# HISTORICAL DATA AND STANDARDIZED CATCH RATES OF PORBEAGLE (*LAMNA NASUS*) CAUGHT AS BY-CATCH OF THE SPANISH SURFACE LONGLINE FISHERY TARGETING SWORDFISH (*XIPHIAS GLADIUS*) IN THE ATLANTIC OCEAN

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*SUMMARY*

*Standardized catch rates of porbeagle shark (*Lamna nasus*) were obtained from 15 458 trip observations of surface longline targeting swordfish, during the period 1986-2007. In roughly 12% of these trips at least one individual belonging to this species was found. Because of the low prevalence of this species in this fishery, standardized CPUE was developed using GLM procedures assuming a delta-lognormal distribution error. A base case run and alternate runs were done. The base case run suggests a moderately decreasing trend between 1986 and 1996, a period of stability until the year 2000 and a slight increase thereafter. The results obtained using only the traditional style longline with some data restrictions indicate that the trend was substantially stable from 1986-2000. The results obtained show standardized CPUE trends that were very similar for the whole time series, regardless of the type of analysis conducted. Scientific estimations of annual catches for the period 1997-2008 have also been updated.*

*RÉSUMÉ*

*Des taux de capture standardisés de requin-taupe commun* (Lamna nasus*) ont été obtenus à partir de 15.458 sorties de palangriers de surface dirigées sur l'espadon, pendant la période 1986-2007. En ce qui concerne environ 12% de ces sorties, au moins un spécimen de cette espèce a été localisé. En raison de la faible prévalence de cette espèce dans cette pêcherie, la standardisation de la CPUE a été réalisée au moyen de procédures GLM postulant une distribution d'erreur delta-lognormale. Des scénarios de cas de base et d'autres scénarios ont été élaborés. Les résultats du cas de base suggèrent une tendance légèrement décroissante entre 1986 et 1996, suivie d'une période de stabilité jusqu'en 2000 et une légère augmentation par la suite. Les résultats obtenus en n'utilisant que la palangre traditionnelle, avec certaines restrictions de données, affichent une tendance de plus grande stabilité entre 1986 et 2000. Les résultats obtenus présentent des tendances de CPUE standardisée très similaires pendant la totalité des séries analysées, indépendamment du type d'analyse réalisée. Les estimations scientifiques des captures annuelles ont également été mises à jour pour la période 1997-2008.*

*RESUMEN*

*Se obtuvieron tasas de capturas estandarizadas del marrajo sardinero (*Lamna nasus*) a partir de 15.458 mareas de palangreros de superficie dirigidos al pez espada, observadas entre los años 1986 y 2007. En aproximadamente el 12% hubo presencia de al menos un individuo de esta especie. Debido a la baja prevalencia de esta especie en esta pesquería, la estandarización de la CPUE fue realizada mediante GLM asumiendo una distribución de error delta-lognormal. Se realizaron análisis de caso básico y otros ensayos restringiendo las observaciones. Los resultados del caso básico sugieren una tendencia ligeramente decreciente entre 1986 y 1996, seguida de un periodo de estabilidad hasta el año 2000 y un ligero incremento a partir de dicho año. Los resultados obtenidos usando sólo el palangre tradicional, con algunas restricciones en los datos, ofrecen una imagen de mayor estabilidad entre 1986-2000. Los resultados obtenidos muestran, en general, tendencias de CPUE estandarizada bastante similares a lo largo de la serie analizada, independientemente del*

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*análisis realizado. Se actualizaron también estimaciones científicas sobre capturas anuales de marrajo sardinero para el periodo 1997-2008.*

*KEY WORDS*

*Porbeagle, catch, CPUE, GLM, abundance index*

## 1. Introducción

The porbeagle (*Lamna nasus*) is a large, highly migratory pelagic shark belonging to the Family Lamnidae present in Atlantic (including the Mediterranean Sea) and also in some areas of other oceans. The temperature in the brain and eyes of the porbeagle is 5°C warmer than the water because the *rete mirabile* is present in this species. This brain and eye warming system seems to buffer the central nervous system from the effects of rapid temperature change (Carey and Teal 1969, Carey *et al*. 1985). The porbeagle is among the most cold-tolerant of the pelagic sharks commonly found in the cold, continental offshore fishing areas as well as in the epipelagic layers of cold oceanic areas from the surface down to at least 700 m. It is usually distributed in waters colder than 18° and down to 1°C, although sporadic records of this species have been cited from warmer waters (Compagno 2001). This preference for cold water habitats with high prey availability conditions its geographic distribution, and in the Atlantic it is more prevalent in the boreal and austral regions near the respective continents. Tagging data suggest that this species carries out migratory movements that are relatively broad, seasonal and repetitive (Stevens *et al.* 1983, Stevens 1990, Francis *et al.* 2008, Kohler *et al.* 2002, Pade *et al.* 2009). Like many other large migratory fish species, it tends to segregate by size and sex, depending on biological processes (feeding, mating, gestation, parturition, etc.). Over the course of history, the greater or lesser extent to which individuals aggregate, depending on the zone and season, has had a major impact on the potential development of the fisheries of this species targeted by some of the Atlantic coast fleets -which have, in some cases, been operating for centuries- or it being caught sporadically or as bycatch, in others (Domingo *et al*. 2002, Matsunaga and Nakano 2002). This species is mainly caught in cold waters at temperatures between 5º-10º (Campana and Joyce 2004).

In addition to the target fisheries that have historically developed in the Atlantic (Campana *et al*. 2002, Anon. 2004, ICES 2007, Campana and Gibson 2008), the porbeagle may be caught sporadically as bycatch in a variety of fisheries-gears in the Atlantic Ocean including surface and bottom longlines, pelagic and bottom trawls, gillnets and handlines. Some of these gears are used for targeting tuna or tuna-like species, but the areas having the most intense fisheries directed at tuna or tuna-like species are usually located outside the major porbeagle distribution areas or in their margins owing to high thermal dependence of tuna or tuna-like species and the fact that they have a preference for temperate and/or warm waters.

According to FAO data, the mean annual catches of porbeagle from 1999-2006 amounted to roughly 1 442, 27 and 1 469 t/yr in the North and South Atlantic, and the whole Atlantic, respectively (Fernández-Costa and Mejuto in press). However, these estimations may not be realistic because of the small amount of species-level data recorded, the partial report of catches, incorrect species identification-assignment, etc. Catches of other similar sharks may be inaccurately identified as porbeagle in some cases, which would lead to disproportionate amounts being declared in regard to other shark species that are close in taxonomic relation.

The International Commission for the Conservation of Atlantic Tunas (ICCAT) reported nominal annual catches of porbeagle in the Atlantic of about 500 t/yr during the period 2005-2007, mostly from North Atlantic areas (ICCAT 2009). However, roughly 70% of the catches in the North Atlantic were reported by only one country and in most cases they pertained to target fisheries in the NE Atlantic unrelated to the fishery of tuna or tuna-like species (Gauld 1989, Poisson and Seret 2009). The different interpretations of the ICCAT recommendations on sharks [Res. 01-11] [Rec. 04-10] [Rec. 05-05] and [Rec. 07-06] by the contracting parties may have led to some confusion as to what kind of shark data should be reported to the ICCAT. Porbeagle catches in the ICES areas indicate that historically some countries have carried out important fisheries in the North Atlantic, but this activity has been greatly reduced in recent years. Catches declared in these areas total around 300-500 t/yr, most of which are reported by only one country (ICES 2007). Porbeagle catches in the NAFO areas (areas 2-6) point to the occurrence of important fisheries at the close of the past century, with annual catches amounting to a maximum of 9 200 t, while the mean annual catch totalled 483 t from 1999 to 2006. Some countries like Norway, Canada the Faeroe Islands, have carried out important fisheries in the NW Atlantic, but current landings have diminished substantially in comparison with their historical records.

The Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) has sporadically caught porbeagle as a low prevalent by-catch, with the two most prevalent shark species being blue shark (*Prionace glauca*) and, to a lesser extent, shortfin mako (*Isurus oxyrinchus*). The first descriptions citing porbeagle as a low bycatch species in this fishery date from the early eighties, when part of this fleet was operating in the NE Atlantic, generally between 35º-50º N latitude (Mejuto and González-Garcés 1984, Mejuto 1985). These authors estimated catches for this fleet of 28 t and 20 t with catch rates of 2.07 and 1.1 (kg/1000 hooks) for years 1983 and 1984, respectively. Data on size at sex, sex-ratios and size-weight relationships by sex etc., were also reported. During those years, approximately 62% of the catch in weight was made up of females. During the same period, the porbeagle accounted for 6.6% of the catch of shortfin mako and porbeagle combined. However, in subsequent years, due to the fact that this fleet changed fishing grounds, moving toward the South and West, it would be possible to predict a considerable reduction of this ratio in later periods. Other authors have also reported the presence of porbeagle as a sporadic bycatch in this Spanish fleet (González-Garcés and Rey 1984, Rey *et al*. 1988, Moreno 1992, Buencuerpo *et al*. 1998). Contrary to what occurred historically with the blue shark, no porbeagle discards have been reported in the whole time series studied. Therefore the landings and catches may, in this case, be considered equivalent terms.

From 1997 onward, as a consequence of the start of ICCAT recommendations on shark species caught in association with the fisheries of tuna or tuna-like specie in this convention area, a research project was launched in Spain for the following purposes: to conduct out a study on the specific composition of the bycatch of this fishery, to carry out a scientific estimation of the catch levels; to identify possible data deficiencies and to propose actions to improve the statistics on these species, including the porbeagle which is found at very low prevalence (Mejuto *et al.* 2009). According to these authors, the mean annual catch of porbeagle from years 1997-2006 ranged between 24.5 t and 3.1 t in the North and South Atlantic, respectively. The porbeagle accounted for 0.11% and 0.03% of the catch in weight of the pelagic sharks landed (species combined) in each of these Atlantic areas, respectively. As regards the two most prevalent Lamnidae species of those commonly known in Spain as "*marrajos*" (*I. oxyrinchus* and *L. nasus*), which are often the cause of confusion in terms of statistics, during the above period the porbeagle catch was 1.21% and 0.31% for both species combined in each Atlantic area respectively, or 0.93% for the two areas of the Atlantic combined. This would suggest that a similar ratio for the two species would be expected in the different statistical sources, particularly after 1996. Although this prevalence was greater for earlier periods in the areas where the fleet was operating, it would not be much greater than 6.6%, as was reported at the beginning of the eighties.

This document analyzes scientific records gathered from the mid 1980s in order to obtain the standardized catch rates for the North Atlantic where this surface longline fleet has traditionally operated. The scientific estimates provided by the ICCAT on the catch level of porbeagle as bycatch of the Spanish surface longline have also been updated.

## 2. Material and methods

The annual catch data on the porbeagle were updated following the methodology previously applied (Mejuto *et al.* 2009). The standardized CPUE was obtained based on previous works carried out on the Spanish longline fleet in the Atlantic and used in the CPUE analysis of different Atlantic longline fleets (Mejuto and De la Serna 2000, Ortiz *et al.* 2007). The data used in this case consisted of trip information obtained under research activities covering the period 1986-2007. Data on porbeagle catches per trip were recorded. The nominal fishing effort was defined as thousands of hooks per trip estimated from the number of sets times the mean number of hooks per set during the trip. The nominal CPUE was calculated as kilograms of round weight caught per thousand hooks. The traditional surface longline gear of the Spanish fleet in the Atlantic has remained relatively constant over the past few decades in terms of general structure and configuration (Rey *et al*. 1988, Hoey *et al*. 1988). There have been some technological improvements in the traditional fishing gear over this period within Atlantic Ocean, generally allowing for a greater number of hooks per set which were appropriately considered as nominal effort in the analysis. However, around the year 2000 the monofilament units or so-called "American style" were suddenly and widely introduced in most fishing areas-boats. The two styles of gears were categorized in this analysis; the traditional multifilament and the new monofilament or "American style". The spatial definition for GLM runs considered 7 zones (**figure 1**). The temporal definition corresponding to 'quarters' was: Q1 = January, February, March; Q2 = April, May, June; Q3 = July, August, September; Q4 = October, November, December.

