

**Working Document to the North Western Waters RAC and the
Focus Group on Cod Avoidance Plans of the NWW RAC
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**Cod *By-catch* of the Spanish fleets operating from
Northern of Scotland to the Celtic Sea (ICES Divisions
VIab and VIIbc, e-k)**

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In the study and research of fisheries, collaboration between scientists, the fishing industry and the Administration is essential. This paper intends to give an example of this assertion.

The authors

1.- Introduction

1.1. The ecosystem

1.2. Cod fishery in Divisions VIab-VIIbc, g-k

1.2.1. Cod fishery of NW Scotland (VIa)

1.2.2. Cod fishery at the Rockall Bank (VIb)

1.2.3. Cod fishery of West Ireland and Celtic Sea (VIIbc y VIIg-k)

1.3. Spanish fishery in Subareas VI-VIIbc, g-k

2.- *By-catch* landings of the Spanish fleet

3.- Information on the *By-catch* from scientific onboard observers

4.- Catches in PORCUPINE 2001-2007 bottom trawl surveys

5.- Conclusions

6.- Acknowledgements

7.- References

8.- Tables

9.- Figures

1.- Introduction

1.1. The ecosystem

The area that covers the Divisions VIab and VIIbc,g-k of the ICES, includes the west of Scotland and Ireland and the Celtic Sea, the south of Ireland and the southwest of the United Kingdom and northwest of the French Brittany. In this zone, there is a great deal of fishing carried out on the continental shelves and slopes of the above mentioned countries, including the Rockall and Porcupine banks and their adjacent deep areas (Figure 1).

ICES (2006, 2007a, 2007b) provides a description of the ecosystem. This description indicates that the levels of phytoplankton have increased steadily over the last 20 years, whereas the abundance of zooplankton has decreased in recent years.

The same studies state that in the northern part of the area a significant fishing industry of demersal and benthic species has developed in which the main target species are Nephrops, cod, haddock, whiting and flat fish. Species such as hake and anglerfish are caught throughout the area.

On the continental slope (at a depth of 500m-1800m) inhabit a completely different set of fish, such as the grenadier and other macrouridae, black scabbardfish, blue ling, orange roughy and deep water sharks. In the fishing grounds of Celtic Sea, the fish assemblage is made up of about 100 species, of which 25 represent 99% of the total biomass.

With respect to the trophic chain, the above mentioned studies indicate that the main predators in the Celtic Sea are indicated as being hake, megrim, anglerfish, whiting, cod and saithe. Blue whiting were the prey most often found in the stomachs of predators on the continental slope during the summer months, whereas mackerel and *Trisopterus* spp were the most abundant on the continental shelf during the winter half of the year.

Special reference is made to the consumption of fish by the seal populations, especially in the area of the Hebrides and Orkney Islands. The numbers of grey seals (*Halichoerus grypus*) are estimated to be between 50 000 and 110 000 and of harbour seals (*Phoca vitulina*) about 15 000 (ICES WGNSDS, 2007a).

Regarding future influences on these fisheries, both climate change and fishing pressure are mentioned. Both can potentially produce changes in the food chain and should be considered carefully when making management plans for fisheries. One of the main trends observed in the ecosystem is the continuous water warming in this area, particularly in the slope current. The waters around the Rockall depression have warmed continuously in recent years.

1.2. Cod fisheries in Divisions VIab-VIIbc, g-k

Initial data on catches in these areas appear in the Fisheries Statistics edited by ICES since 1903 (ICES 1903-1987, ICES 1973-2001). The fisheries or management units are divided by ICES in three zones: the NW of Scotland (Division VIa), the Rockall bank and adjacent waters (Division VIb) and the W of Ireland and the Celtic Sea (Divisions VIIbc and VIIg-k respectively), Figure 1.

In Table 1 and Figure 2 the historical development (1903-2006) of European landings in the above mentioned geographical zones are shown. The periods corresponding to the two World Wars are shown without landings, 1914-1918 and 1939-1945. The most recent data, from 2001, are taken from WGNSDS (ICES, 2007) and WGSSDS (ICES, 2007 b).

1.2.1. Cod fishery of NW Scotland (VIa)

International catches registered in the first decade of the 20th century rose from 597t in 1903 to almost 22 000 t in 1910 and were mainly carried out by Scottish and English vessels (UK) and some German and Irish ones. Before the First World War, catches fluctuated between 15 000 t and 18 000 t. No catches were registered between 1914 and 1918 due to the military conflict. In the early years after the war catches again reached 16 000t (1922) to later stabilise at between 5 000t and 8 000 t per year between 1924 and 1933 (Table 1, Figure 2) (ICES, 1903-1987; ICES, 1973-2001).

Following the Second World War (1939-1945), catches in Division VIa increased from around 5 000 t in the early post-war years to about 15 000 t in the second half of the fifties, fluctuating later between 10 000 t and 20 000 t until 1990. Since then, there has been a continuous fall in catches, which since 2004 currently stand at around 500 t (Table 1, Figure 2).

In 1966 there appears to be an incorrect allocation of French catches between Divisions VIa and Divisions VIIbc,g-k.

The current low catches are due to both the stock evolution and the restrictive measures on the management of the fishing effort.

From the end of the 90s, the stock situation has been so weak that in the latest report of the assessment working group for this species (ICES, 2007a) they state that the spawning stock biomass is at the lowest historical observed levels, much lower than the biomass limit reference point, i.e. that one that can produce low recruitment levels with a high probability.

For this reason, ICES has been recommending TAC zero since 2003 (ICES, 2007b) and the European Union has implemented a recovery plan with restrictions on TACs and fishing effort in this statistical Division (Council Regulation No 41/2006). As a result of this (biomass evolution and management measures), there has been a significant drop in the TAC finally adopted as well as in the fishing effort in the zone.

1.2.2. Cod fishery of the Rockall bank (VIb)

The first registered catches from this zone date from 1905 with 5t and were made by some Belgian vessel (ICES, 1903-1987), with Scottish and English ones joining in the following years, and French units from the beginning of the thirties.

Except for the two periods of the World Wars, in which no catches were registered, catches fluctuated without definite trends throughout the historical period, between 100 t and 2 500 t (maximum registered in 1969), until 1997. In our opinion they were very dependent on the yearly fishing effort made in a distant and difficult zone and the yield from areas that were closer to base ports.

Since 1997, there has been a continuous decline in the catches until the present, dropping from 1 000 t in 1997 to just 50 t in 2005-2006 (Table 1, Figure 2).

Due to the scarce data available, no analytical assessments have been carried out on this stock (ICES, 2007a).

1.2.3 Cod fisheries of W Ireland and Celtic Sea (VIIbc and VIIg-k)

These are mixed fisheries for demersal trawling, which catch the greatest quantities of cod in all the area in waters near the south of Ireland and the Bristol and Saint George's channels, in Division VIIg of the ICES (according to WGSSDS, ICES 2007. b) areas not often fished by the Spanish fleet.

The cod fishery in these areas provided international landings of a few hundred tonnes at the beginning of the last century, landed by Irish vessels and some Belgian and English ones. Before the First World War, landings already exceeded 1000 t. In the post-war years they almost reached 5 000 t (1921) and fluctuated between this value and 1000 t in the period between wars, in which the English fleet was the main one in the fishery.

From the thirties, the French fleet increasingly took part in the fishery and since the fifties catches in VIIbc have been mainly French and more recently Irish. Whereas, in the fifties, (Divisions VIIg-k) the fleets were French (70%), British, Irish and Belgian, and mainly French from the sixties onwards.

Landings increased later reaching levels of up to 10 000t in the eighties and 20 000t in the nineties. Landings have decreased continuously since 1998 and in recent years have been around 3 000t. In the west of Ireland, VIIbc, they decreased from 519t to 24t between 1995 and 2006 according to the WGSSDS (ICES, 2007b).

In 1989 and 1990 there appears to have been an error in the allocation of French landings, which could include landings from other adjacent areas. In 1999 French landings did not appear in VIIg-k, which probably is due to a mistake. This errors may determine the peaks and low catches from these years, respectively (Table 1 and Figure 2).

