orange indicates the involvement of IFREMER)



2.1 Indicators: calculation methods and variables used

The indicators required under the DCF are specified in Table 1 below.

They are calculated individually for each vessel on an annual scale, based on data from the economic survey and additional data. Individual data are reported to the Statistics and Prospective Service (SSP) of the Ministry of Agriculture, which performs the rest of the processing (including the segment level calculation).

Table 1. Variables collected in the survey and used to calculate the socio-economic variables required by the DCF

Category	DCF variables	Unit	IFREMER individual return	Survey variables used
Effort	Days at sea	Days	x	Number of days at sea
	Energy consumption	Litres	x	Fuel volume
Employment	Number of crew on board	Number	x	Average number of crew
	FTEs	Number	x	Average number of crew, number of days at sea
	Total hours worked per year	Number		
	Unpaid labour	Number		
Income	Gross value of landings	Euro	x	Fishing income
	Income from leasing of quotas or other fishing rights	Euro		
	Operating subsidies	Euro		
	Other income	Euro		
	Investment grants	Euro		
Expenses	Consumption of fixed capital	Euro		
	Energy Costs	Euro	x	Fuel costs
	Other non-variable costs	Euro	x	Costs of gears, other fitting out expenses, insurance premium, licences, management centre subscription
	Other variable costs	Euro	x	Oil, bait, food, ice, landing taxes
	Personnel Costs	Euro	x	Personnel costs
	Maintenance and repair costs	Euro	x	Maintenance and repair costs
	Payments for leasing quotas or fishing rights	Euro		
	Value of unpaid labour	Euro		
	Value of quotas and other fishing rights	Euro		
	Investments	Euro		
Capital	Short/long-term debt rate	Euro	x	Share of loans in the financing of the vessel
	Replacement value of capital	Euro		
	Total assets	Euro		

The methods for calculating the indicators provided by IFREMER at the vessel level for the sub-sample allocated to it by the SSP are specified below, where applicable.

- **Value of landings**
- **Number of days at sea**

- **Number of crew on board**

IFREMER provides this variable, but it is also calculated by the SSP, at the segment level, over the entire national population.

- **Full-Time Equivalents (FTE)**

$$FTE = \min(\text{average number of crew}; \frac{\text{average number of crew} * \text{number of days at sea}}{250})$$

The full-time equivalent (FTE) per vessel is calculated on the basis of the average number of crew, the number of days at sea and the reference number of days at sea. A decree of the maritime labour code specifies that the full time work of a sailor cannot exceed 250 days, so if the number of days at sea of the vessel is greater than 250 days, the value taken for the FTE is the average number of crew.

The reference number of days at sea is the European standard: 250 days. IFREMER provides this variable, but it is also calculated by the SSP, at the segment level, over the entire national population.

- **Volume and cost of fuel**
- **Cost of repairs**
- **Other non-variable costs**

Other non-variable costs

$$= \text{Gear cost} + \text{management centre subscription} + \text{insurance premium} \\ + \text{other fitting out expenses} + \text{licence costs} + \text{mandatory professional contribution}$$

The indicator 'Other non-variable costs' is the sum of the various fixed costs recorded in the economic survey: the cost of gears, the management centre subscription, the vessel insurance premium, the other fitting out expenses, the cost of licences and the mandatory professional contribution.

- **Other variable costs**

$$\text{Other variable costs} = \text{oil} + \text{bait} + \text{food} + \text{ice} + \text{landing taxes}$$

The indicator 'Other variable costs' consists of the costs of oil, bait, food, ice and landing taxes.

- **Personnel Costs**

Personnel costs include salaries, employers' social security contributions: *Etablissement national des invalides de la marine* (ENIM; a social security body for professional seafarers), *Caisse d'allocations familiales* (CAF; family allowance fund), *Association pour l'emploi dans l'industrie et du commerce* (ASSEDIC; association for employment in industry and commerce), apprenticeship tax, *Service Sociale Maritime* (SSM), paid leave and bonuses. The overall cost of personnel comes either from the survey, where available, or from a calculation based on the survey data (number of days at sea, crew ENIM category, crew share) and contribution rates (source ENIM).

These data make it possible to calculate the ENIM base, which is the basis for calculating social security contributions. The details of these calculations are given in Appendix 1.

The personnel cost is then calculated as follows:

$$\begin{aligned} \text{Personnel cost} = & (\text{Income} - (\text{Landing taxes} + \text{Fuel} + \text{Oil} + \text{Bait} + \text{Food} + \text{Ice})) \\ & \times \text{Share}_{\text{Crew}} \\ & + \text{Social contributions}_{\text{Employer}} + \text{paid leave} \end{aligned}$$

- **Replacement value of capital**

IFREMER does not provide the capital variables, these are calculated by the SSP.

