



**SCIENTIFIC COUNCIL MEETING – JUNE 2013**

Method to estimate catches based on the Observers on board information.  
by

Fernando González-Costas

Instituto Español de Oceanografía  
P. O. Box 1552. Vigo, Spain  
fernando.gonzalez@vi.ieo.es

**Abstract**

The aim of this document is to present the method used in the period 2004-2010 to estimate the Spanish catch by species based in the information collecting by the “NAFO Observers” and the “Spanish Scientific Observers”.

**Introduction**

The Spanish fleets carry out different fisheries in NAFO Regulatory Area (NRA) Divisions 3LMNO depending on the target species, area, depth and mesh size (Gonzalez-Costas 2012). The Spanish fisheries are the following: 1) In Divisions 3LMNO at more than 600 meters depth with demersal 130 mm mesh size gear with Greenland halibut as target species. 2) In Divisions 3LMNO, mainly in Div 3O and 3M with demersal 130 mm mesh size gear in the 200-600 strata. The target species is the redfish 3) In Divisions 3NO with demersal 130 mm mesh size at depth less than 200 meters. This is a mix fishery with different catch composition. 4) In Divisions 3NO with 280 mm mesh size at less than 200 meters depth. The target species are the skates. 5) In Division 3LM with 40 mm mesh size at depth between 300-500 meters. The target species of this fishery is the shrimp. 6) In Division 3M at depth between 150-550 meters targeting cod with 130 mm mesh size gear.

In NAFO there are two types of catch data: official catches (STATLANT) that are the basis for the administrative and compliance issues and the Scientific Council approved catches which are the basis for the assessments. The latter are agreed reviewing all available catch information from different countries and sources (official data, estimates, observer data, monitoring, etc.). Most Contracting Parties only present the official catch information but for some countries are available catch data based on different information sources as observer on board information, Canadian surveillance information, etc.

In NAFO there are two kinds of observers on board: “NAFO Observers”, which are mandatory for all vessels operating in the NRA. Their main objective is to collect catch data for surveillance and compliance matters. And the “Scientific Observers”, which main tasks are to recollect biological information and to carry out the catch length sampling and for some countries also collect catch information.

The aim of this study is to present the method used to estimate the Spanish catch in the period 2004-2010 by species based in the information collecting by the “NAFO Observers” and the “Spanish Scientific Observers”. In the period 2002-2003 Spanish catches estimations were based only in the NAFO Observers information.

### **Observer data available**

“NAFO Observers”: There are information haul by haul about the position, gear, mesh size, effort and catch by species. NAFO Observer information has almost 100% coverage of the effort made by the Spanish fleet. Table 1 shows the NAFO observers effort coverage in total effort percentage in the period 2006-2010. The low percentage observed in 2010 was due to the change of company in charge of the NAFO Observers program.

“Scientific Observers”: The main tasks of these observers are to recollect biological information and to carry out the catch length sampling. Besides these tasks, the scientific observers collecting information haul by haul about the position, gear mesh size, effort and catch by species during the fishing trip. Scientific observers have around 20% coverage of the total effort made by the Spanish fleet. Table 2 shows the scientific observers effort coverage in percentage in the period 2006-2010. Scientific observers schedule is planned to be distributed throughout the year and in all fisheries. Table 3 present the days observed by the scientific observers in the year 2010 by month.

### **Catch Estimation Method**

The first step is to debug of errors the “NAFO observers” and the “Scientific observers” data bases. After have the data bases debugged, we extract the annual distribution of effort (fishing hours) by fishery and Division from the NAFO Observer information. The NAFO Observer Information has almost 100% coverage of the total effort made by the Spanish fleet in the NRA (Table 1). This information has not 100% coverage for different problems, but always it is available the NAFO total days at sea by month for the Spanish fleet. In the years that such coverage it is not 100%, the “NAFO observers” effort with information by fishery and month is raised to the total effort by month. This process gives the annual effort in fishing hours carry out by each of the Spanish fisheries in the NRA.

The annual CPUEs of different species by fishery and NAFO Division are calculated with the “Scientific observers” data. These CPUEs (kg / hour) are raised for each fishery and division by the total effort obtained from “NAFO observers” so we get the estimates of the total catch by species division and fishery. For some species catch occasionally (by-catch ) probably there are very little data on the IEO “Scientific Observers” data to calculate a good CPUE. In these cases, the catches observed by the “NAFO Observers” by Division and fishery are taking as the best estimated. Figure 1 shows a scheme of the method described above.