The latest cod stock assessment in VIIe-k (ICES, 2007 b) indicates low recruitment levels since 2002; continuous decline of the biomass and spawning stock since 1996, and fishing mortality higher than 0.8 from 1986 to 2005 (0.6 in 2006), while the precautionary F is fixed by ICES at 0.68. The October 2007 report of the ACFM of ICES sets fishing mortality objective at 0.33 (50% of current F), which produces high yield in the long-term and a low risk of collapse of spawning stock (ICES, 2007b). As a result, the ICES recommendation for 2008 was TAC zero.

Cod from west Ireland, Divisions VIIbc, was not evaluated independently in 2007 owing to doubts about whether they should be included in the stock from VIa or from VIIe-k. At the moment, it is included in these latter Divisions for evaluation purposes.

1.3. Spanish fishing activity in Subareas VI-VII bc, g-k

Spanish fishing activity in the zone VII start in 1927, after a pair trawler, *Los Chimbos*, carried out an experimental trip to the Grand Sole (Division VIIj) obtaining spectacular catches of hake and other important commercial species (Quiroga, 1952, Paz Andrade, 1954; Industrias Pesqueras, 1967; Fernández, 1985).

Since then the trawling fleet of the north and northwest fishing ports of Spain has increased and extended its radius of action progressively towards to the north as the skippers gained more knowledge of the fishing grounds, until reaching Porcupine bank and after higher latitudes (Azcúe, 1948; Sinde Cantorna, 2002).

The British researcher Hickling (1946) had already cited the Spanish fleet as often being in the waters of the Celtic Sea (Fernández y Morlán, 1986). In 1936 the Spanish trawling fleet fishing in VII reached 60 vessels, and increased up to 158 in 1953 (Paz Andrade, 1954).

In 1974 the Galician fleet was concentrated in the ports of A Coruña and Vigo with 216 units and with the main target species being hake, megrim, anglerfish and Norway lobster (Fernández *et al.* 1975). Cod were not cited in this paper among the main accompanying species, before extending Economic Exclusion Zone (EEZ) to 220 miles, either as by-catches or among the main discarded species.

The Spanish trawlers fleet in the area VII (and which made some trips to the VI, parallel 58° N, mainly during the summer), including units from the Basque ports of Pasajes and Ondárroa, reached 272 units in 1975. In those years, these hake (and megrims) trawlers made average catches of 283 kg of hake per fishing day (Fernández *et al.* 1976).

From the first half of the seventies some units using bottom gillnets (“*volantas*”) gradually joined in targeting hake. They fished mainly on the continental slope of the VIIj zone (ICES, 1977) and some bottom longliners, also targeted hake, began also in the fishery in the same years. Nevertheless, information from the fishing industry indicates that even in the sixties some manual longliners and fishermen using artisanal gillnets made trips to the zones of the Grand Sole bank (J. Etchevers, pers. comm.). Both longline and gillnet fleets reached 40 units in 1974-76 (ICES, 1978).

A part of this trawler fleet also made trips to Subarea VI, of which 18 units fished in "trio" metier (ICES, 1978), in which two boats pair trawled and the third transported the catch to the port.

Following the extension of the EEZ of the coastal states in 1977 (Ireland, U.K., France), Spanish gillnetters were banned from the waters of the then "EEC of 10", and therefore they changed into longliners, and quite trawlers also did after the same in order to use only 0.5 licences according to CEE fishing conditions (Fernández and Morlán, 1986).

In Figure 3 the change in the number of trawlers in the A Coruña (port with target species of hake, anglerfish and *Nephrops*) between 1967 and 2006 can be seen, as well as of the bottom longline fleet of A Coruña, Celeiro and Burela targeting hake in the same period, according to monitoring by the Spanish Institute of Oceanography (IEO).

The trawler fleet of the port of A Coruña reached 179 units in 1975 and has declined steadily since then (19 vessels in 2006). This decline was due to the Irish (and British and French) extension to 200 miles in 1977, when Spain was considered "third country" and also because of the Accession Treaty of 1986, as well as due to the scarcity of quotas with respect to the authorised effort (and far of the actual one) The change of base for some vessels also influenced in the evolution of A Coruña trawling fleet.

However, the effort made by the trawler fleet from the ports of Vigo and Marín only show two periods: between 1982 to 1991 with values around 70 000 days/100 HP and a second period 1997-2006 with 50 000 days/100 HP (ICES, 2006b)

However, it must be pointed out that the evolution of these Spanish fleets does not follow the same trend as the total fishing effort on the stocks. An important number of vessels changed their flag by the other European countries (UK, Ireland, France) due mainly to the low level of the Spanish quotas for hake, monkfish and megrims in the pre-Accession period (1977-1985), and to the low percentages on the TACs fixed in the Accession Treaty to the CEE (1986 on), MAPA, 1986.

The Galician longline fleet grew quickly from 1975 to 1983 (from zero to 120 vessels) and then remained stable until 1991 around 110 units, decreasing gradually till 2000. In the last seven years the fleet flying Spanish flag was around 60 vessels (Figure 3).

The bottom gillnet fishery was again authorised by the EU in 1998 after a ban of 20 years.

Currently the Spanish fleet in Subareas VI-VII is made up of 101 trawlers (93 using otter trawl (bacas) and 8 pairs trawlers), 58 longliners and 6 gillnetters (*Spanish General Secretary of Marine Fisheries*).

Estimations indicate that total landings of fleets based in the Galician ports reached a first-sale value of 167 million euros in 2003 (Fernández *et al.*, 2005).

2.- By-catch landings of the Spanish fleet

The terms by-catch and discards used in this study come from those defined by Alverson (1994) in which by-catch is defined as those species caught but not wanted (generally, because their economic value is low, of course than the target species, or is virtually zero). This catch can be either retained and landed, or discarded.

The *Oceanographic Center* of A Coruña of the IEO has been collaborating with the Port of A Coruña since 1973, in particular up to 1997. Thanks to this collaboration, the total landings per trip at this port of the "Grand Sole fleet" are available, without distinction between fishing gear used, from 1976 to 1989.

The results are presented in Table 2 in which total landings of cod, total fishes, crustaceans and mollusks per year are shown. The percentage of cod landed of total landings fluctuates between 0.01% and 1.69%, the average annual percentage of the series being 0.81%. Data include landings from foreign flag vessels landing at A Coruña, that although they fished the same way than the Spanish ones (the skippers were Spanish), were allowed to land cod.

Furthermore, between 1983 and 1997 and thanks to the collaboration already mentioned with the Port of A Coruña, the IEO directly processed landings per trip and fishing gear, trawlers and longliners (both targeting hake). From 1999, the information presented comes from landings per trip also but sampled in the wholesale fish market, with a high percentage of cover and later extrapolating to total trips. The results are summarized in the same Table 3.

The average percentage of cod in the total catch by trawlers in this series is around 0.23% and by the longliners 0.26%. It is important to highlight that the percentages show a downward trend in recent years in the series, perhaps influenced by the decrease in the stock biomass, and because from 1992 landings of other than Spanish flag vessels are not included.

Consequently, cod and total landings from 1978 to 1990 shown in Tables 2 and 3, although they reflect the fishing activity from the fleet landing in A Coruña port in Grand Sole – W Ireland, they also include catches from foreign vessels.

This is especially important in this paper because those no-Spanish vessels were always allowed to fish cod and to fish in the so-called Irish Box, area having higher cod abundance. This area, located East to the 12° 00' meridian and between parallels 50° 30' and 56° 30', was banned to the Spanish vessels in the pre-Accession agreements (i.e. CEE, 1979) and also in the Accession Treaty from 1986 (MAPA, 1986).

Thus, the cod percentages allocated to the Spanish fleets would correspond to the estimations of the period 1999-2006, based on direct sampling of the Spanish vessel trips in the A Coruña port by IEO : 0.02 for trawlers and 0.25 for logliners.

Low cod landings at the A Coruña port can be explained by the zones being fished, which are far from the shallow areas, both in Subareas VI and VII, but could also be affected by the obligatory discarding set in the quotas management system of UE in

multispecies fisheries, that is not very rational from a scientific point of view (Fernández, 1988).