The standardization of the porbeagle CPUE (in kg round weight per thousand hooks) was carried out by two independent groups using GLM procedures. One group used all of the available information with no restrictions

to evaluate the variables and levels of the raw data, without any previous detailed knowledge of the history of the fishery. The factors 'year', 'zone' 'quarter', 'gear' and 'bait' and their interactions were tested and modeled as the *base case*. The second group carried out alternative analyses, using different restrictions based on the empirical knowledge of the fishery, taking into account possible uncertainties in some of the data and omitting certain zones from the analysis not considered to be representative, etc. The models finally defined in the latter case were split into the traditional longline period (1996-2000) vs. the American style period (2000-2007). The main factors considered were 'year', 'quarter' and 'zone'. Zones 1 and 4 were not included in the analysis conducted on the traditional longline, while all the available observations were used for the American style longline.

The significance of the factors tested was evaluated at α=5%. Owing to the extremely low prevalence of porbeagle in the surface longline, only around 12 % of the trip observations presented a positive catch and the rest reported zero catch. So, the standardized catch rates were estimated assuming a delta–lognormal model error distribution. Under this model, both the catch rates of positive sets and the proportion of positive sets were fitted separately (Lo *et al.* 1992, Ortiz and Arocha 2004). The response variables considered were logged catch rates (RW kg) and the proportion of positive sets, respectively. The mean catch rate of positive sets was modelled assuming a lognormal distribution. The proportion of positive sets (sets with at least one individual) was assumed to be the result of ***s*** successful trips of a total ***n*** number of trips, with each one representing the execution of an independent *Bernouilli* process, and modelled assuming a binomial error distribution. The final CPUE index was the product of these two components. The total deviance refers to that of the null model and P(>|Chi|) refers to consecutive models (*stepwise manner*) to identify the set of significant factors and interactions that explain the greatest variability.

## 3. Results and discussion

**Table 1** presents an update of the scientific estimations of the annual porbeagle catch (kg in round weight) in the fishery of the Spanish surface longline fleet targeting swordfish in the ICCAT-BIL regions, during the 1997-2008 period. **Figure 1** summarizes the number of individuals caught in the trips observed during the 1986-2007 period in the 7 zones defined. Most of the accumulated captures were observed in some of the NE Atlantic regions where this fishery operated preferentially in the eighties, prior to the geographic expansion to the NW Atlantic and South Atlantic. **Table 2** summarizes the number of observations (trips) and the fishing effort by year and gear type. **Figure 2** presents a summary of the number of fishing days (sets) observed in the different zones, quarters and years, by gear type. The traditional longline was commonly used between 1986 and 2000 in most of the zones defined with the exception of zones 1 and 4. Zone 1 is the most recently accessed by this fleet, which is why the traditional longline is barely found. The traditional longline appears in zone 4 only sporadically during certain years and quarters. Also observed in this zone during some summer seasons in the eighties were porbeagle concentrations along with the presence of large specimens of female swordfish and a high local abundance of small pelagic teleosts which are often preyed upon by both species. Some of the trips carried out during the above years may have taken advantage of these sporadic local concentrations of porbeagle. Starting in 1999 the American style longline was gradually introduced in most zones, largely replacing the traditional longline. For this reason, some of the alternative analyses that were carried out excluded some of the zones in the period 1986-2000 and others performed from 2000-2007 separated the longline gears into two categories.

The *base case* data using all the time series suggest that there is some overlapping between the two types of fishing gear (**Table 2**). Although the monofilament quickly replaced the traditional multifilament longline, between 2000 and 2003 there appears to be a sufficient number of observations for the model to compare the effect of the two types of gear on porbeagle catch rates. The analysis of deviance (**Table 3**) highlights the main factors and factor-interactions that reduce the overall deviance by more than 5% of the full model (model with all factors and possible interactions that provided a solution) of both the positive only observations model and the proportion of positive model components. The proportion of positive components serves to model the probability of capturing a porbeagle shark (at least one) in a trip. The results indicated that year, zone, quarter and type of bait were major factors, but the interactions of year*zone, year*quarter and year*bait may also contribute to the variability observed. The type of gear had no effect on the probability of capture. Since the objective was to provide a relative annual index of abundance, interactions, particularly those involving the year factor, can not be included as a fixed interaction in the model. Alternatively, year interactions may be considered random interactions (Maunder and Punt, 2004), where the estimated variance due to interaction is incorporated into the annual trend along with its estimated standard error. For the positive mean catch rate *base case* model component, the deviance table (**Table 3)** indicated that year, zone and bait type were the main factors as well as the interactions year*zone, year*quarter and zone*quarter. The type of gear had a relatively minor effect

(statistically significant at the 5% alpha level but with a relatively low percent of the deviance explained) on the catch rates of porbeagle. **Table 4** shows the evaluation of the random interactions for the model. According to three different criteria; Akaike (AIC), Bayesian information (BIC) and the likelihood ratio test, the year*zone and year*quarter were significant and have been included in the final base case model. The evaluation of random interactions indicated that year*zone and year*quarter were significant. It is important to point out that bait had an opposite effect on both the probability of catch and mean catch rates of porbeagle. However, one of the categories of the factor included unknown or non-specified bait type. A review of the effect, showed that bait type 1 (mackerel) predicted higher catch rates, followed by bait type 6 (squid), while the lowest catch rates were for bait type 0 (unknown). **Figure 3** shows the residual pattern of log-transformed positive catch rates by main factors and qq-plot obtained for the *base case*. **Figure 4** provides the frequency distribution of log-transformed catch rates and residual patterns. **Table 5** and **figure 5** present the CPUE values obtained for the series analyzed as a whole. The results corresponding to the *base case* tend to support the whole time series used. Nonetheless, certain specific observations, especially during the most recent period, probably need further review owing to their great impact and leverage. The ICCAT&ICES working group for the assessment of porbeagle has specifically requested that the authors restrict additional base case runs to the Western and Eastern zones used in this paper. These CPUE estimations are provided in **Annex 1**.

The alternative analysis carried out on the traditional longline during the period 1986-2000 also provided satisfactory results. The deviance table analyses indicate that all main factors considered in this run were significant (T**able 6**). **Figure 6** shows the observed logged catch rates and the standardized mean values for the main factors modelled and F**igure 7** provides the distribution of the observed logged catch rates and qq-plot by year. **Figure 8** shows the residuals pattern obtained. Standardized CPUE values are provided in **Table 7** and **Figure 12.** The estimated CPUE values are at levels similar to the nominal CPUEs reported for Northern areas of the Atlantic at the beginning of the eighties (Mejuto and González-Garcés 1984, Mejuto 1985).

The results of the alternative analysis carried out on the American style longline during the period 2000-2007 were also satisfactory, although more variable. The deviance table analyses indicate that the main factors considered were significant (**Table 6**). **Figure 9** displays the observed logged catch rates and the standardized mean values for the main factors modelled and F**igure 10** provides the distribution of the observed logged catch rates and qq-plot by year. **Figure 11** shows the residual pattern obtained. Standardized CPUE values are provided in **Table 8** and F**igure 12.**

In general, the results point to similar CPUE trends in the different runs carried out. The *base case* results suggest a greater interannual variability in the CPUE during some of the periods and a moderately decreasing trend in the CPUE between 1986 and 1996, followed by a stable period until 2000, and a slight increase thereafter. However, the results from the most recent years, affected by the introduction of the new style of longline, were more variable than in previous periods. Further research is needed on this aspect. The results obtained using only the traditional longline and omitting some zones, show stable CPUE values between 1986-2000 and a moderate variability between consecutive years, which is in keeping with what would be expected in these types of longevous species with an oviparous reproductive strategy in which there is little likelihood of the occurrence of substantial changes in their abundance in biomass over short time periods. The analysis considering only the American style longline during the most recent period generated results that were similar to those obtained for the *base case* over the same time period, since this type of longline was largely operative during these years. A more detailed verification of the basic records from the years after 2000 would be advisable in order to verify the gear coding of some vessels. Additional studies on the effect of bait type should also be conducted. The preliminary analyses in the *base case* would suggest that this factor might be significant, but its effects appear to be the opposite between the proportion of positive sets and the CPUE obtained in the positive sets. Analyses should probably be restricted to the records where the type of bait is clearly identified. Since squid has started to be used as bait in the most recent period, particularly in association with the use of the American style longline and in specific regions, it is possible that the design of the observations may be causing these contradictory results. In any case, the general trends of the CPUEs obtained in the different runs, with or without bait as a factor, were similar.

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**Table 1.** Scientific estimations of annual catches (kg round weight) of porbeagle in the Spanish surface longline fishery of swordfish, during the period 1997-2008. Data for the period 1997-2006 were taken from (Mejuto *et al*. 2009).

| *Year* | *BIL94A* | *BIL94B* | *Total North* | *BIL96* | *BIL97* | *Total South* | *TOTAL ATL* |
|---|---|---|---|---|---|---|---|
| 1997 | 2715 | 22486 | 25201 | 0 | 2257 | 2257 | 27458 |
| 1998 | 9097 | 15589 | 24686 | 526 | 1298 | 1824 | 26510 |
| 1999 | 2762 | 15353 | 18115 | 0 | 1537 | 1537 | 19652 |
| 2000 | 4737 | 8420 | 13157 | 6938 | 0 | 6938 | 20095 |
| 2001 | 2588 | 21522 | 24110 | 0 | 505 | 505 | 24615 |
| 2002 | 5158 | 49196 | 54354 | 1127 | 1344 | 2471 | 56825 |
| 2003 | 2075 | 24444 | 26519 | 152 | 8587 | 8739 | 35258 |
| 2004 | 5108 | 5958 | 11066 | 273 | 3443 | 3716 | 14782 |
| 2005 | 7430 | 6516 | 13946 | 232 | 0 | 232 | 14178 |
| 2006 | 8854 | 24698 | 33552 | 2627 | 0 | 2627 | 36179 |
| 2007 | 6011 | 1952 | 7963 | 421 | 4752 | 5173 | 13136 |
| 2008 | 37210 | 3901 | 41111 | 3322 | 623 | 3945 | 45056 |

**Table 2.** Number of observations (trips) and effort (thousand hooks) by year and longline type.

| | *Traditional* | | *American* | |
|---|---|---|---|---|
| *Year* | *Nobs.* | *Effort* | *Nobs.* | *Effort* |
| 1986 | 522 | 14618.55 | 0 | . |
| 1987 | 332 | 10047.13 | 0 | . |
| 1988 | 558 | 14466.625 | 0 | . |
| 1989 | 577 | 14916.62 | 1 | 23.4 |
| 1990 | 692 | 19240.73 | 0 | . |
| 1991 | 711 | 19655.638 | 0 | . |
| 1992 | 644 | 19780.827 | 0 | . |
| 1993 | 753 | 21240.214 | 0 | . |
| 1994 | 798 | 24728.964 | 0 | . |
| 1995 | 995 | 32245.739 | 0 | . |
| 1996 | 1148 | 36583.789 | 0 | . |
| 1997 | 1176 | 40938.049 | 0 | . |
| 1998 | 1116 | 40510.768 | 4 | 37.638 |
| 1999 | 798 | 35865.025 | 19 | 422.45 |
| 2000 | 354 | 14874.388 | 301 | 6664.54 |
| 2001 | 217 | 4405.886 | 508 | 11681.728 |
| 2002 | 193 | 3571.358 | 552 | 13492.187 |
| 2003 | 144 | 3074.3 | 426 | 12199.093 |
| 2004 | 40 | 2179.2 | 537 | 12675.056 |
| 2005 | 21 | 752.4 | 491 | 13121.291 |
| 2006 | 5 | 186.6 | 419 | 11135.623 |
| 2007 | 2 | 105.8 | 404 | 10800.023 |