To configure the PIM (perpetual inventory method) capital estimation model, the SSP notably uses the value of the vessel at purchase and insurance value, collected in the economic survey (Daurès et Le Grand, 2015).

- **Debt ratio**

$$\text{Financing of vessel} = x\% \text{ self financing} + y\% \text{ subsidies} + z\% \text{ loans}$$

The debt ratio is estimated by the share of loans (z) in the financing of the vessel at purchase.

2.2 Economic survey data

Table 2 presents the survey questions that are used to produce the socio-economic indicators required by the DCF. It contains the variables used for the mathematical calculation of the indicators (in bold) and the questions whose answers make it possible to validate (comparison, cross-validation) the calculated value of the indicator.

Table 2. Survey questions used to produce the DCF variables: calculation + validation

DCF variables	Survey questions used to produce DCF variables	Questionnaire theme
Value of landings	5.1 Income	5. Revenues and costs
	5.2 Auction share	5. Revenues and costs
	5.3 Distribution of non-auction income	5. Revenues and costs
	5.5 Detail of income by species	5. Revenues and costs
	5.6 Contribution to the bad weather fund	5. Revenues and costs
	3.1 Fishing effort	3. Activity
	3.2 Main métiers	3. Activity
	5.13 Diversification without using the vessel	5. Revenues and costs
	5.14 Diversification using the vessel	5. Revenues and costs
	5.16 Pensions	5. Revenues and costs
	1.2 Work in partnership of vessels	1. Information about the respondent/entourage
	1.3 Operation of other vessels	1. Information about the respondent/entourage
	1.5 Professional activity of the spouse	1. Information about the respondent/entourage
Days at sea	3.1 Fishing effort	3. Activity
	5.13 Diversification without using the vessel	5. Revenues and costs
	5.14 Diversification using the vessel	5. Revenues and costs
	3.2 Main métiers	3. Activity
Number of crew on board	3.3 Average duration of a fishing trip	3. Activity
	6.2 Average annual number of crew	6. Crew and method of remuneration
	6.1 Owner alone on board	6. Crew and method of remuneration
	6.3 Crew rotation	6. Crew and method of remuneration
FTEs	6.4 Number of foreign sailors	6. Crew and method of remuneration
	<i>Calculated from Number of crew on board and Number of days at sea</i>	
	Energy consumption and cost	5. Revenues and costs
	3.1 Fishing effort	3. Activity
Maintenance and repair costs	5.17 Vessel maintenance and repair	5. Revenues and costs
	5.18 Engine change	5. Revenues and costs
Other non-variable costs	5.19 Other fitting out expenses	5. Revenues and costs
	2.8 Insurance premium and value	2. The vessel
	3.4 Licenses	3. Activity
	4.1 Gear	4. Fishing gear and rigs
	4.2 Rigs	4. Fishing gear and rigs
	5.10 Management centre subscription	5. Revenues and costs
Other variable costs	5.11 CPO (mandatory professional contribution)	5. Revenues and costs
	5.8 Intermediate types of consumption	5. Revenues and costs
	5.7 landing taxes	5. Revenues and costs
Personnel Costs	5.9 OP (producer organisation) subscription	5. Revenues and costs
	6.7 Total annual crew cost	6. Crew and method of remuneration
	6.4 Number of foreign sailors	6. Crew and method of remuneration
	6.5 Remuneration by share of catch	6. Crew and method of remuneration
	6.6 Crew bonuses	6. Crew and method of remuneration
	6.8 Detail of personnel costs	6. Crew and method of remuneration
	6.9 Salary of a crew member	6. Crew and method of remuneration
	6.10 ENIM crew category	6. Crew and method of remuneration
	1.1 Status of the owner	1. Information about the respondent/entourage
	Replacement value of capital	2.1 Year of acquisition of the vessel
2.2 New construction		2. The vessel
2.4 Degree of ownership of the vessel		2. The vessel
2.5 Purchase price		2. The vessel
2.7 Repayment of loans		2. The vessel
2.8 Insurance premium and value		2. The vessel
2.9 Second-hand market value of the vessel		2. The vessel
Debt ratio	2.6 Share of loans in the financing of the vessel	2. The vessel

2.3 Validation steps

The various steps of validation are detailed below, including a section on data traceability: qualification and correction flags are defined for each validated variable in order to trace any corrections made.