In Figures 4 and 5 the three-monthly VMS positions of the whole Spanish fleet in 2006 and 2007, respectively, are shown. They were provided by the *Fishing Pursuance Center of the Spanish General Secretary of Marine Fisheries*

This influence of the area on the low cod catches of the Spanish fleet occurs since the beginnings of the fishery. Thus, landings of fresh cod (in ice) in Galician ports, before the extension of the EEZ to 200 miles (therefore without restrictions on cod landings) were around 200 t (*Subsecretaría de la Marina Mercante*, 1971-1977).

3.- By-catch information from on-board scientific observers

From 1988 the IEO has carried out several programmes of on-board scientific observers (not systematically until 2003) in vessels from different metiers of the so called "fleet of 300". This name comes from the number of vessels that were authorised in the Spanish Accession Treaty to the EEC to fish in zones Vb-VI-VII-VIIIabd of the ICES (MAPA, 1986).

Observer programmes were financed by the IEO and the European Union (Studies DG XIV first, Data Collection Regulation EC No. 1639/2001, Fisheries DG, later). The planning, selection and training of observers, as well as the analysis of the results were responsibility of the IEO.

Between 1988 and 2006 observations were carried out on a yearly average of 10 vessels. A total of 101 trips, 3 517 hauls and 15 420 fishing hours were sampled during the whole period. In Table 4 the sampling intensity per year is shown by fishing metier; the trawlers targeting megrim "Megrim fleet" (*Rapanteros*) and those targeting hake "Hake fleet" (*Merluceros*) whose metiers respectively correspond to the nomenclatures OTB-MEG/MNZ-7 and OTB-HKE-7 of the Plan of Basic Fish Data of the EU Commission. These metiers, according to the main species targeted, were already described in Fernández *et al*, 1975, 1976.

In Figures 6 the situations of hauls carried out by the fleet with an observer on-board are shown. They are separated by decades (1988-89, 1994-1999 and 2000 to 2006) both for the megrim fleet and the hake one (both with important by-catch of other species).

It can be seen that the areas fished by the Spanish megrim fleet mainly correspond to the Grand Sole bank and adjacent areas (Celtic Sea) and to a lesser extent to the Porcupine and Rockall banks (shallow waters), the same ones cited by Fernández *et al*, 1976 and Lart *et al*. in 2001. The hake fleet fish in the deeper areas of the continental shelf, including the shelf-breaks and slopes of Divisions VIIbcjk and the Porcupine and Rockall banks.

Results indicate that cod catches are scarce. Cod catch, compared with the total catch of all species (including invertebrates) represents around 0.6 % for the "megrim" fleet, and less than 0.1% for the hake fleet. With respect to the catch that is retained on board, cod

only represent 1.8% (1.1% excluding 1988, anomalous year for cod) of the total of the retained species for the megrim fleet and less than 0.2% (0.06% excluding 1988) for the hake fleet.

The percentage of the cod catch discarded out of the total discard was 0.04% for the megrim fleet and 0.06% for the hake fleet. In Table 5 the percentages for the years of the sampling programme are shown.

The average cod catch (discards and retained) per trip of the vessels sampled over 9 years was 354 kg for the megrim fleet and 38 kg for hake fleet. Based on this information and the total effort in number of trips by both fleets, a total annual catch of 156 t is estimated as an average for 2000-2006 for the megrim fleet and 16 t for the hake one.

The difference between boats that target megrim and those that target hake as their main species can be due to various reasons. Firstly, it is due to the zones and depths that they fish in: the megrim fleet fishes in shallow waters (e.g. Grand Sole, Porcupine bank) around 100-150 fathoms (Azcúe, 1948; Lart et al., 2001), whereas the hake fleet usually fishes at greater depths, including continental slope areas, up to 300 and 400 fathoms (Fernández, 1976; Lart et al., 2001). In Figure 6 the differences can be observed.

Furthermore, the boats targeting megrim use bottom trawl gear with little vertical opening, between 1.5 and 2.0 metres, while the gear for hake open somewhat more, between 2.5 and 3.0 metres on average (J. Etchevers and H. González, pers. comm.). The small vertical opening in both fishing métiers could influence the low cod catch of both fleets. However, the relatively greater abundance of cod linked to shallower depths appears to be the key factor in the differences and in the low cod catch because is the megrim fleet, which has a smaller vertical opening, and fishes in shallower waters catches more cod.

As for the longline fleet, they are vessels that clearly target hake, according to the results of the 1994 sampling programme (Pérez et al., 1996a, 1996b). This gear has a high specific selectivity (around 80% of the total catch are hake), and low percentage of discards (only between 2 and 2.5% of the catch is discarded). Owing to both of these factors, observers were no longer sent to sample this métier and since then all the effort of the observer programs has been focussed on the trawler fleet.

Within the percentages mentioned above the longliners with an observer on-board only made a token cod catch from 370 hauls observed (165 fishing days, 3638 fishing hours). This was probably also due to the depths at which these vessels operate, such as the shelf-breaks of the Celtic Sea and in Divisions VIIjh (Pérez et al., 1996). Only in the few hauls in the shallower strata (depth of 100-200 m) were some cod specimens caught by longliners, 1.6% of the total catch.

As for bottom set gillnets (in Spanish called *Volanta*), also targeting hake, we only have direct information from the scientific observer on-board a Pilot Action of Experimental Fishing (code RAI-AP-3/2006) carried out at the south-eastern cliffs of the Division VIIj and SW of the VIIIh, between September and October 2006. Nets of 100, 110 and 120 mm (Fariña, 2007) were used in order to observe the selectivity of the three sizes. Of the 69 hauls carried out using the three sizes of net, not one specimen of cod was

caught with any of three trial nets, possibly, as was mentioned previously, because cod are not commonly found at the depths at which the fishing took place (around 400 m depth). This first experience indicated that bottom set gillnet gear targeting hake has very little by-catch and discards (4%). Hake was 93% of the total biomass caught in the experimental fishing (total catch 15.8t).

4.- Catches from the PORCUPINE 2001-2007 bottom trawl surveys

Since 2001, with a new oceanographic Spanish ship “*Vizconde de Eza*” of the SGPM, the IEO put in action a series of bottom trawl surveys known as “PORCUPINE” to the west of Ireland, in Divisions VIIbck of the ICES (Porcupine bank and adjacent areas), with the aim of contributing to the knowledge of this fishery, given its importance for Spanish fisheries. The target species of these surveys are hake, megrim, anglerfish and Norway lobster.

Since then, there have been seven surveys carried out (2001-2007) of approximately 30 days duration each one and in the month of September of each year. The methodology of the surveys has been one of stratified random sampling design with bottom trawling gear. For more details consult ICES (2003), Velasco and Serrano, (2003).

During the surveys, faunal lists per haul of all fish, mollusks, crustaceans and other invertebrates caught were made. From these, abundance indices in number and weight by species, sector and depth strata and for the total of each cruise were obtained. In Figure 7 the situations of the hauls carried out each year are shown.

During the seven surveys carried out up to now, there has been a total catch of 457.5 t from the 568 hauls carried out (284 fishing hours), and with a total cod catch of 50.8 kg (17 specimens), which represents 0.01% of the total biomass caught and 0.18 kg per fishing hour. In Table 6 the partial cod results of each cruise are given.

The average catch in kg/30' haul fluctuates between zero and 0.21 kg/haul over the period considered. In the table 6 average values in weight and number with their stratified standard errors are given.

All the cod caught were concentrated in the shallowest strata, less than 300m (Table 7), mainly on the Irish shelf. Only in the first two years were some specimens caught in the Porcupine bank itself. In Figure 8, the location of the hauls and those in which cod specimens were caught are shown.

During surveys in recent years, 28 hauls intercalibration experiments with the *R/V Celtic Explorer*, of the Marine Institute of Ireland were carried out. There were also 17 special hauls outside the random stratified design, which in 2001 caught two cod specimens (11.4 kg) in the shallowest hauls (200m-250m) (Table 8).

The results indicate that cod numbers in the zones and depths covered by these cruises are very low: only few specimens appear nearly exclusively in the shallowest strata of those sampled on the Irish continental shelf and are practically absent in the zone of the Porcupine bank and its slopes.

Furthermore, in the seven surveys, 11 444 specimens of hake and 2 195 of anglerfish (*Lophius piscatorius* and *L. budegassa*) were caught, which indicate that hake is the main predator species in this fishery, and the anglerfish appear to be the ones for the benthic zone.