**Table 3.** Deviance table analyses of the factors tested in the *base case* model, for positive catch rates and for proportion of positives, respectively.

| *Model factors positive catch rates values* | *d.f.* | *Residual deviance* | *Change in deviance* | *% of total deviance* | *p* |
|---|---|---|---|---|---|
| 1 | 1 | 2641.9731 | | | |
| Year | 21 | 2318.8431 | 323.13 | 35.8% | < 0.001 |
| Year Zone | 6 | 1963.1202 | 355.72 | 39.4% | < 0.001 |
| Year Zone Quarter | 3 | 1938.7877 | 24.33 | 2.7% | < 0.001 |
| Year Zone Quarter Gear | 1 | 1934.958 | 3.83 | 0.4% | 0.050 |
| Year Zone Quarter Gear Bait | 2 | 1899.4662 | 35.49 | 3.9% | < 0.001 |
| Year Zone Quarter Gear Bait Gear*Bait | 1 | 1898.8831 | 0.58 | 0.1% | 0.445 |
| Year Zone Quarter Gear Bait Year*Gear | 6 | 1891.6756 | 7.79 | 0.9% | 0.254 |
| Year Zone Quarter Gear Bait Quarter*Gear | 3 | 1890.7872 | 8.68 | 1.0% | 0.034 |
| Year Zone Quarter Gear Bait Zone*Bait | 9 | 1887.9063 | 11.56 | 1.3% | 0.239 |
| Year Zone Quarter Gear Bait Zone*Gear | 6 | 1887.8053 | 11.66 | 1.3% | 0.070 |
| Year Zone Quarter Gear Bait Quarter*Bait | 6 | 1874.5028 | 24.96 | 2.8% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Bait | 22 | 1869.072 | 30.39 | 3.4% | 0.109 |
| Year Zone Quarter Gear Bait Zone*Quarter | 16 | 1813.4842 | 85.98 | 9.5% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Quarter | 62 | 1756.9553 | 142.51 | 15.8% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Zone | 97 | 1739.8184 | 159.65 | 17.7% | < 0.001 |

| *Model factors proportion positives* | *d.f.* | *Residual deviance* | *Change in deviance* | *% of total deviance* | *p* |
|---|---|---|---|---|---|
| 1 | | 3567.819 | | | |
| Year | 21 | 3223.179 | 344.64 | 15% | < 0.001 |
| Year Zone | 6 | 2515.264 | 707.91 | 30% | < 0.001 |
| Year Zone Quarter | 3 | 1709.705 | 805.56 | 34% | < 0.001 |
| Year Zone Quarter Gear | 1 | 1708.625 | 1.08 | 0% | 0.299 |
| Year Zone Quarter Gear Bait | 2 | 1496.900 | 211.73 | 9% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Gear | 10 | 1485.409 | 11.49 | 0% | 0.321 |
| Year Zone Quarter Gear Bait Quarter*Bait | 6 | 1473.781 | 23.12 | 1% | < 0.001 |
| Year Zone Quarter Gear Bait Quarter*Gear | 3 | 1462.938 | 33.96 | 1% | < 0.001 |
| Year Zone Quarter Gear Bait Zone*Bait | 12 | 1462.777 | 34.12 | 1% | < 0.001 |
| Year Zone Quarter Gear Bait Zone*Gear | 6 | 1455.456 | 41.44 | 2% | < 0.001 |
| Year Zone Quarter Gear Bait Zone*Quarter | 17 | 1360.108 | 136.79 | 6% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Bait | 39 | 1335.655 | 161.25 | 7% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Quarter | 63 | 1314.240 | 182.66 | 8% | < 0.001 |
| Year Zone Quarter Gear Bait Year*Zone | 117 | 1231.871 | 265.03 | 11% | < 0.001 |

**Table 4.** Porbeagle *(L. Nasus)* andom effects evaluation for the GLM *base case* analyses.

| *GLMixed Model* | *-2 REM Log likelihood* | *Akaike's Information Criterion* | *Bayesian Information Criterion* | *Likelihood Ratio Test* | | *Dispersion* |
|---|---|---|---|---|---|---|
| **Proportion Positives** | | | | | | |
| Year Zone Quarter Bait | 4782.6 | 4784.6 | 4789.5 | | | 1.9325 |
| Year Zone Quarter Bait *Year*Zone* | 4766.3 | 4770.3 | 4776.2 | 16.3 | 0.0001 | 1.8791 |
| Year Zone Quarter Bait *Year*Zone Year*Quarter* | 4696.6 | 4702.6 | 4711.5 | 69.7 | 0.0000 | 1.7307 |
| Year Zone Quarter Bait *Year*Zone Year*Quarter Year*Bait* | 4700.0 | 4708.1 | 4719.9 | -3.4 | N/A | 1.5671 |
| **Positives catch rates** | | | | | | |
| Year Zone Quarter Gear Bait | 5438.3 | 5440.3 | 5445.8 | | | |
| Year Zone Quarter Gear Bait *Year*Zone* | 5433.4 | 5437.4 | 5443.1 | 4.9 | 0.0269 | |
| Year Zone Quarter Gear Bait *Year*Zone Year*Quarter* | 5407.5 | 5413.5 | 5422 | 25.9 | 0.0000 | |
| Year Zone Quarter Gear Bait *Year*Zone Year*Quarter Year*Bait* | 5407.1 | 5415.1 | 5426.4 | 0.4 | 0.5271 | |

**Table 5.** Number of observations (trips) used in the *base case*, scaled nominal CPUE, scaled standardized CPUE and their confidence intervals and estimated values.

| *Year* | *N obs.* | *Nom. CPUE* | *Stand. CPUE* | *Lci* | *Uci* | *CV* | *Std. error* | *Nominal* | *Estimated* |
|---|---|---|---|---|---|---|---|---|---|
| 1986 | 522 | 0.527 | 0.826 | 0.427 | 1.599 | 34% | 0.139 | 0.962 | 0.409 |
| 1987 | 332 | 0.452 | 0.994 | 0.486 | 2.031 | 37% | 0.182 | 0.825 | 0.492 |
| 1988 | 558 | 1.885 | 2.208 | 1.241 | 3.927 | 29% | 0.322 | 3.441 | 1.094 |
| 1989 | 578 | 1.735 | 1.439 | 0.805 | 2.573 | 30% | 0.212 | 3.168 | 0.713 |
| 1990 | 692 | 0.720 | 1.151 | 0.639 | 2.074 | 30% | 0.172 | 1.315 | 0.570 |
| 1991 | 711 | 0.776 | 1.388 | 0.755 | 2.553 | 31% | 0.214 | 1.417 | 0.688 |
| 1992 | 644 | 0.300 | 0.670 | 0.338 | 1.327 | 35% | 0.117 | 0.548 | 0.332 |
| 1993 | 753 | 0.325 | 0.912 | 0.470 | 1.768 | 34% | 0.154 | 0.594 | 0.452 |
| 1994 | 798 | 0.799 | 1.765 | 1.014 | 3.075 | 28% | 0.247 | 1.459 | 0.875 |
| 1995 | 995 | 0.245 | 0.668 | 0.349 | 1.281 | 33% | 0.111 | 0.447 | 0.331 |
| 1996 | 1148 | 0.725 | 0.460 | 0.240 | 0.882 | 33% | 0.076 | 1.323 | 0.228 |
| 1997 | 1176 | 0.310 | 0.473 | 0.242 | 0.924 | 34% | 0.081 | 0.566 | 0.234 |
| 1998 | 1120 | 0.276 | 0.613 | 0.328 | 1.143 | 32% | 0.097 | 0.505 | 0.303 |
| 1999 | 817 | 0.289 | 0.568 | 0.298 | 1.082 | 33% | 0.093 | 0.529 | 0.281 |
| 2000 | 655 | 0.368 | 0.538 | 0.257 | 1.125 | 38% | 0.102 | 0.671 | 0.267 |
| 2001 | 725 | 0.629 | 0.721 | 0.364 | 1.428 | 35% | 0.126 | 1.148 | 0.357 |
| 2002 | 745 | 5.250 | 1.870 | 1.001 | 3.495 | 32% | 0.297 | 9.586 | 0.927 |
| 2003 | 570 | 3.400 | 0.931 | 0.424 | 2.042 | 41% | 0.188 | 6.208 | 0.461 |
| 2004 | 577 | 0.460 | 0.940 | 0.454 | 1.948 | 38% | 0.175 | 0.840 | 0.466 |
| 2005 | 512 | 0.749 | 0.875 | 0.389 | 1.967 | 42% | 0.183 | 1.367 | 0.433 |
| 2006 | 424 | 1.388 | 1.148 | 0.507 | 2.597 | 43% | 0.242 | 2.534 | 0.569 |
| 2007 | 406 | 0.395 | 0.841 | 0.370 | 1.914 | 43% | 0.179 | 0.721 | 0.417 |

**Table 6.** Deviance table analysis. Response variable: logged catch rates (RW, kg), upper panel; proportion of positive sets, lower panel. Total deviance explained refers to the deviance explained by the maximal model; P(>|Chi|) refers to the $\chi^2$ probability between consecutive models; shaded rows, statistically significant factor $\alpha$ = 5%. Traditional longline for the period 1986-2000 for zones 2 ,3, 5, 6 and 7.

| *Model ( MT_8600_23567 )* | *Resid. df* | *Resid. Dev.* | *Change in Dev.* | *% total Dev.* | *P(>\|Chi\|)* |
|---|---|---|---|---|---|
| *Null* | 1493 | 1413.63 | | | |
| *Year* | 1479 | 1380.94 | 32.69 | 29.41 | 8.37E-04 |
| *Year + Quarter* | 1476 | 1361.20 | 19.74 | 17.76 | 6.13E-05 |
| *Year + Quarter + Zone* | 1472 | 1343.30 | 17.90 | 16.10 | 4.84E-04 |
| *Year + Quarter + Zone + Quarter * Zone* | 1460 | 1302.46 | 40.84 | 36.74 | 7.59E-06 |
| ***Total deviance explained ( maximal model )*** | | | | **7.86** | |

| *Model ( MT_8600_23567 )* | *Resid. df* | *Resid. Dev.* | *Change in Dev.* | *% total Dev.* | *P(>\|Chi\|)* |
|---|---|---|---|---|---|
| *Null* | 291 | 2092.60 | | | |
| *Year* | 277 | 1862.83 | 229.77 | 14.89 | 4.30E-41 |
| *Year + Quarter* | 274 | 1170.94 | 691.89 | 44.85 | 1.21E-149 |
| *Year + Quarter + Zone* | 270 | 604.40 | 566.54 | 36.72 | 2.70E-121 |
| *Year + Quarter + Zone + Quarter * Zone* | 258 | 549.91 | 54.49 | 3.53 | 2.23E-07 |
| ***Total deviance explained ( maximal model )*** | | | | **73.72** | |