To do this, validation routines are employed using survey data entered and consolidated by the investigators, other SIH data sources and validated historical economic data (Figure 2). Validation thus involves:

- a univariate approach that allows the values for each variable to be qualified and corrected: treatment of partial non-responses,
- a multivariate approach that provides an overall expert reading of all vessels in the sample,
- the calculation of the variables required by the DCF on an individual scale.

This validation work is carried out on the Atlantic and Mediterranean coasts.

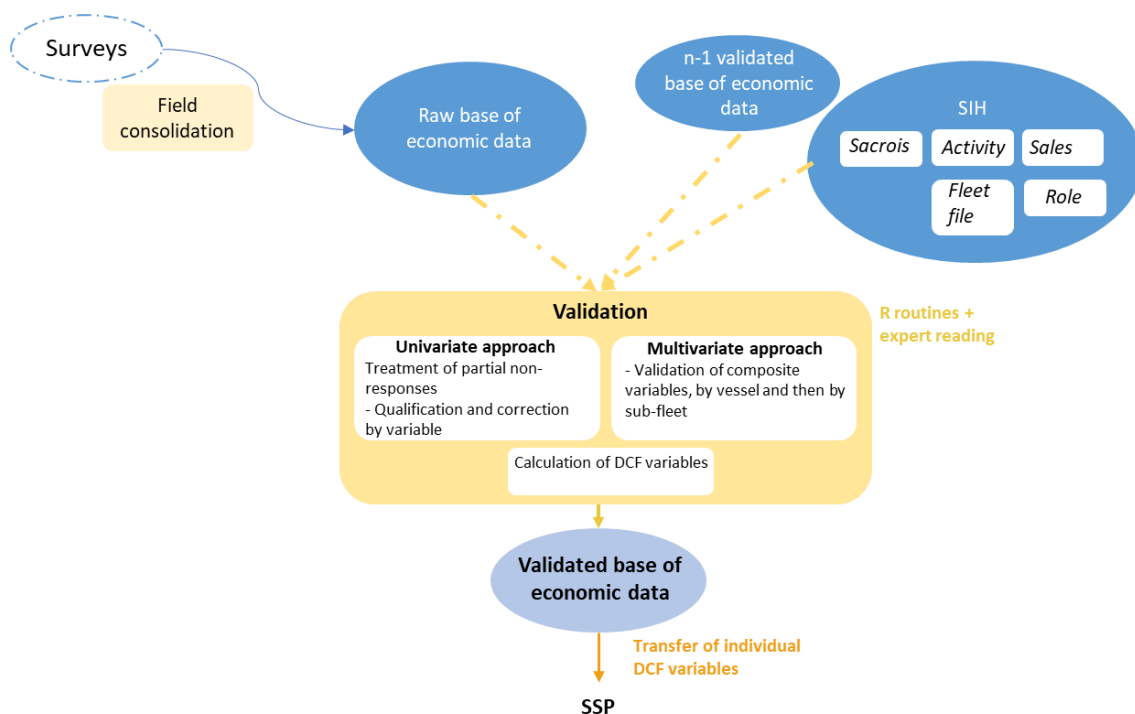


Figure 2. Steps of the validation and sources of data used

2.3.1 Univariate approach – Treatment of partial non-responses

2.3.1.1 Validation and qualification of individual data

The variables of the survey are qualified: missing, extreme or outlier values are identified by comparing the value of the vessel with:

- the reference values of a homogeneous group of vessels (segment or other level of reporting) of the vessel for the year concerned;
- historical benchmarks for homogeneous groups of vessels;

- indicators that may come from other sources of data available at the level of each vessel (e.g. fishing effort and production data reported for the vessel in question, grouped together in the SACROIS database).

Notably, validation routines make it possible to identify potentially outliers such as:

- at the level of a segment $Value_n < 0.85 * P5 Value_{segment}$ ou $Value_n > 1.15 * P95 Value_{segment}$;
- by making calculations of consistency of costs ($Value_n / Income_n > x\%$);
- or by checking certain ratios (e.g. Income / Person / Days at sea; Fuel costs / Income, etc.).

The values to be checked are traced and coded as follows:

Table 3. Tracability and data qualification flags

Flag	Signification	Commentary
0	Non-qualified value	Default value at the beginning of the work period
1	Good value	A value which might have seemed dubious at first, but which turns out, after verification, to be good
2	Value without statistics	Little used
3	Doubtful value	Used for values reported by owners that appear questionable, outliers
4	False value	Used only for interviewer errors: data entry errors, calculation errors
9	Missing value	No data for the variable and the vessel concerned.