5.- Conclusions

- The situation of cod stocks in Divisions VIab and VIIbc, g-k of ICES are at very low biomass levels. The ICES recommended TAC zero in ICES Divisions VIa and VIIbc,g-k for 2008. These fisheries provided around 30 000 t of cod in the eighties.
- Spanish fishing in Subareas VI-VII has been focused on hake, anglerfish, megrim, and Norway lobster for many years (since 1930), and cod is a species that is very scarce in the catches.
- Cod by-catch of the hake fleet (including landings of no-Spanish vessels landing at Spain) is low, being 0.23% of the total landings from trawlers and 0.26% from longliners. Percentages from recent years including only vessels with Spanish flag were 0.02 for trawlers and 0.25 for longliners.
- According to the programmes of on-board scientific observers on commercial vessels, the cod catch of hake trawlers (*Merluccios*) is low, around 0.05% of the total, and the percentage of megrim fleet (*Rapanteros*) ones is 0.59%. The relatively greater catch of cod by trawlers of megrim is due to the shallower fishing areas they operate in, on the continental shelf, although far from coastal areas.
- Catches of cod identified by scientific observers on board in the longliners fleet targeting hake were minimal. Only a few specimens were caught in the hauls carried out at shallower depth.
- The bottom gillnet gear appears not to catch cod.
- There have only been testimonial catches of cod specimens during the PORCUPINE cruises, and only in the shallower stratum (< 300m).
- Spanish ships that fish in the Northeast Atlantic do not operate in areas where cod are abundant, such as the continental shelf of north and west Scotland (Divisions VIa) nor in the shallower area of Celtic Sea (Divisions VIIg and the eastern part of VIIh), nor do they have this species as a target.
- Neither were landings of cod by the Spanish fleet significant before the 200 mile extension of EEZ in 1977, thus it seems that the fishing effort of Spanish fleet has not contributed to the negative evolution of cod stocks between north Scotland and the Celtic Sea.

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	N, NW Scotland	Rockall	W Ireland - Celtic Sea		N, NW Scotland	Rockall	W Ireland - Celtic Sea		N, NW Scotland	Rockall	W Ireland - Celtic Sea
Year	VI a	VI b	VIIbc,g-k	Year	VI a	VI b	VIIbc,g-k	Year	VI a	VI b	VIIbc,g-k
1903	597		119	1938	5806	321	2332	1973	10515	1155	5238
1904	1059		274	1939				1974	13415	1151	3438
1905	1023	5	178	1940				1975	13163	243	4336
1906	5037	706	487	1941				1976	17405	1571	5234
1907	1955	1240	875	1942				1977	12619	168	2753
1908	9471	836	1268	1943				1978	13521	752	2890
1909	11803	997	1247	1944				1979	16242	670	3575
1910	21868	869	1909	1945				1980	17870	696	5737
1911	16772	433	319	1946	3784	51	1520	1981	23950	863	8868
1912	18002	187	1572	1947	6282	287	4135	1982	21965	373	7492
1913	15047	577	1141	1948	6673	389	2178	1983	21491	1106	6462
1914				1949	5047	367	1635	1984	20552	1023	7356
1915				1950	5144	242	1490	1985	18614	1973	8205
1916				1951	5826	269	1233	1986	11526	1601	9727
1917				1952	8628	211	1404	1987	19199	1298	9176
1918				1953	12417	252	2135	1988	19182	1886	12355
1919	8323	396	1487	1954	15024	651	2318	1989	15425	549	32208
1920	10745	577	4511	1955	15616	185	3283	1990	11777	1349	21655
1921	12935	587	4917	1956	15680	207	3850	1991	10628	1596	13158
1922	16373	894	3711	1957	10033	263	5135	1992	9022	1176	13339
1923	1090	327	1295	1958	17001	169	4989	1993	10475	1097	13871
1924	5990	924	1069	1959	13959	91	4401	1994	9131	661	14074
1925	5840	256	991	1960	11668	97	2705	1995	9660	1031	15819
1926	5596	91	1055	1961	10378	283	3161	1996	9580	775	16502
1927	6647	53	1071	1962	9747	301	2716	1997	6992	962	19101
1928	7093	291	1074	1963	13746	624	3252	1998	5671	661	19665
1929	6971	624	1060	1964	23164	973	5201	1999	3447	659	3963
1930	5733	292	1537	1965	23033	1189	7004	2000	3064	572	10772
1931	6524	348	2344	1966	17129	1522	15079	2001	2441	409	10133
1932	7877	178	2537	1967	23021	2189	5889	2002	2231	115	9478
1933	5264	168	3099	1968	24357	665	6102	2003	1299	102	6522
1934	4591	99	2292	1969	21739	2533	8830	2004	596	75	3755
1935	4078	168	2461	1970	12682	875	5367	2005	510	51	3176
1936	5144	288	2039	1971	10032	807	5801	2006	484	58	3341
1937	5454	187	2451	1972	8244	2218	3103				

Table 1.- Historical Evolution of cod landings for the north of Scotland to the Celtic Sea.

YEAR	COD	FISH	CRUSTACEANS	MOLLUSKS	TOTAL	% cod
1976	0.3	1897.5	129.9	88.9	2116.6	0.01
1977	57.6	31384.4	1558.4	810.9	33811.3	0.17
1978	46.1	28523.0	1834.2	761.7	31165.1	0.15
1979	111.0	26504.8	2251.9	381.0	29248.8	0.39
1980	170.0	34765.3	2693.9	397.2	38026.4	0.45
1981	481.9	33452.8	3340.5	446.4	37721.6	1.31
1982	455.3	35889.1	3909.7	610.7	40864.8	1.14
1983	464.2	32736.7	2960.7	250.2	36411.8	1.30
1984	252.6	35104.1	2878.5	138.8	38374.1	0.67
1985	480.9	31658.0	2981.0	251.8	35371.7	1.39
1986	298.0	28475.2	1611.7	207.3	30592.2	0.99
1987	301.7	33082.6	2013.1	576.1	35973.6	0.86
1988	631.4	35441.4	1937.2	764.3	38774.2	1.69
1989	210.3	22857.1	1512.8	708.3	25288.4	0.86
Total	3961.3	411772.1	31613.4	6393.7	453740.4	0.81

Table 2.- Landing of cod and other species at the port of A Coruña (1976 – 1989).

YEAR	OTTER TRAWL		LONGLINE		% COD	
	COD	TOTAL	COD	TOTAL	TRAWL	LONGLINE
1982			34.7	5619.3		0.62
1983	351.2	31840.3	83.1	4412.5	1.10	1.88
1984	245.1	32677.7	20.2	4305.8	0.75	0.47
1985	454.8	28164.9	47.7	5380.1	1.61	0.89
1986	279.8	23142.5	16.0	6412.6	1.21	0.25
1987	248.7	27594.9	53.0	8077.0	0.90	0.66
1988	558.9	25188.1	85.1	8794.1	2.22	0.97
1989	189.1	18017.0	44.1	6009.9	1.05	0.73
1990	172.1	16139.1	16.5	6172.3	1.07	0.27
1991	96.1	15064.9	7.3	5249.9	0.64	0.14
1992	71.9	14222.1	10.8	5342.5	0.51	0.20
1993	71.9	14222.1	10.8	5342.5	0.51	0.20
1994	72.9	15024.3	6.9	6524.3	0.49	0.11
1995	86.5	16024.3	2.7	5692.3	0.54	0.05
1996	44.2	14237.6	0.8	4451.7	0.31	0.02
1997*	0.1	4043.9	na	na	0.00	
1998*	na	na	na	na		
1999*	1.9	5141.4	5.7	844.4	0.04	0.68
2000*	3.1	5573.8	0.1	698.5	0.06	0.01
2001*	0.0	4159.5	1.3	547.7	0.00	0.24
2002*	0.9	3687.8	0.0	988.9	0.03	0.00
2003*	1.7	5716.3	0.0	976.7	0.03	0.00
2004*	0.8	5732.8	10.0	961.5	0.01	1.04
2005*	0.0	5646.0	0.0	691.1	0.00	0.00
2006*	0.0	5329.8	0.0	791.3	0.00	0.00
1999-2006	8,4	40.987,4	17,1	6.500,1	0,02	0,25

Table 3.- Cod landings and totals species (tonnes) by fishing gear at the port of A Coruña (1983 -1996).