**Table 6 (cont).** Deviance table analysis. Response variable: logged catch rates (RW, kg), upper panel; proportion of positive sets, lower panel. Total deviance explained refers to the deviance explained by the maximal model; P(>|Chi|) refers to the $\chi^2$ probability between consecutive models; shaded rows, statistically significant factor $\alpha$ = 5%. American longline, year 2000-2007, zones 1, 2, 3, 4, 5, 6 and 7.

| *Model ( AM_0007_1234567 )* | *Resid. df* | *Resid. Dev.* | *Change in Dev.* | *% total Dev.* | *P(>\|Chi\|)* |
|---|---|---|---|---|---|
| *Null* | 285 | 596.54 | | | |
| *Year* | 278 | 543.44 | 53.10 | 19.36 | 5.55E-07 |
| *Year + Quarter* | 275 | 524.17 | 19.27 | 7.02 | 1.66E-03 |
| *Year + Quarter + Zone* | 269 | 347.11 | 177.07 | 64.55 | 1.23E-27 |
| *Year + Quarter + Zone + Quarter * Zone* | 254 | 322.23 | 24.88 | 9.07 | 1.90E-01 |
| ***Total deviance explained ( maximal model )*** | | | | **45.98** | |

| *Model ( AM_0007_1234567 )* | *Resid. df* | *Resid. Dev.* | *Change in Dev.* | *% total Dev.* | *P(>\|Chi\|)* |
|---|---|---|---|---|---|
| *Null* | 200 | 478.45 | | | |
| *Year* | 193 | 470.45 | 7.99 | 2.69 | 3.30E-01 |
| *Year + Quarter* | 190 | 439.01 | 31.44 | 10.60 | 6.87E-07 |
| *Year + Quarter + Zone* | 184 | 248.49 | 190.53 | 64.22 | 1.97E-38 |
| *Year + Quarter + Zone + Quarter * Zone* | 167 | 181.77 | 66.72 | 22.49 | 7.86E-08 |
| ***Total deviance explained ( maximal model )*** | | | | **62.01** | |

**Table 7.** Standardized mean CPUE by year, standard error, coefficient of variation, 95% confidence limits (based on a normal approximation) and CV %. Traditional longline, period 1986-2000, zones 2, 3, 5, 6 and 7.

| *Year* | *std. CPUE* | *Std. Err.* | *95%upp* | *95%low* | *CV (%)* |
|---|---|---|---|---|---|
| 1986 | 2.4923 | 0.3165 | 3.1126 | 1.8720 | 12.6989 |
| 1987 | 2.8052 | 0.2931 | 3.3797 | 2.2307 | 10.4496 |
| 1988 | 2.8454 | 0.3563 | 3.5438 | 2.1470 | 12.5231 |
| 1989 | 2.5332 | 0.2241 | 2.9725 | 2.0939 | 8.8479 |
| 1990 | 2.3516 | 0.1889 | 2.7218 | 1.9814 | 8.0318 |
| 1991 | 3.0005 | 0.2363 | 3.4636 | 2.5374 | 7.8746 |
| 1992 | 2.6909 | 0.3269 | 3.3316 | 2.0502 | 12.1483 |
| 1993 | 3.1508 | 0.3286 | 3.7948 | 2.5068 | 10.4276 |
| 1994 | 3.0840 | 0.1879 | 3.4522 | 2.7158 | 6.0915 |
| 1995 | 2.4616 | 0.2103 | 2.8737 | 2.0494 | 8.5433 |
| 1996 | 2.2738 | 0.2258 | 2.7164 | 1.8313 | 9.9300 |
| 1997 | 1.8708 | 0.2089 | 2.2803 | 1.4614 | 11.1658 |
| 1998 | 1.9175 | 0.1994 | 2.3084 | 1.5266 | 10.4006 |
| 1999 | 2.3961 | 0.2467 | 2.8797 | 1.9125 | 10.2980 |
| 2000 | 2.7821 | 0.6237 | 4.0045 | 1.5598 | 22.4166 |

**Table 8.** Standardized mean CPUE by year, standard error, coefficient of variation, 95% confidence limits (based on a normal approximation) and CV %. American longline, period 2000-2007, zones 1, 2, 3, 4, 5, 6 and 7.

| *Year* | *std. CPUE* | *Std. Err.* | *95%upp* | *95%low* | *CV (%)* |
|---|---|---|---|---|---|
| 2000 | 5.4201 | 1.6947 | 8.7417 | 2.0986 | 31.2663 |
| 2001 | 4.6368 | 0.8567 | 6.3159 | 2.9577 | 18.4755 |
| 2002 | 15.6943 | 4.3740 | 24.2673 | 7.1213 | 27.8699 |
| 2003 | 12.7843 | 5.2825 | 23.1379 | 2.4307 | 41.3199 |
| 2004 | 5.7936 | 0.9036 | 7.5647 | 4.0225 | 15.5971 |
| 2005 | 7.5366 | 1.8679 | 11.1976 | 3.8755 | 24.7845 |
| 2006 | 10.2920 | 2.7696 | 15.7205 | 4.8636 | 26.9104 |
| 2007 | 5.9979 | 1.1179 | 8.1891 | 3.8068 | 18.6388 |

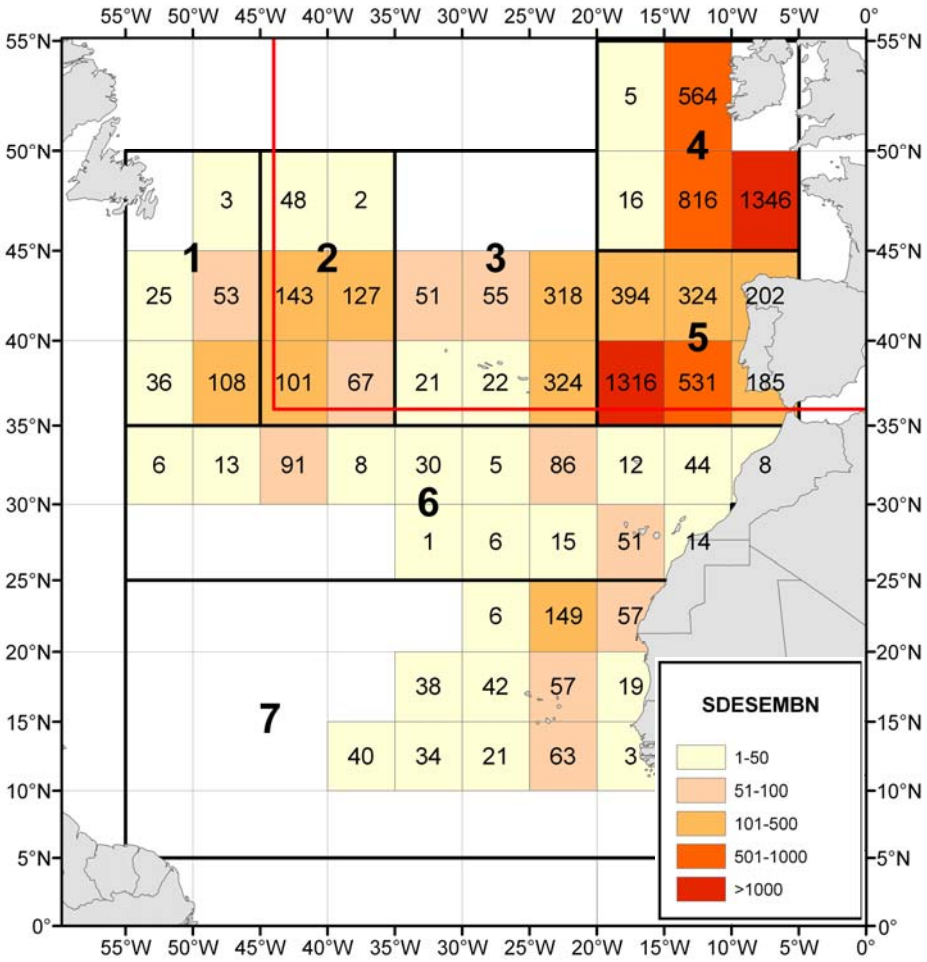



**Figure 1.** Total number of porbeagles caught in the trips sampled during the whole period 1986-2007 in areas North of 5º latitude North, 7 zones defined for GLM runs (black lines) and ICES delimitation area (red line). Colour scale represents densities in accumulated number of fish.

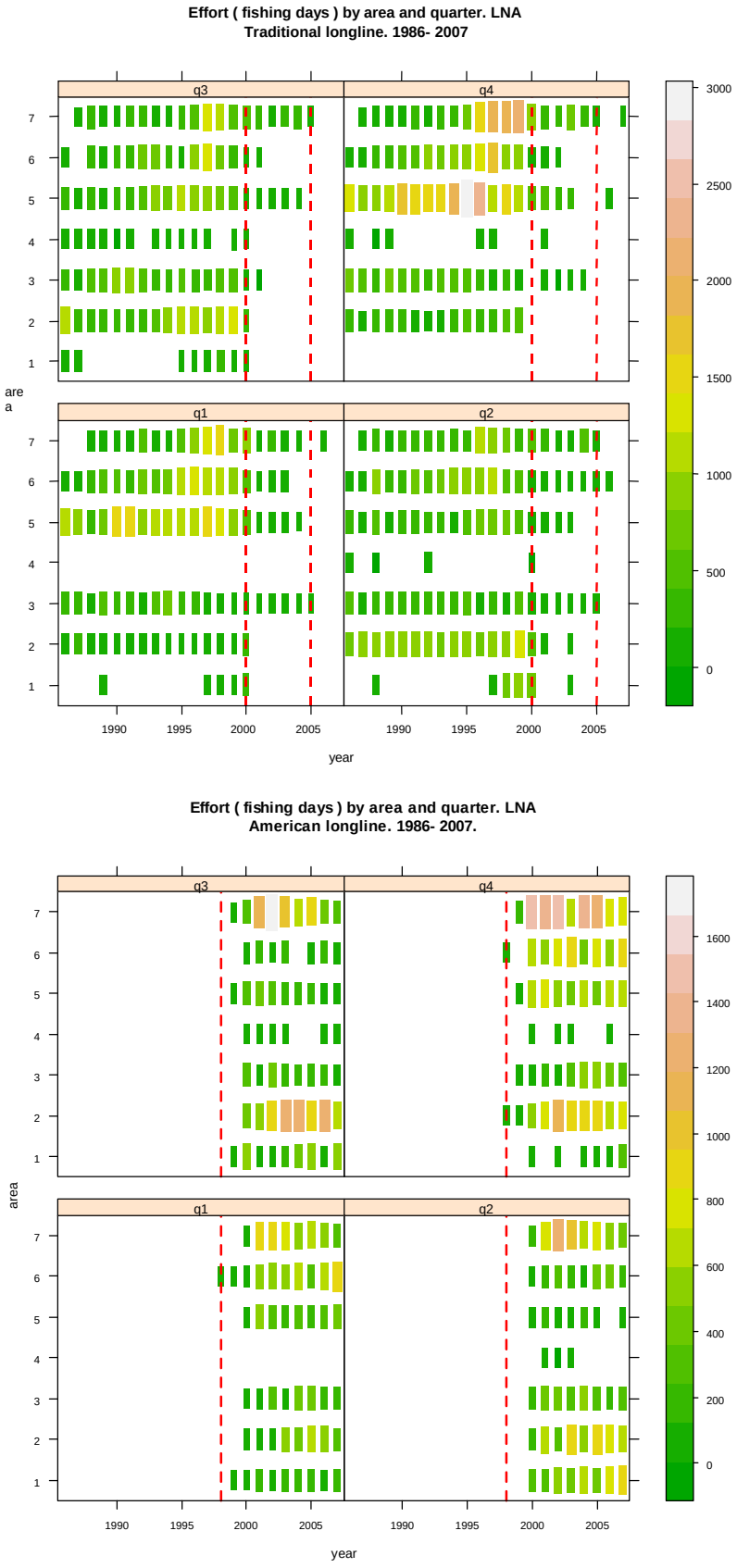



**Figure 2.** Exploratory data analysis: Time series 1986-2007 of fishing days by zone (1-7), quarter (q1-q4) and year. Traditional longline (upper panel, reference vertical red lines set at years 2000 and 2005) and American longline (lower panel, reference vertical red line set at year 1998), for the period 1986-2007. Box size proportional to number of fishing days or sets.