When a vessel has many inconsistencies, it is identified and its survey is checked to find elements that explain possible outliers. The vessel may then be excluded from the calculation of the vessel group benchmarks used for the treatment of partial non-responses for some indicators or removed from the sample altogether if it is deemed to be unreliable overall.

2.3.1.2 Treatment of partial non-responses and values classified as false

Partial non-responses (missing values) and values classified as doubtful (flag 3) or false (flag 4) in the previous step are treated by imputation methods:

- either by using the survey data (data entry error or use of other data from the survey), which allows the value to be inferred;
- or by deduction of the value using other sources of data available at the level of each vessel (activity, effort and production of each vessel, etc.);
- or by imputing a reference value calculated at the sub-fleet level;
- or by using a historical value supposedly fixed over time (e.g. insurance value) from a previous survey of the vessel concerned.

A system of flags traces the corrections made (Table 4).

Table 4. Tracability and flags for data correction

Flag	Signification	Commentary
0	Uncorrected value	Default value at the beginning of the work period
5	Value corrected by imputation	Imputed value
6	Alignment value	Value that exists in the survey (input or calculation error) or that can be directly deduced from the survey information
7	Manually corrected value	Value deduced from an external correction source or expert
8	Panel value	Use of the value declared in the previous or recent year (maximum 3 years) if the vessel has already been surveyed

2.3.2 Multivariate approach / Calculation of DCF variables

The variable-by-variable validation is then complete. The last step of the validation is the overall expert read-through of all the vessels in the sample.

The variables defined by the DCF are calculated as well as economic indicators composed of several validated variables (e.g. personnel costs, net salary per person, income / person / day at sea, share of fuel on income, gross profit). Outliers are identified as:

- Income / Person / Day at sea < 100 or Income / Person / Day at sea > 1100
- Income < 8000€
- Personnel costs / income < 25% or Personnel costs / Income > 75%
- Gross profit / Income < - 25% or Gross profit / Income > 50%
- Salary < 0

Surveys rated as 'poor' by the investigator and vessels for which numerous imputations were made are also checked. Trends in variables by sub-fleet are calculated using the present data, aggregated with the historical validated database.

'Doubtful' vessels are examined for all of their indicators, relative to the other vessels in their sub-fleet. They are either kept in the sample (consistency of the various information from the survey) or considered unreliable (it is then preferable to remove them from the sample).

The final sample returned to the SSP is composed of the variables required by the DCF for this sample.

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4 Appendices

4.1 Appendix 1. Calculation of personnel costs

The first step is to calculate the ENIM base to which the rates of the various social security contributions will apply. The ENIM base is calculated from the ENIM categories of sailors. A distinction is made between the ENIM category of the fishing vessel skipper when this person is the on-board owner from that of the rest of the crew.

$$ENIM\ base_{Fish\ Captain} = cat.\ ENIM_{Fish\ Captain} \times ENIM\ Flat\ rate_{Day} \times Nb\ days\ at\ sea$$

$$ENIM\ base_{Crew} = cat.\ ENIM_{Rest\ of\ Crew} \times ENIM\ Flat\ rate_{Day} \times Nb\ days\ at\ sea \times (number\ of\ crew - 1)$$

$$ENIM\ base_{Total} = ENIM\ base_{Fish\ Captain} + ENIM\ base_{Crew}$$

Different taxes will then be calculated using the ENIM Crew or Total bases. The employer and employee contributions are made up of the taxes detailed in Tables 5.

Table 5. Composition of employer and employee social security contributions

	Social security contributions	
	Employee	Employer
Employee ENIM	x	
Employer ENIM		x
CAF		x
CSG RDS*	x	
Employer Assedic		x
Employee Assedic	x	
CPO (mandatory professional contribution)		
Apprenticeship taxes		x
SSM		x

* Social Charges

The flat-rate salary and paid leave are easily deduced from this information:

$$Net\ Flat\ Rate\ Salary = ENIM\ base_{total} - Social\ Contributions_{Employee}$$

$$Paid\ Leave = Net\ Flat\ Rate\ Salary / 10$$

With this information, it is possible to calculate the cost of personnel and average salaries.

$$Personnel\ Cost = Income - (Landing\ taxes + Fuel + Oil + Bait + Food + Ice) \\ \times Share_{Crew} \\ + Social\ Contributions_{Employer} + paid\ leave$$

$$Gross\ average\ salary_{person} \\ = (Personnel\ cost - (Social\ Contributions_{Employer} + paid\ leave)) \div number\ of\ crew$$

$$Net\ average\ salary_{person} = (Personnel\ cost - (Social\ Contributions_{Employer} + paid\ leave) \\ - Social\ Contributions_{Employee}) \div number\ of\ crew$$