* Information from samples of trips taken at wholesale fish market of A Coruña.

	No. boats			No. trips			No. hauls			Fishing hours		
	M	H	Total	M	H	Total	M	H	Total	M	H	Total
1988	6	8	14	6	8	14	190	289	479	812	1139	1950
1989	5	2	7	5	3	8	136	96	232	615	631	1246
1994	9	6	15	10	10	20	369	334	703	1640	2025	3665
1999	4	2	6	4	2	6	181	49	230	698	278	975
2000	7	2	9	7	3	10	302	86	388	1210	439	1649
2003	7	2	9	7	2	9	316	55	371	1193	342	1535
2004	8	3	11	8	3	11	339	61	400	1255	375	1630
2005	7	3	10	7	3	10	277	60	337	972	337	1309
2006	9	4	13	9	4	13	302	75	377	1033	429	1462
Total				63	38	101	2412	1105	3517	9428	5993	15421

Table 4.- Intensity of sampling programme by on-board observers (1988 – 2006).

R = OTB-MEG/MNZ-7 (Megrim fleet or *Rapanteros*), and M = OTB-HKE-7 (Hake fleet or *Merluceros*).

	% Catch / Total Catch		% Retained/ Total Retained		% Discards/Total Discards		kg/Catch trip	
	M	H	M	H	M	H	M	H
	1988	0,31	0,04	7,27	1,02	0,00	0,00	520
1989	1,80	0,00	0,05	0,00	0,00	0,00	392	0,0
1994	0,91	0,01	1,93	0,02	0,02	0,00	357	2,5
1999	0,64	0,01	2,25	0,29	0,00	0,00	377	1,8
2000	0,46	0,00	1,09	0,00	0,00	0,00	297	0,0
2003	0,53	0,00	2,14	0,00	0,00	0,00	548	0,0
2004	0,10	0,02	0,14	0,04	0,05	0,00	120	8,2
2005	0,21	0,36	0,50	0,14	0,10	0,58	225	200,0
2006	0,37	0,00	1,04	0,00	0,16	0,00	345	0,0
average	0,59	0,05	1,82	0,17	0,04	0,06	354	38,4

Table 5.- Results of the on-board observers' programme (1988 – 2006). Average values of cod caught per trip. R = OTB-MEG/MNZ-7 (Megrim fleet), and M = OTB-HKE-7 (Hake).

				Stratified averages and standard errors			
Year	Sets	kg	N	kg	SE	N	SE
2001	80	13.0	6	0.159	0.089	0.073	0.039
2002	86	19.1	3	0.207	0.199	0.033	0.024
2003	80	0.0	0	0.000	0.000	0.000	0.000
2004	70	5.1	2	0.067	0.050	0.026	0.018
2005	76	3.5	2	0.049	0.038	0.028	0.019
2006	79	0.4	1	0.006	0.006	0.013	0.013
2007	80	9.2	3	0.120	0.076	0.039	0.021

Table 6.- Number of hauls, catches and cod yields during the PORCUPINE surveys (2001–2007). SE: standard error. N= Number of cods.

				Strata A <300 m			
Year	Hauls	kg	N	kg	SE	N	SE
2001	16	13.0	6	0.814	0.455	0.375	0.202
2002	18	19.1	3	1.059	1.018	0.167	0.121
2003	16	0.0	0	0.000	0.000	0.000	0.000
2004	15	5.1	2	0.342	0.256	0.133	0.091
2005	14	3.5	2	0.252	0.195	0.143	0.097
2006	15	0.5	1	0.032	0.032	0.067	0.067
2007	15	9.2	3	0.613	0.386	0.200	0.107

Table 7.- Number of hauls, catches and yields of cod during the PORCUPINE surveys (2001 – 2007) in the shallowest strata. SE: standard error. N= Number of cods.

Data Extra Hauls			
Year	Hauls	kg	N
2001	3	11,4	2
2002	0	0,0	0
2003	1	0,0	0
2004	0	0,0	0
2005	2	0,0	0
2006	6	0,0	0
2007	5	0,0	0

Table 8.- Results of cod catches from special hauls (not included in the stratified sampling design during the PORCUPINE surveys. N= Number of cods.

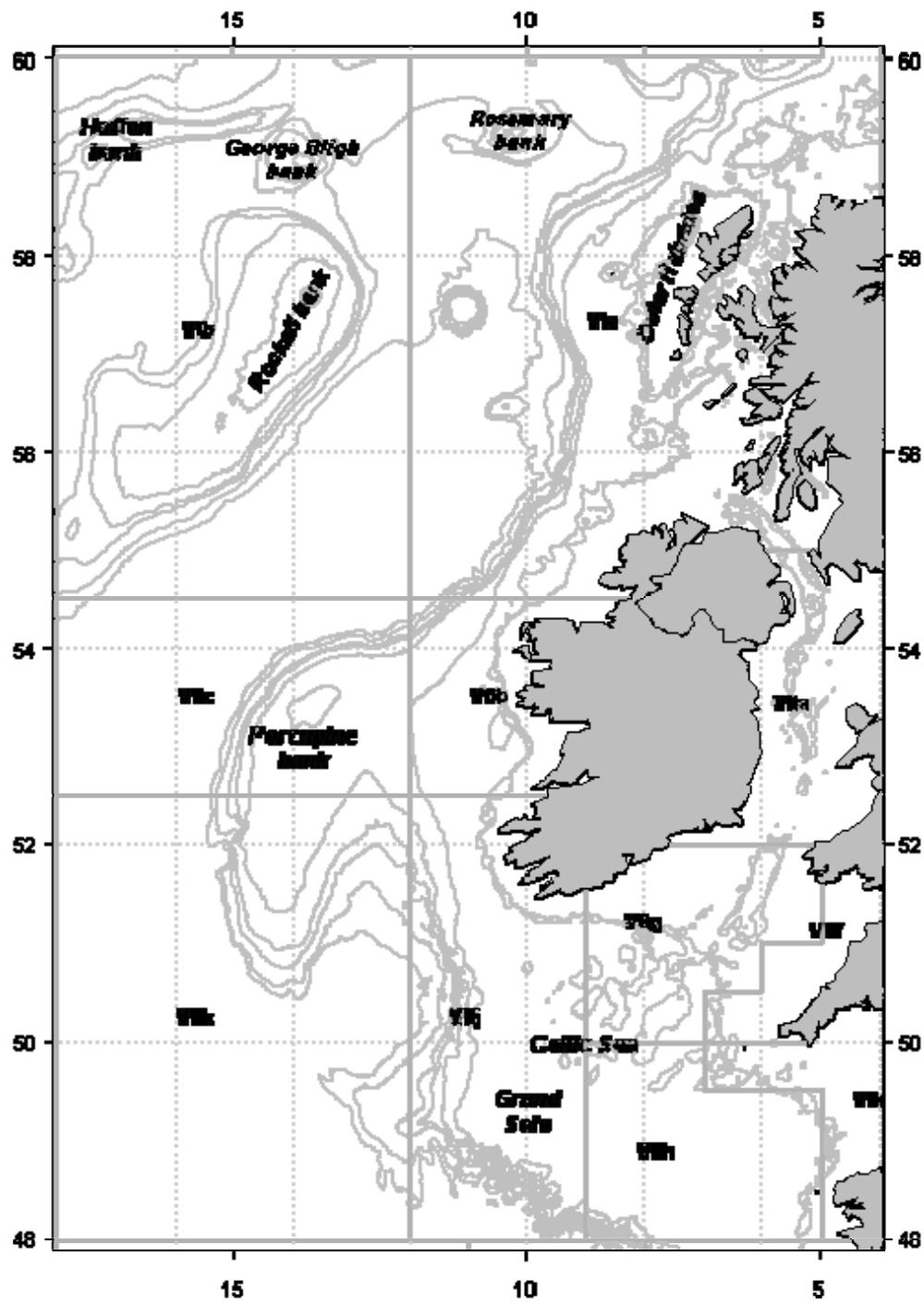


Fig. 1.- Fishing grounds and ICES divisions between the north of Scotland and the Celtic Sea.