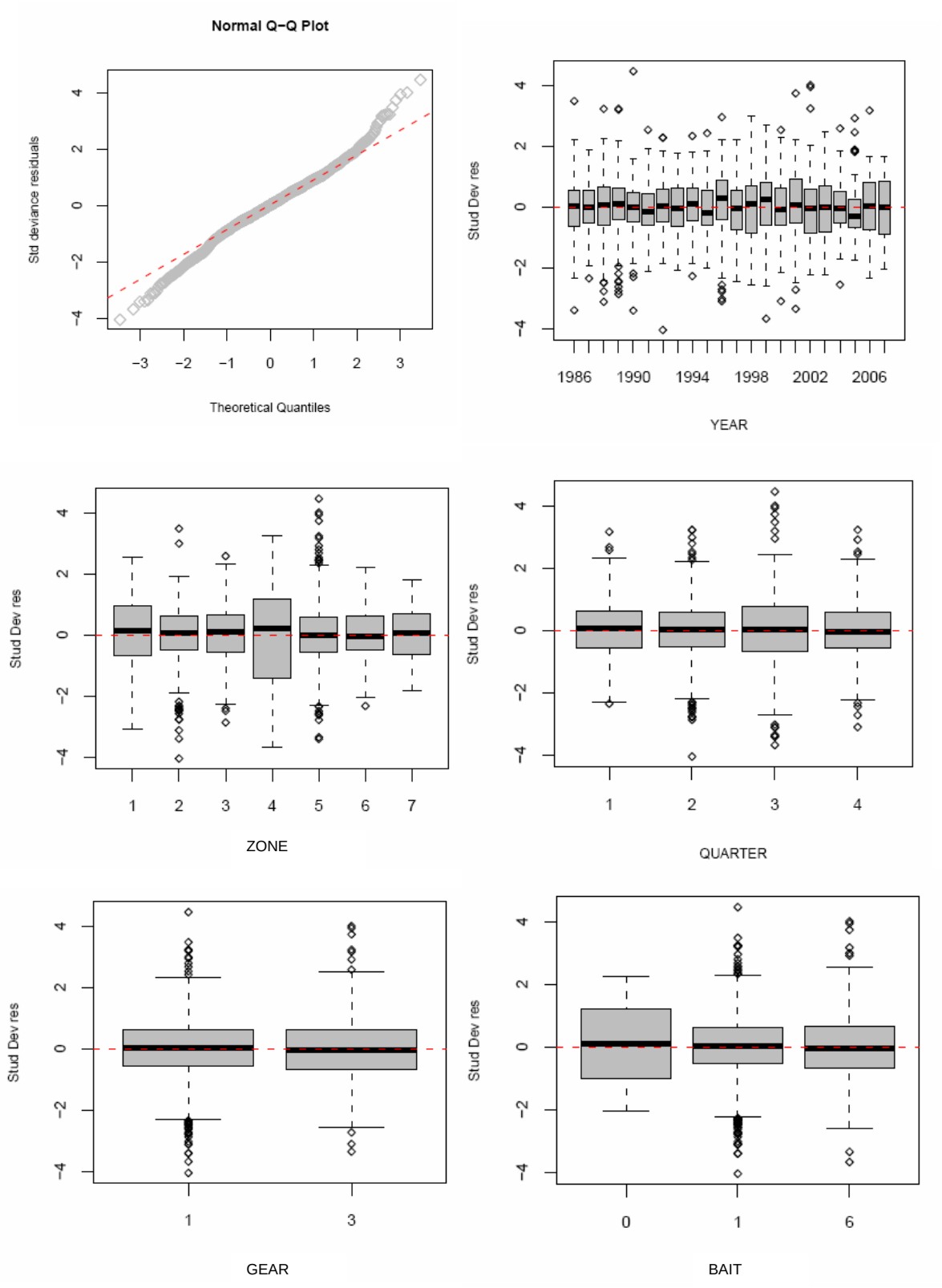



**Figure 3.** Residual patterns of the log-transformed positive catch rates by main factors considered and qq-plot for the *base case* run. Gear 1=traditional, Gear 3= American. Bait 1= makerel. Bait 6= squid. Bait 0= unknown.

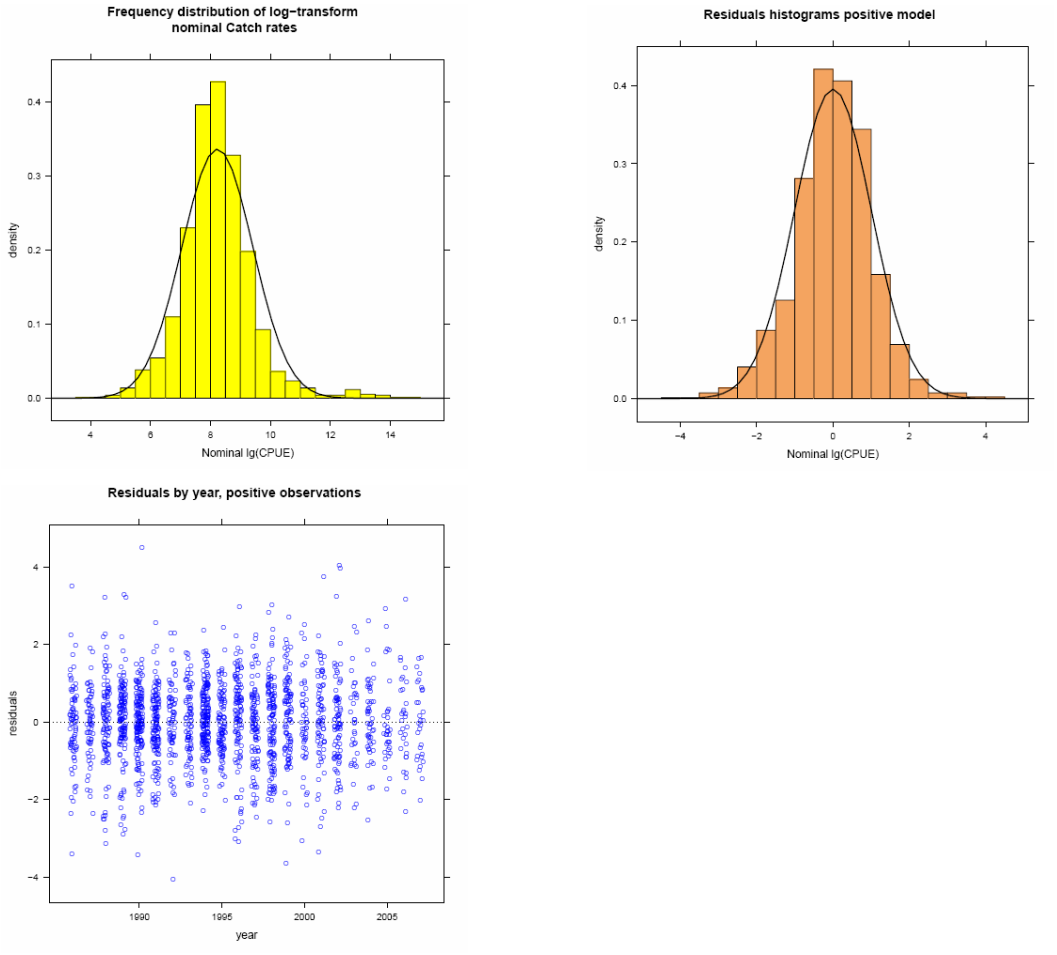



**Figure 4.** Frequency distribution of log-transformed nominal catch rates (positive observations) and residual patterns obtained for the *base case* run.

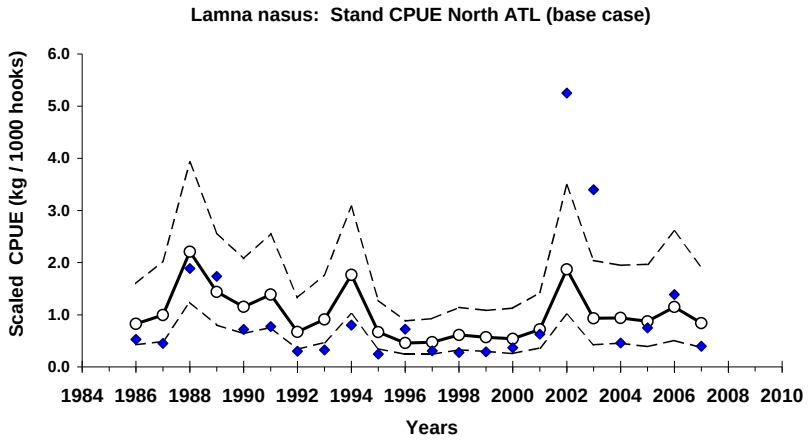



**Figure 5.** Standardized CPUE obtained for the *base case* (line in boldface and circles), confidence intervals (dashed lines) and mean nominal CPUEs (blue rhombuses) (see table 5 for more details).