### **Quality of the Estimations**

For one year, we analyzed the uncertainty of the catch estimated for Greenland halibut made by this method. Almost 100% of the Greenland halibut catch are caught in the Greenland halibut fishery. It was performed a bootstrap with the “Scientific Observers” individual observations (catch by haul) to calculate the confidence intervals of the estimates made by this method. They were estimated 1000 new Greenland halibut bootstrap CPUEs by Division for the Greenland halibut fishery and these CPUEs were applied to the “NAFO Observers” effort by Division for the Greenland halibut fishery to have 1000 new estimates of Greenland halibut catches. The results of the Greenland halibut bootstrap catches are show in Table 4. The median of the bootstrap are very close to the estimation made by the method base on the observers information in all Divisions and the 5 and the 95 percentiles have a deviation around 10% of the mean in all Division except in Division 3O were this deviation is very high. This is because the effort and catch of the Greenland halibut in Division 3O is very small and the variability in the CPUEs are very high due to the scarce Division 3O information in the “Scientific Observer” data.

For some years were compared the Scientific Observers catches and the NAFO observers catches for the most important species. This comparison was made for the same vessels and days with both observers on board. Table 5 shows the comparison for the species with biggest differences. For the years with this information available the catches observed by the “NAFO Observers” were around 50%-60% of the catches observed by the “Scientific Observers”.

### **Method Problems**

The biggest problem of the estimation method is that it was designed to obtain the catches length distributions and biological information more than to perform catches estimations. This problem was tried to solve by increasing the observation days at sea to obtain better catches estimates. Other big problem is that the catch estimation made by the observers has a subjective component depending on the observer experience and other circumstances factors. This estimation is not an easy task and it needs experience to do. The scientific observers only measure the sample weight and they estimate the total catch weight by haul. The “Scientific Observers” use different methods to estimate the total catch by haul like counting freezing trays, marsh fishing volume, fishing gear volume, crew information, etc. The use of a particular method depends on the vessel, the observer and the work conditions.

In this method there is not a temporal stratum (quarter, semester, etc) to estimate the catches and it is well know that the CPUEs for many species are seasonally dependent. The main reason to have not temporal stratum it is that the estimation is made by fishery because the species CPUEs between fisheries are very different and more variable than seasonality and to have information by fishery and temporal stratum it will be necessary increase the observers on board, increasing the cost of the Scientific Observers program. The assumption made in this case to estimate the catches is that the temporal distribution around the year of the days surveyed by the Scientific Observers in the different fisheries are representative of the temporal distribution of the total Spanish effort in the NRA.

### **Discussion**

Official data STATLANT 21A and the catches recorded by “NAFO Observers” are often very similar and very close to the TACs approved. While the catches estimated with the observers data by the method explained above are often very different to the STATLANT 21.

The estimates made by this method have uncertainties (see Table 4), and the Official data (STATLANT) should have less uncertainties than the estimation made by this method. Normally the official data come from census (Logbooks). The catch estimation and the official data normally are not similar or equivalent for the most important species in the catches. Official catch data (STATLANT 21) are very close to the data obtained by “NAFO Observers” and very different from the estimates made by this method. These differences come mainly from the based observations (see Table 5) more than the method used in the estimation.

### **References**

González-Costas, F. 2012. Spanish fisheries in NAFO Subarea 3. *NAFO SCR Doc.* 12/021, Serial No. N6045.

Table 1.- Percent of the total effort made by the Spanish fleet in NRA area with NAFO observers information .

Year	2006	2007	2008	2009	2010
Coverage	98%	100%	98%	99%	72%

Table 2.- Percent of the total effort made by the Spanish fleet in NRA area with Scientific Observers information.

Year	2006	2007	2008	2009	2010
Coverage	12%	17%	21%	16%	26%

Table 3.- Scientific observers surveyed days by month in 2010.

Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Observ.
31	56	41	45	57	27		23	60	73	49	13	475

Table 4.- Bootstrap confidential intervals of the Greenland halibut catch estimation in percentage. The 100% correspond to the catch estimated by the method base on the observers information.