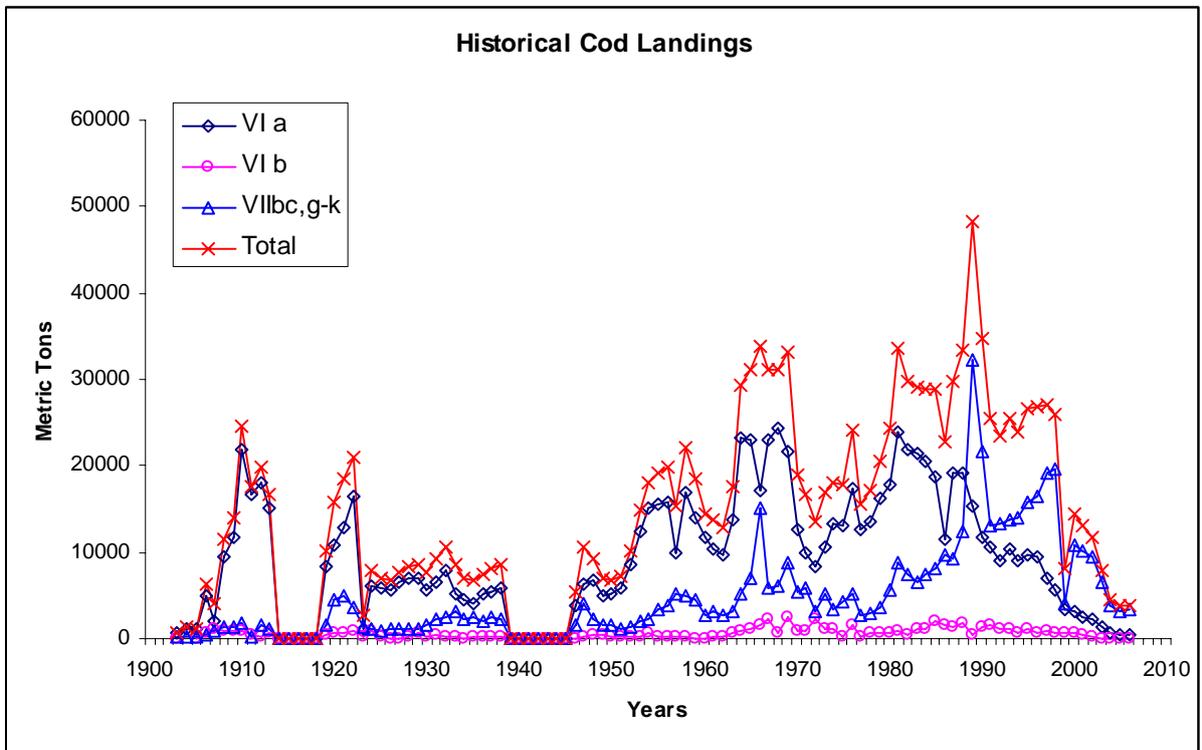


Fig. 2.- Historical development of cod landings between the north of Scotland and the Celtic Sea, by ICES Division.

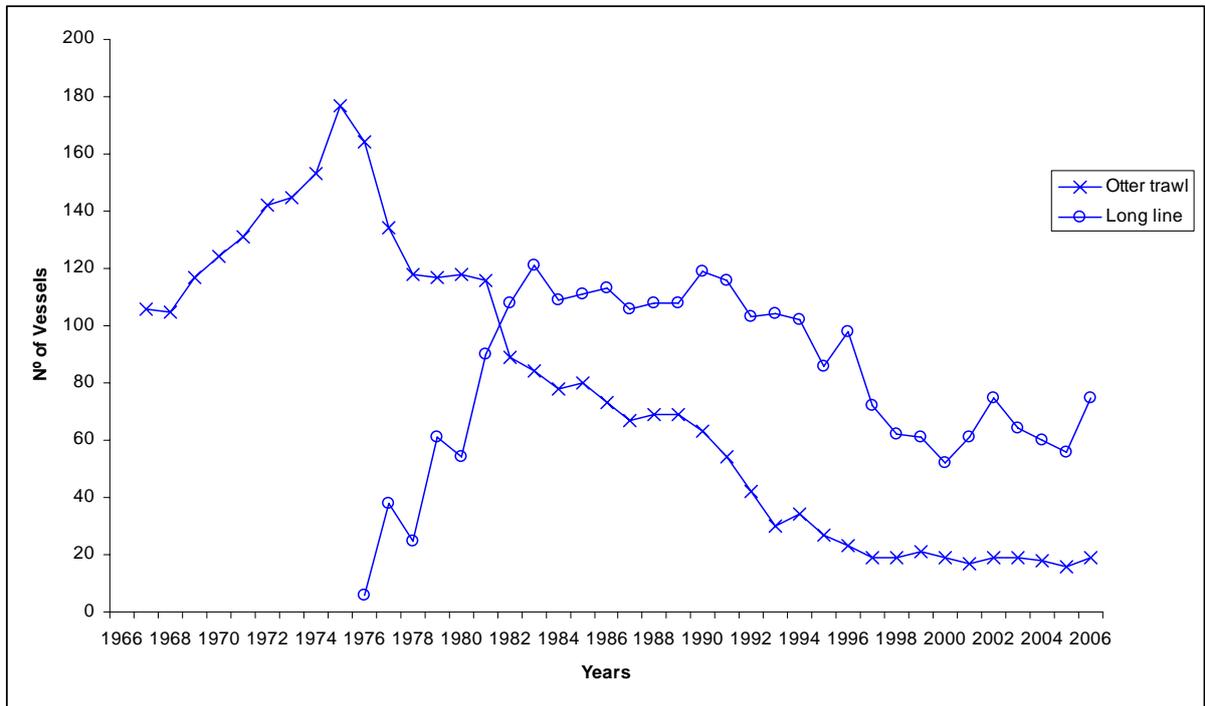


Fig. 3.- Evolution of the trawler (A Coruña) and longline (A Coruña, Celeiro and Burela) fleets from Northern Galician ports.