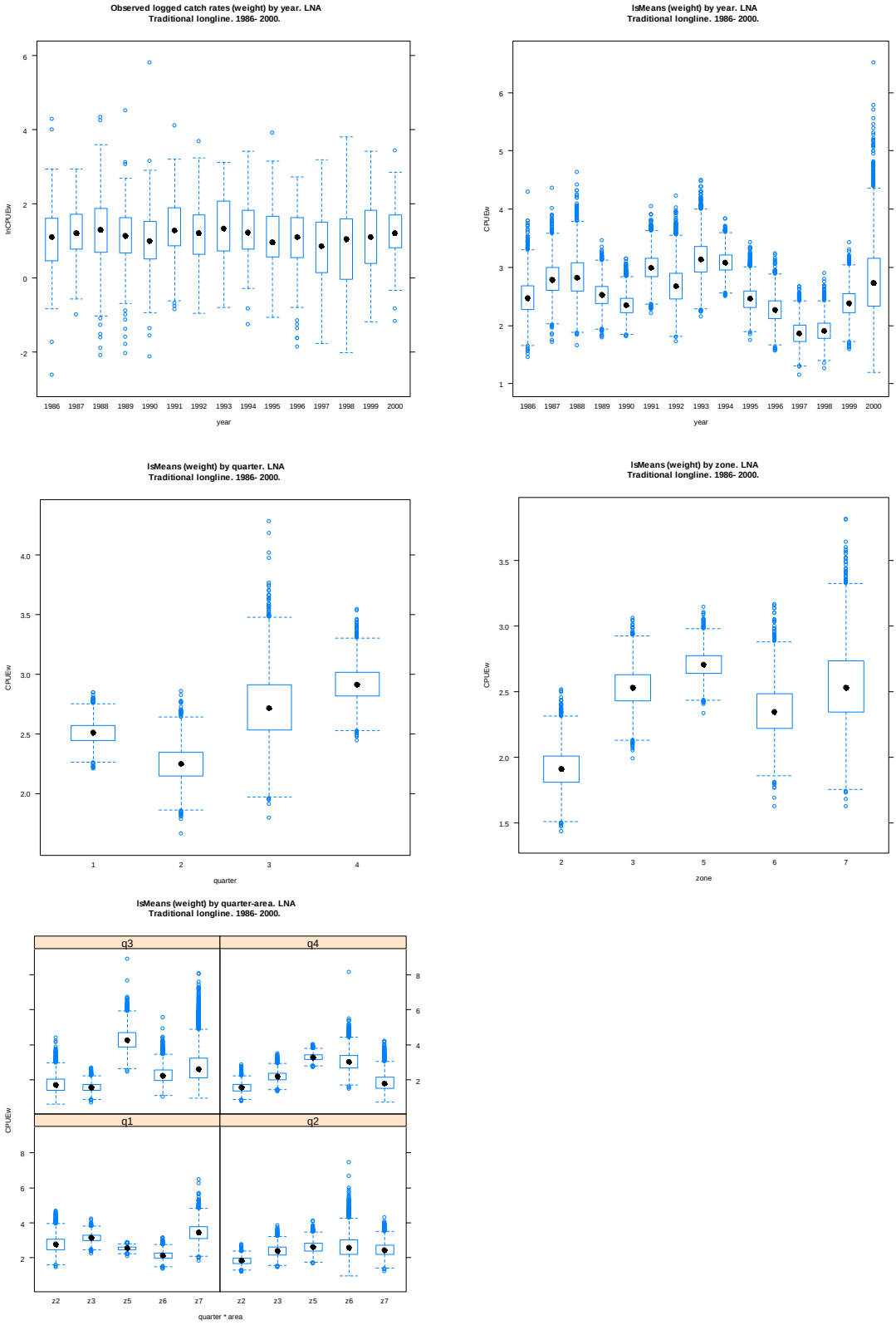



**Figure 6.** Observed logged catch rates by year and predicted CPUE (Lsmean) by main factors for the traditional longline during the period 1986-2000, for zones 2, 3, 5, 6 and 7.

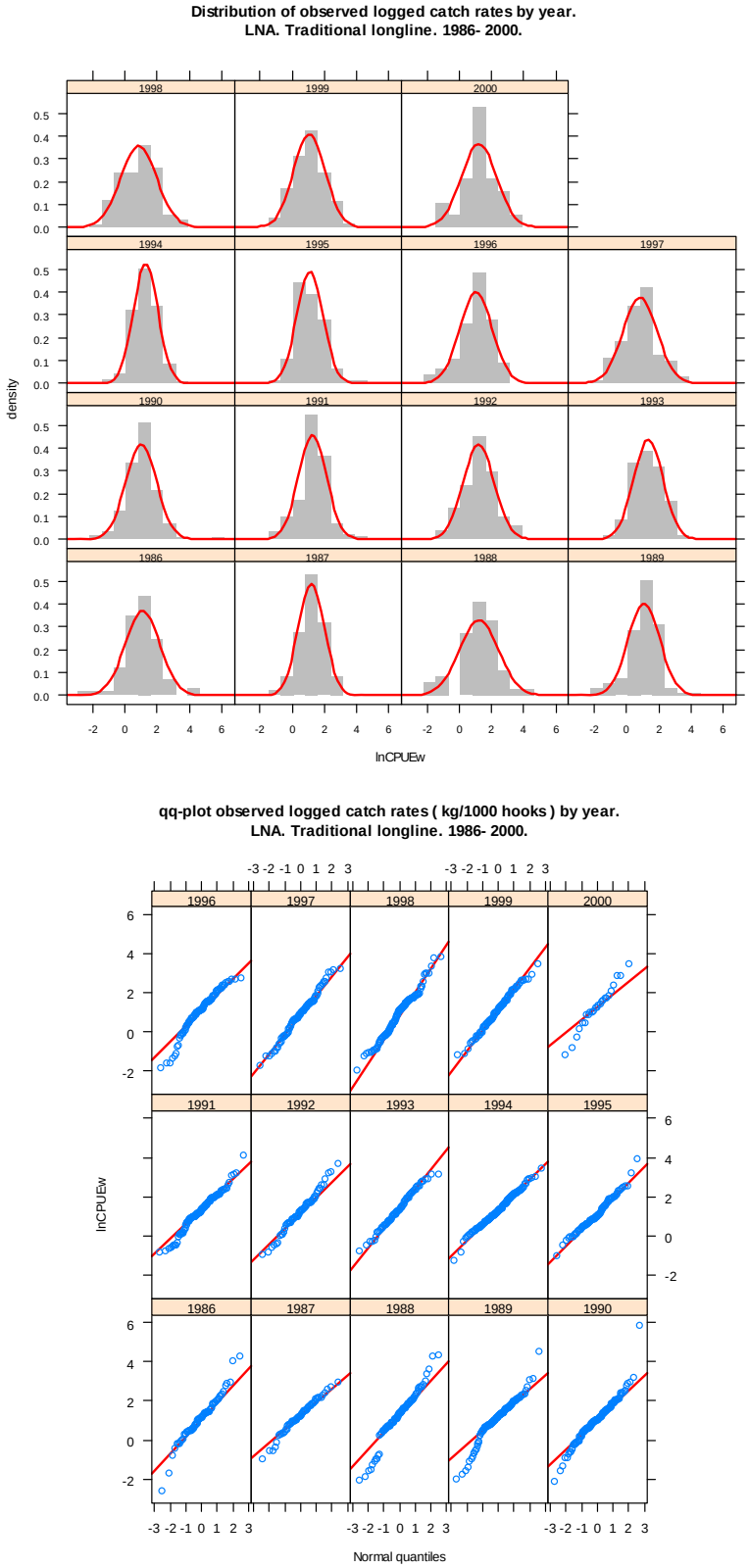



**Figure 7.** Distribution of the observed logged catch rates (upper panel) and qq-plots (lower panel) by year for the traditional longline during the period 1986-2000, considering zones 2, 3, 5, 6 and 7.

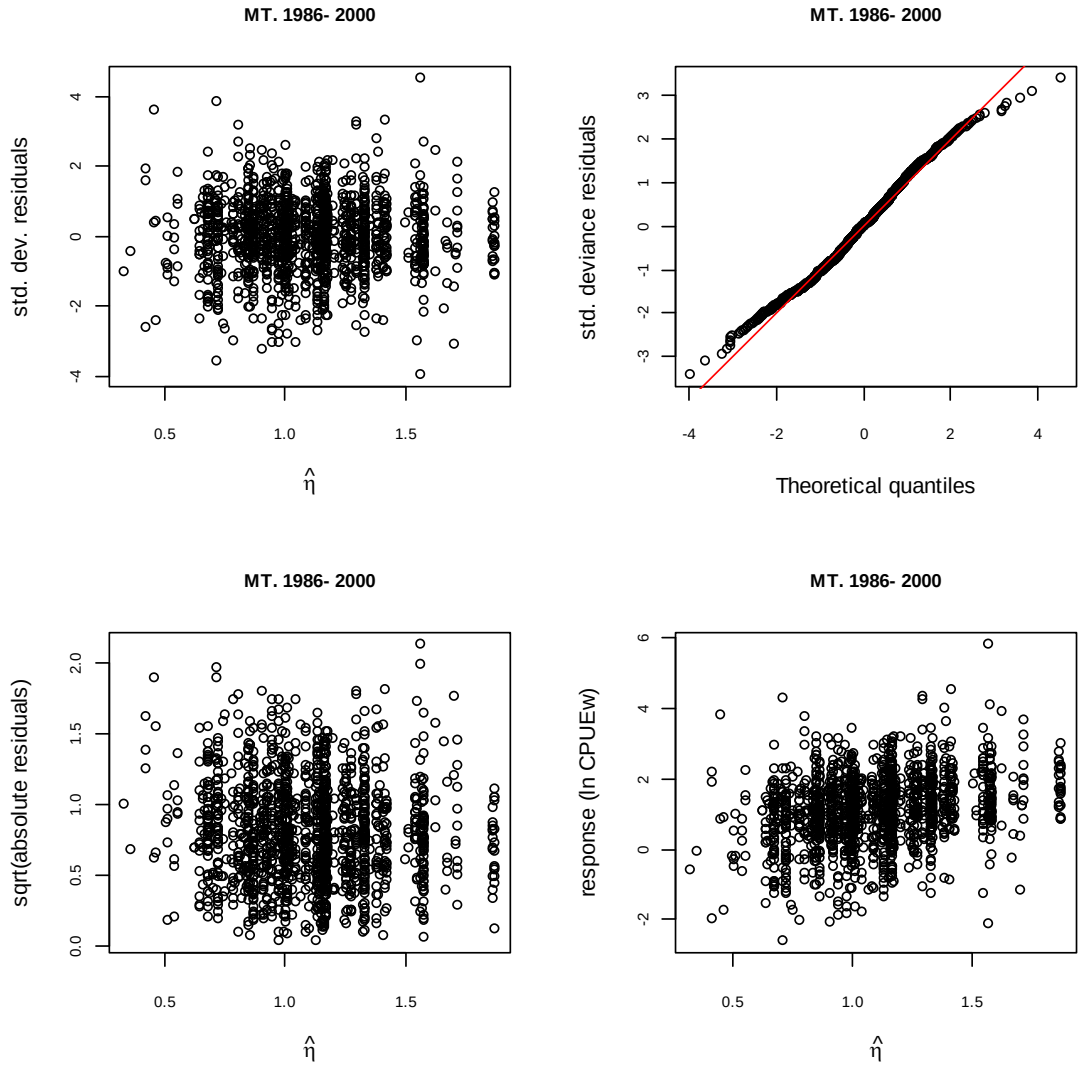



**Figure 8.** Residual patterns and theoretical quantiles (qq-plot) obtained for the traditional longline during the period 1986-2000, considering zones 2, 3, 5, 6 and 7.