Greenland Halibut	Division				Total 3LMNO
In % of the estimation	3L	3M	3N	3O	
Catch Estimated by the Method	100%	100%	100%	100%	100%
Bootstrap 5% Catches	87%	88%	90%	3%	87%
Bootstrap 50% Catches	96%	99%	100%	97%	97%
Bootstrap 95% Catches	106%	111%	109%	237%	108%

Table 5.- One species Scientific Observers catches for the effort surveyed by them and the NAFO Observers catches for the same species and effort by year in percentage. 100% is the Scientific Observers catches.

Catch %	2006	2007	2008	2009	2010
Scientific Observers	100%	100%		100%	
NAFO Observers	52%	51%		59%	

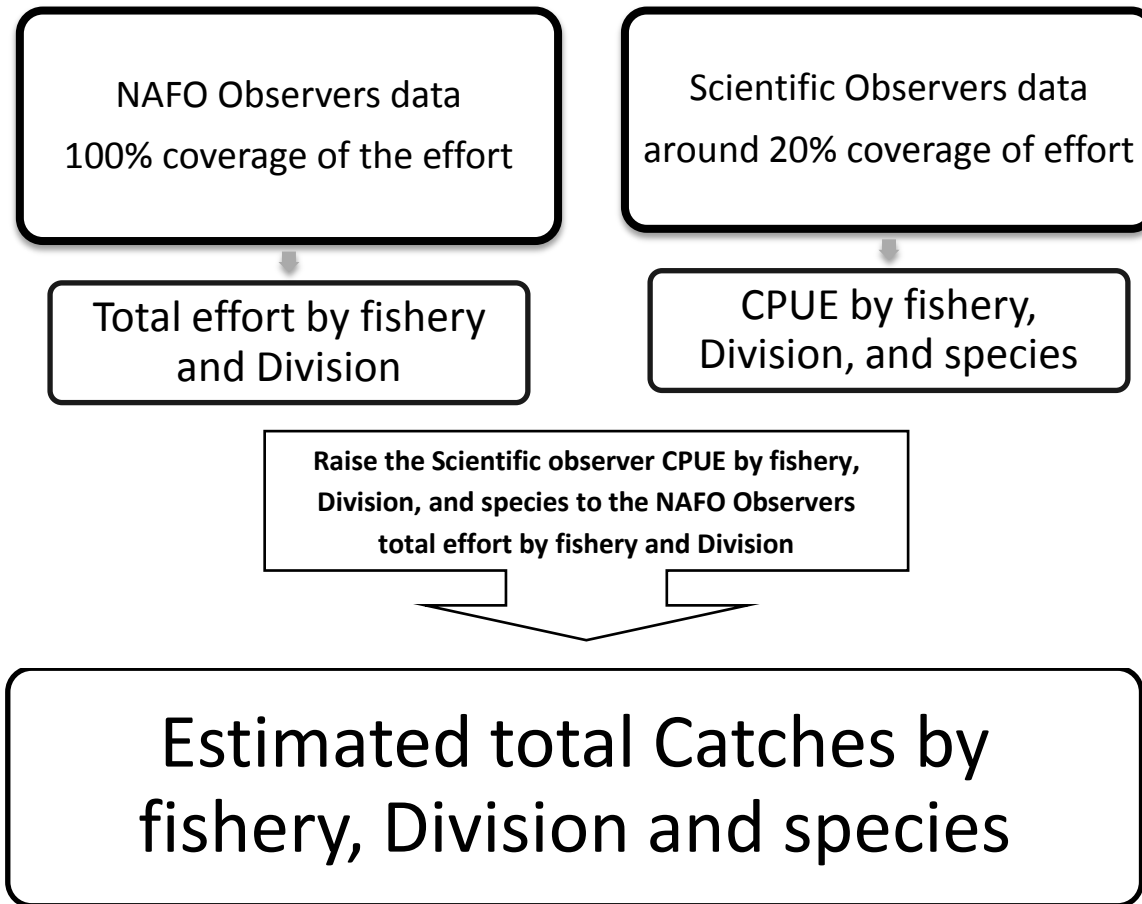


Figure 1.- Scheme of the method to estimate the catches based on the NAFO and Scientific observers on board used in the period 2004-2010.