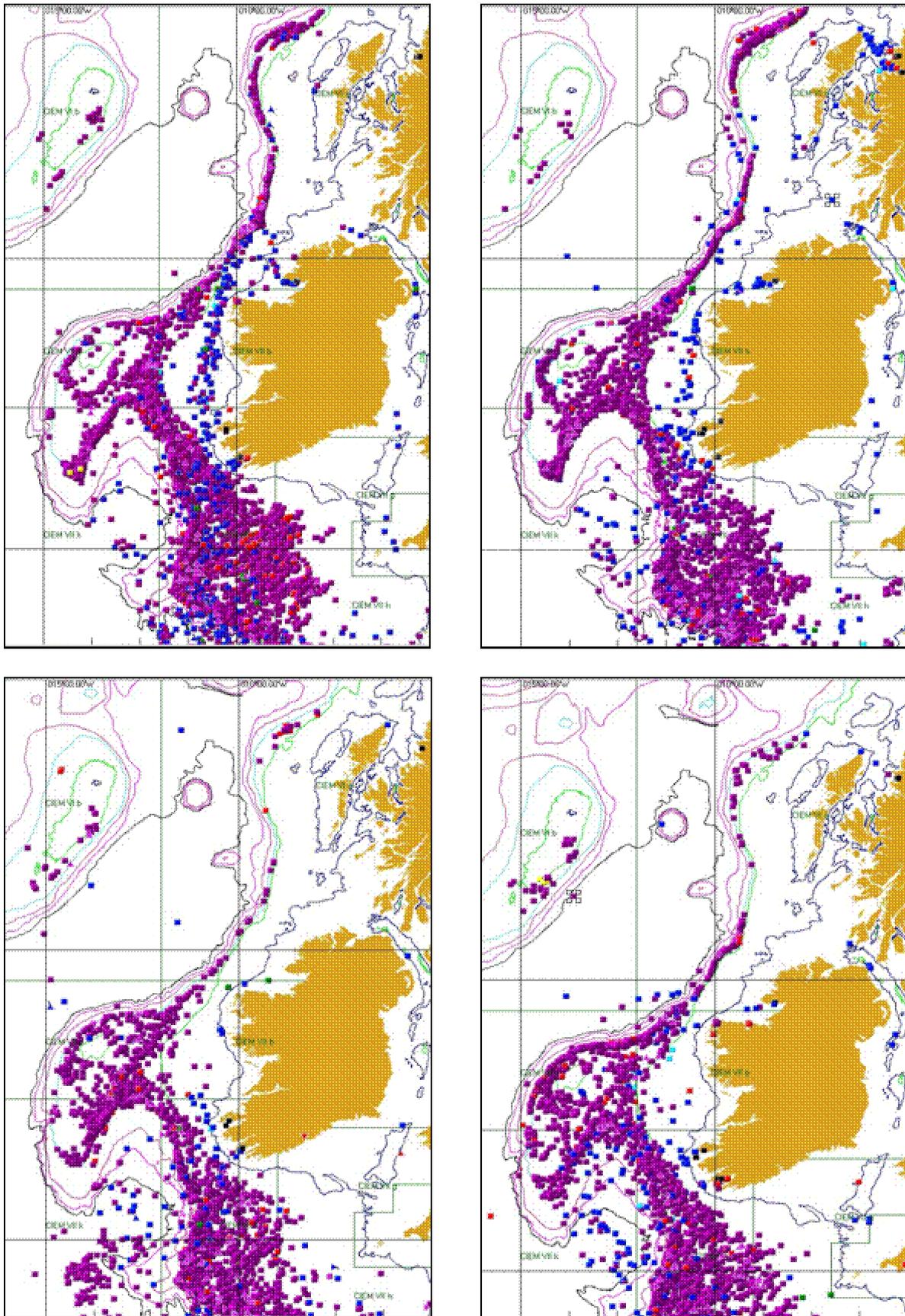


Fig. 4.- VMS positions of the Spanish fleet in 2006 by quarters. The blue dots correspond to navigation. The system registers one position per boat per day.

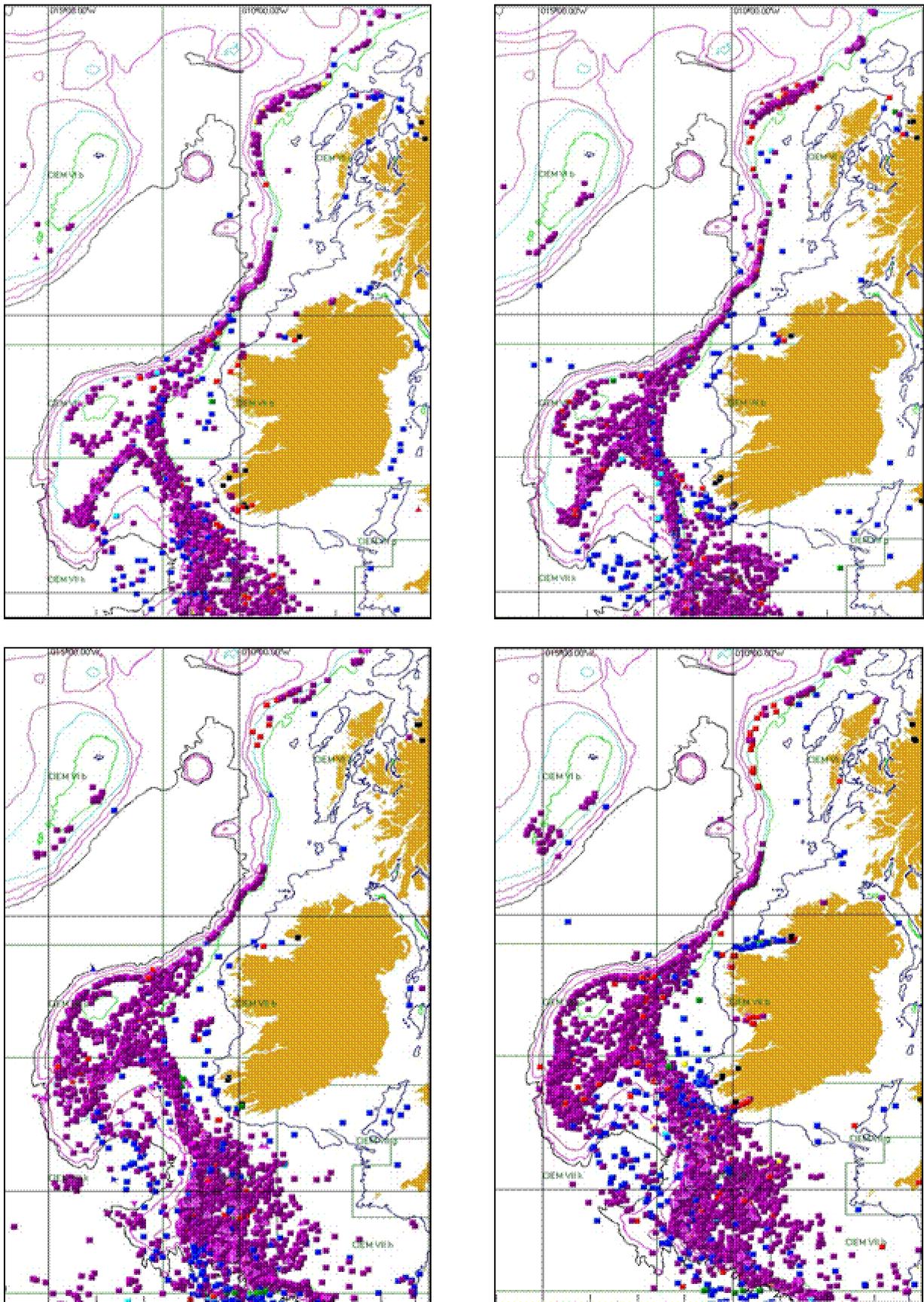
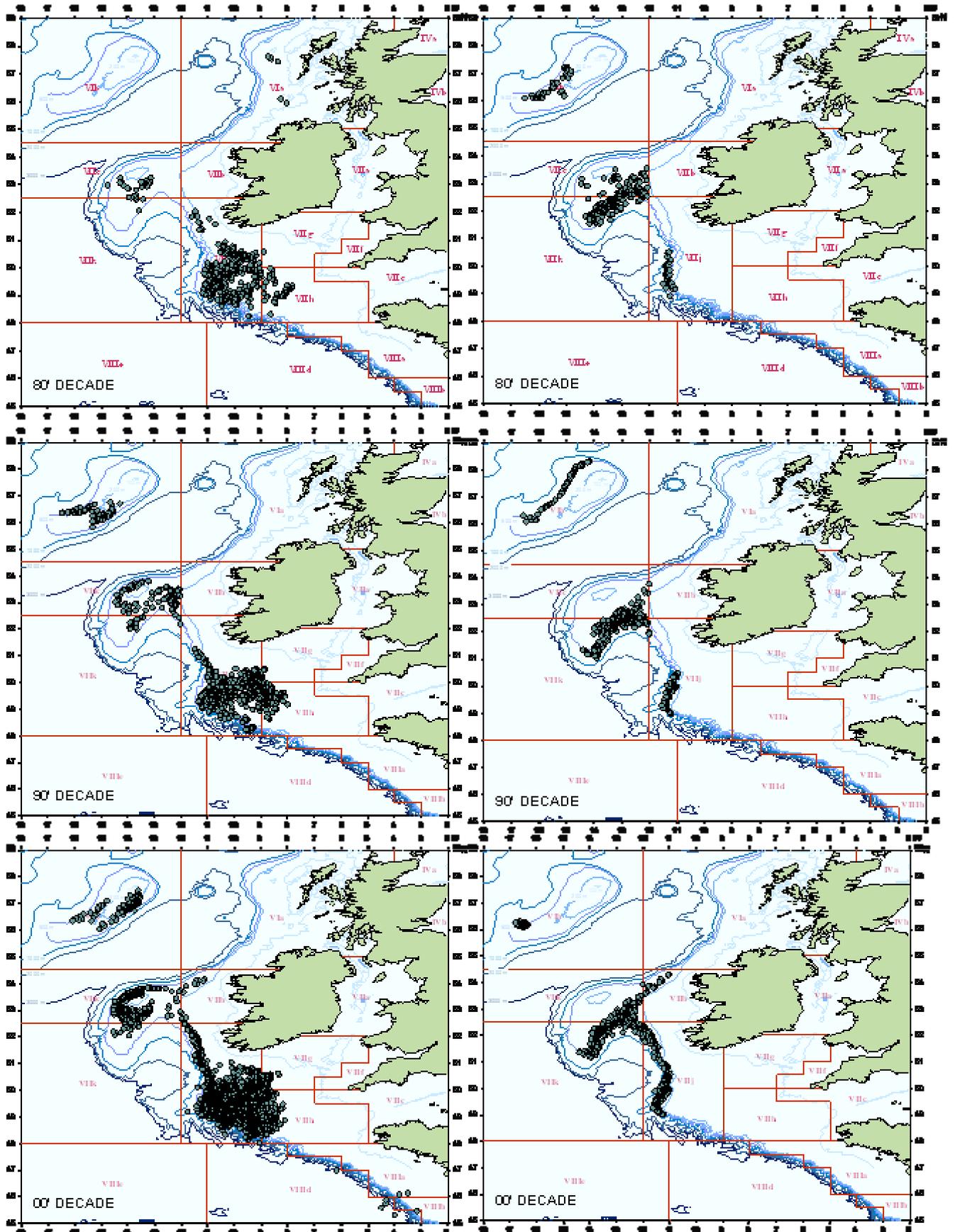