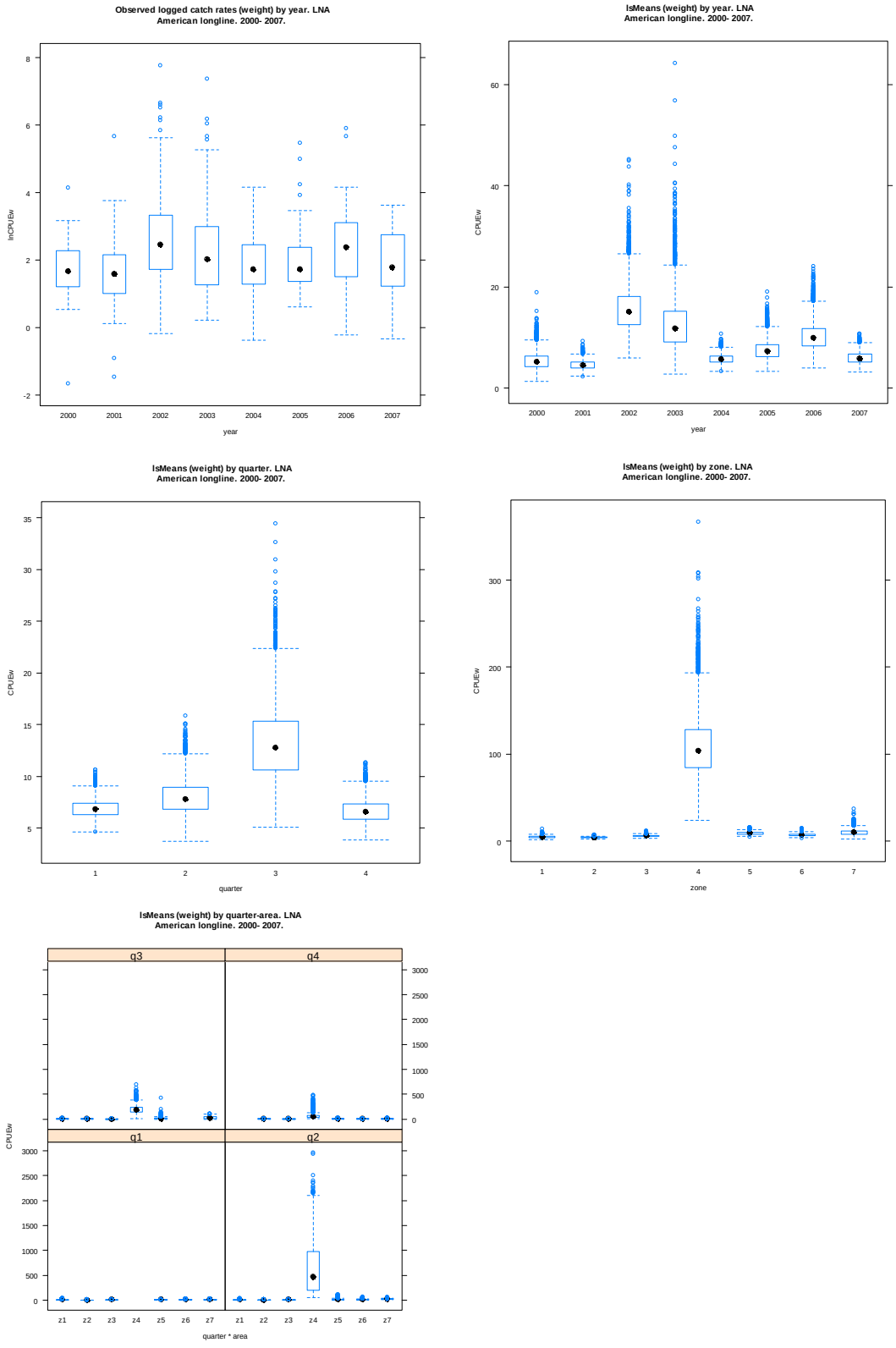



**Figure 9.** Observed logged catch rates by year and predicted CPUE (Lsmean) by main factors American longline style during the period 2000-2007 for zones 1, 2, 3, 4, 5, 6 and 7.

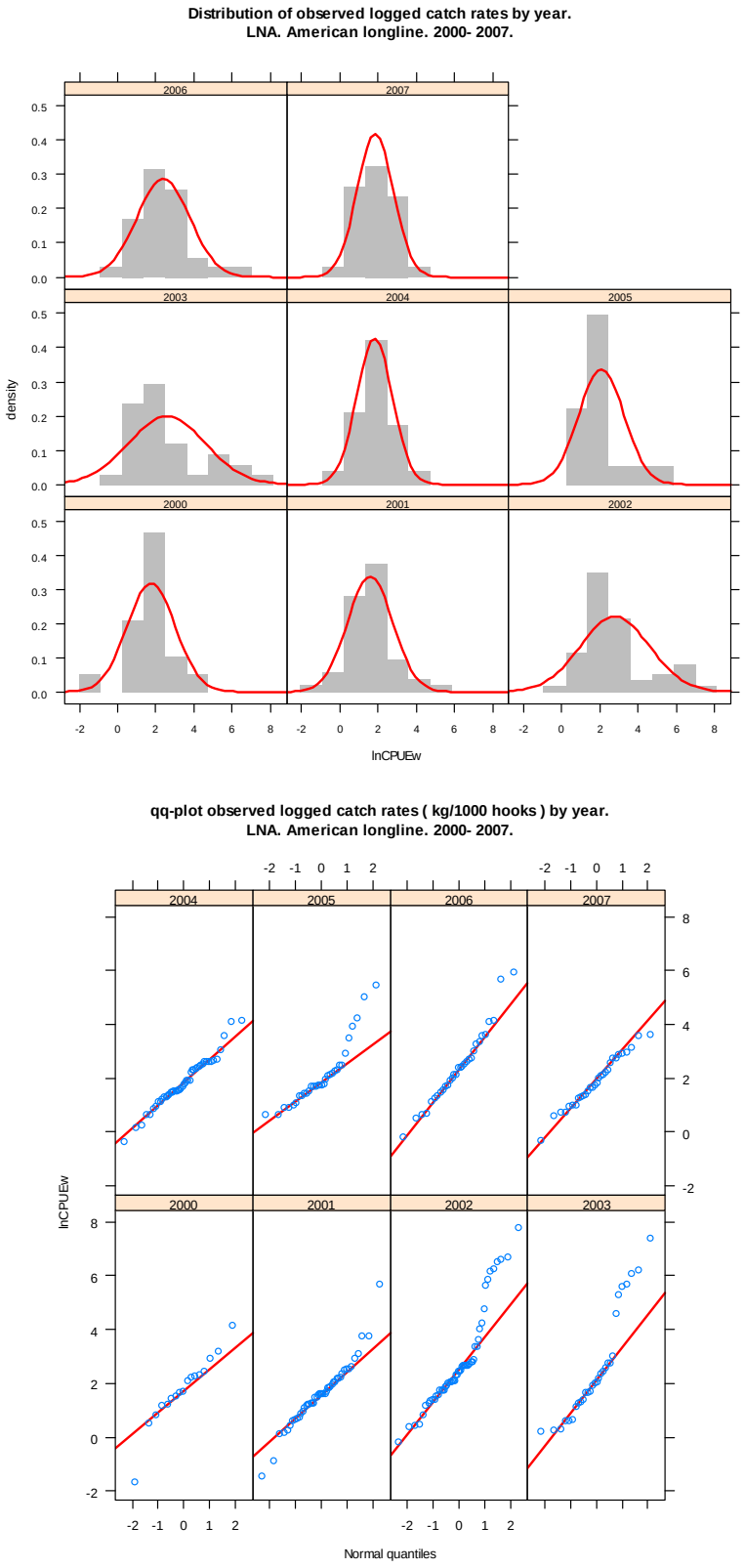



**Figure 10.** Distribution of the observed logged catch rates (upper panel) and qq-plots (lower panel) by year for the American style longline during the period 2000-2007, considering zones 1, 2, 3, 4, 5, 6 and 7.

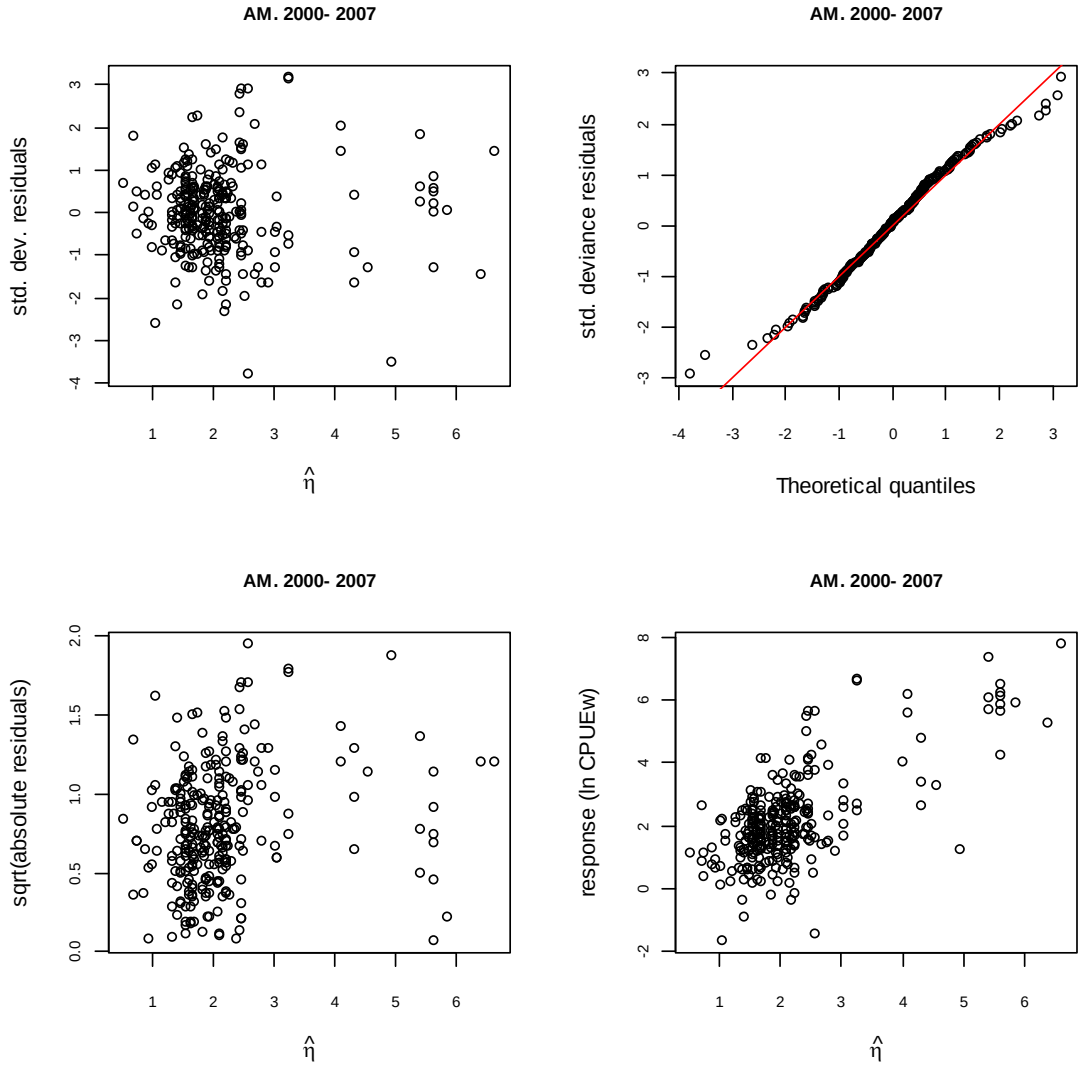
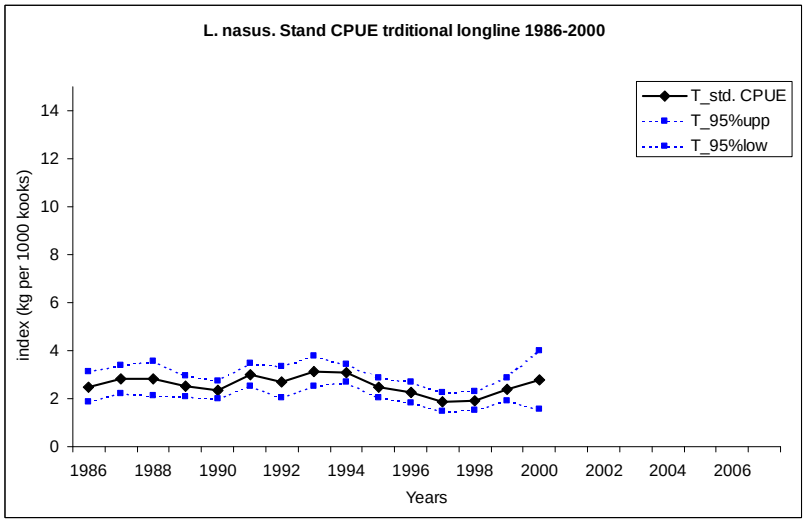
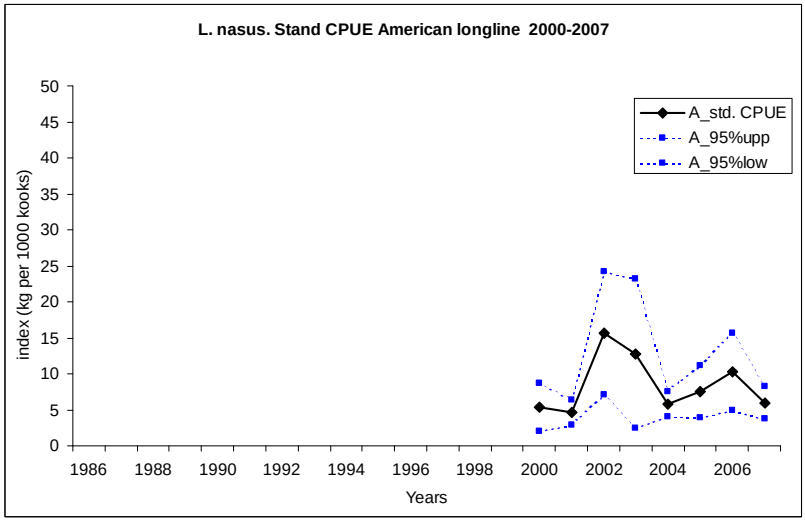



**Figure 11.** Residual patterns and theoretical quantiles (qq-plot) obtained for the American longline during the period 2000-2007 in zones 1, 2, 3, 4, 5, 6 and 7.