Fig. 5.- VMS positions of the Spanish fleet in 2007 per quarter. The blue points correspond to navigation. The system registers one position per boat per day.



Figs. 6.- Hauls positions with on-board scientific observer per decade of the megrim fleet (left) and of the hake fleet (right).

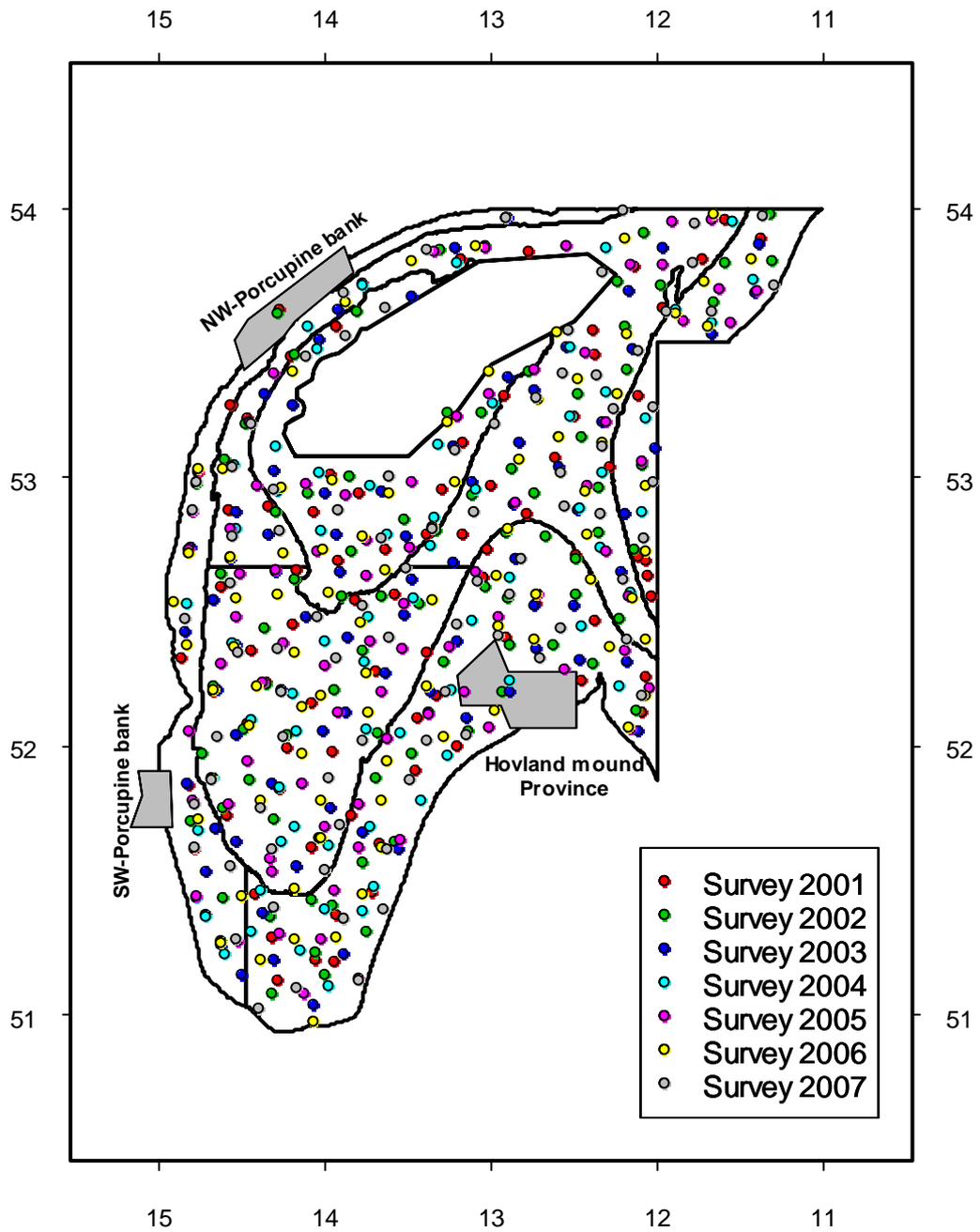


Fig. 7. Map of the hauls carried out during the seven Porcupine surveys.

Gadus morhua

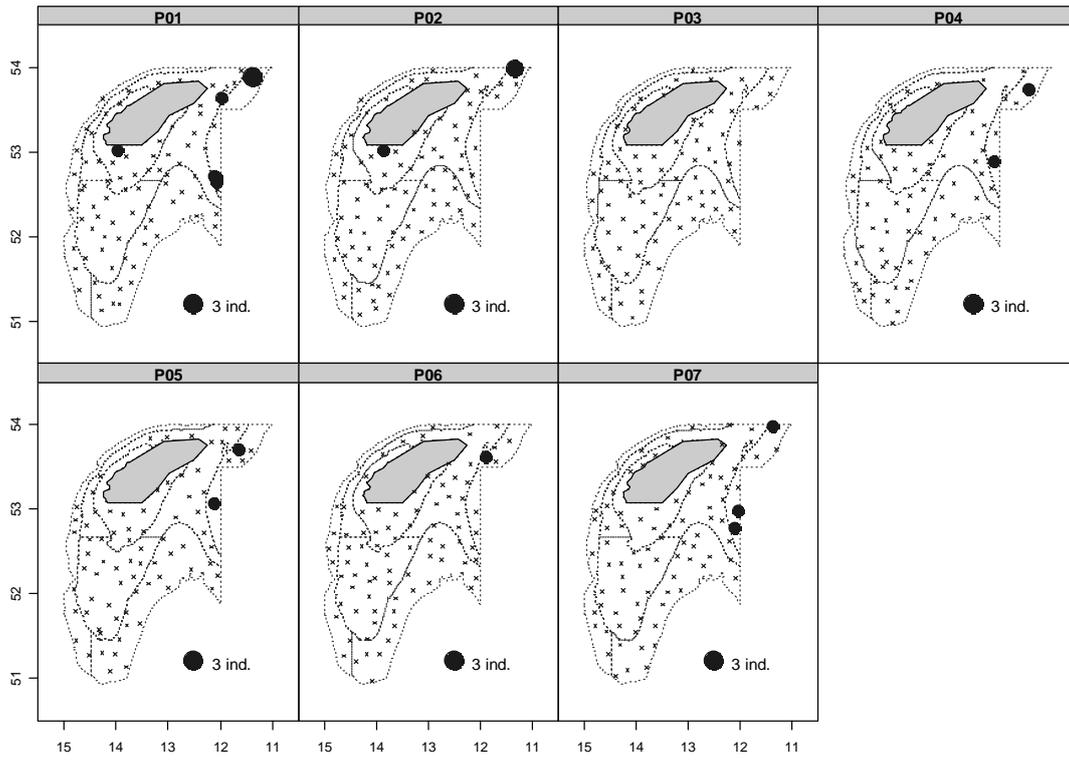


Fig. 8.- Cod catch distribution in numbers obtained during the PORCUPINE surveys.