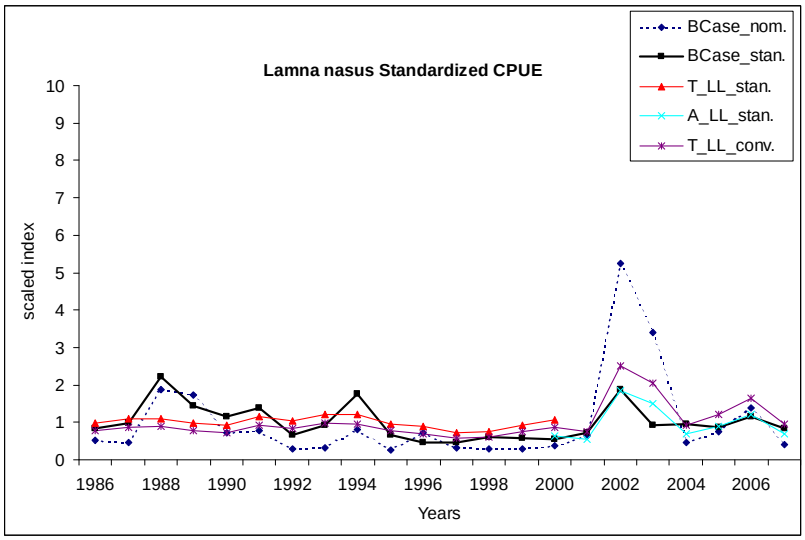
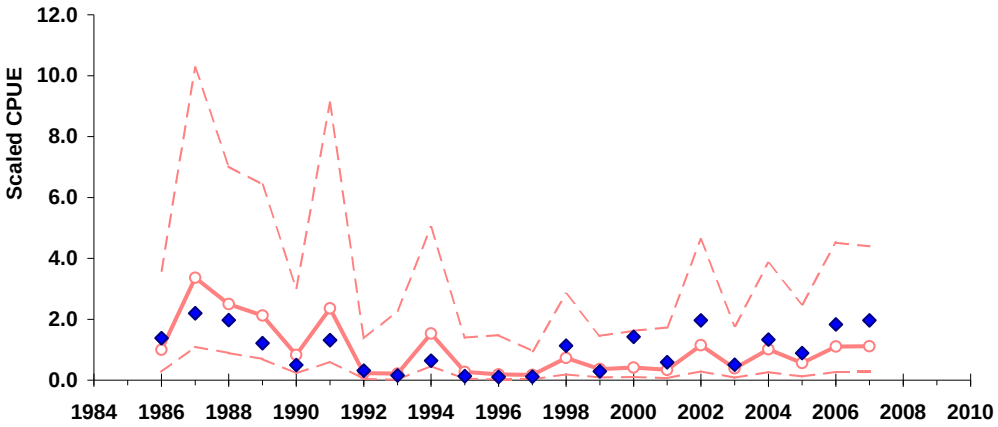




**Figure 12.** Standardized CPUE and confidence intervals obtained for the traditional longline during the period 1986-2000 (upper panel), American longline during the period 2000-2007 (middle panel) and comparative scaled indices obtained in the base case, the two alternate runs, the nominal CPUE and a converted as traditional longline index assuming the CPUE ratio between both gears for year 2000 (see Hilborn and Walters 1992, Sparre and Venema 1997).

**Annex 1**. CPUE estimations from the base case run, considering only zones 1 & 2.

| *Year* | *N obs.* | *Nom. CPUE* | *Stand. CPUE* | *Lci* | *Uci* | *CV* | *Std. error* | *Nominal* | *Estimated* |
|---|---|---|---|---|---|---|---|---|---|
| 1986 | 135 | 1.383 | 0.997 | 0.28 | 3.59 | 71% | 0.257 | 0.79 | 0.36 |
| 1987 | 95 | 2.196 | 3.364 | 1.10 | 10.27 | 60% | 0.734 | 1.26 | 1.21 |
| 1988 | 84 | 1.973 | 2.502 | 0.89 | 7.03 | 55% | 0.499 | 1.13 | 0.90 |
| 1989 | 92 | 1.218 | 2.124 | 0.70 | 6.42 | 60% | 0.459 | 0.70 | 0.77 |
| 1990 | 74 | 0.499 | 0.832 | 0.23 | 3.03 | 72% | 0.216 | 0.29 | 0.30 |
| 1991 | 79 | 1.320 | 2.357 | 0.61 | 9.11 | 76% | 0.647 | 0.76 | 0.85 |
| 1992 | 75 | 0.315 | 0.237 | 0.04 | 1.36 | 107% | 0.092 | 0.18 | 0.09 |
| 1993 | 78 | 0.154 | 0.216 | 0.02 | 2.29 | 174% | 0.135 | 0.09 | 0.08 |
| 1994 | 113 | 0.642 | 1.531 | 0.47 | 5.03 | 65% | 0.360 | 0.37 | 0.55 |
| 1995 | 137 | 0.136 | 0.275 | 0.05 | 1.40 | 97% | 0.096 | 0.08 | 0.10 |
| 1996 | 91 | 0.112 | 0.189 | 0.02 | 1.49 | 138% | 0.094 | 0.06 | 0.07 |
| 1997 | 99 | 0.114 | 0.175 | 0.03 | 0.95 | 103% | 0.065 | 0.07 | 0.06 |
| 1998 | 150 | 1.130 | 0.731 | 0.19 | 2.83 | 76% | 0.201 | 0.65 | 0.26 |
| 1999 | 178 | 0.289 | 0.363 | 0.09 | 1.46 | 79% | 0.103 | 0.17 | 0.13 |
| 2000 | 145 | 1.423 | 0.413 | 0.10 | 1.63 | 78% | 0.115 | 0.82 | 0.15 |
| 2001 | 87 | 0.595 | 0.344 | 0.07 | 1.73 | 96% | 0.119 | 0.34 | 0.12 |
| 2002 | 97 | 1.968 | 1.153 | 0.29 | 4.62 | 79% | 0.327 | 1.13 | 0.42 |
| 2003 | 124 | 0.510 | 0.388 | 0.08 | 1.78 | 89% | 0.124 | 0.29 | 0.14 |
| 2004 | 124 | 1.331 | 1.017 | 0.27 | 3.84 | 74% | 0.273 | 0.76 | 0.37 |
| 2005 | 124 | 0.892 | 0.563 | 0.13 | 2.50 | 86% | 0.175 | 0.51 | 0.20 |
| 2006 | 108 | 1.836 | 1.110 | 0.27 | 4.52 | 80% | 0.320 | 1.05 | 0.40 |
| 2007 | 115 | 1.964 | 1.120 | 0.29 | 4.40 | 77% | 0.312 | 1.13 | 0.40 |

**Porbeagle (L.nasus) Standardized CPUE Longline Spain Zones 1 & 2**



**Annex 1 (cont.)**. CPUE estimations from the base case run, considering only zones 4 & 5.

| *Year* | *N obs.* | *Nom. CPUE* | *Stand. CPUE* | *Lci* | *Uci* | *CV* | *Std. error* | *Nominal* | *Estimated* |
|---|---|---|---|---|---|---|---|---|---|
| 1986 | 263 | 0.288 | 0.661 | 0.15 | 2.85 | 84% | 1.085 | 1.36 | 1.29 |
| 1987 | 161 | 0.146 | 0.292 | 0.05 | 1.62 | 104% | 0.594 | 0.69 | 0.57 |
| 1988 | 191 | 1.870 | 2.280 | 0.61 | 8.56 | 74% | 3.295 | 8.83 | 4.45 |
| 1989 | 226 | 1.486 | 0.961 | 0.26 | 3.58 | 74% | 1.380 | 7.01 | 1.87 |
| 1990 | 332 | 0.491 | 0.683 | 0.15 | 3.15 | 89% | 1.187 | 2.32 | 1.33 |
| 1991 | 309 | 0.544 | 1.456 | 0.37 | 5.77 | 78% | 2.214 | 2.57 | 2.84 |
| 1992 | 223 | 0.220 | 0.389 | 0.07 | 2.03 | 99% | 0.752 | 1.04 | 0.76 |
| 1993 | 340 | 0.157 | 0.491 | 0.09 | 2.55 | 98% | 0.943 | 0.74 | 0.96 |
| 1994 | 325 | 0.521 | 1.846 | 0.46 | 7.42 | 79% | 2.841 | 2.46 | 3.60 |
| 1995 | 466 | 0.137 | 0.330 | 0.06 | 1.73 | 99% | 0.639 | 0.65 | 0.64 |
| 1996 | 483 | 0.616 | 0.340 | 0.09 | 1.35 | 78% | 0.517 | 2.91 | 0.66 |
| 1997 | 434 | 0.275 | 0.699 | 0.17 | 2.82 | 79% | 1.078 | 1.30 | 1.36 |
| 1998 | 457 | 0.174 | 0.421 | 0.08 | 2.10 | 95% | 0.784 | 0.82 | 0.82 |
| 1999 | 274 | 0.224 | 0.169 | 0.04 | 0.78 | 89% | 0.293 | 1.06 | 0.33 |
| 2000 | 216 | 0.258 | 0.419 | 0.10 | 1.83 | 85% | 0.696 | 1.22 | 0.82 |
| 2001 | 292 | 0.486 | 0.350 | 0.08 | 1.46 | 82% | 0.558 | 2.29 | 0.68 |
| 2002 | 238 | 6.044 | 2.874 | 0.84 | 9.84 | 68% | 3.806 | 28.52 | 5.61 |
| 2003 | 146 | 5.002 | 3.445 | 0.89 | 13.27 | 76% | 5.100 | 23.61 | 6.72 |
| 2004 | 138 | 0.252 | 0.537 | 0.09 | 3.18 | 110% | 1.152 | 1.19 | 1.05 |
| 2005 | 97 | 1.059 | 1.236 | 0.21 | 7.32 | 110% | 2.648 | 5.00 | 2.41 |
| 2006 | 115 | 1.674 | 1.969 | 0.43 | 9.02 | 89% | 3.402 | 7.90 | 3.84 |
| 2007 | 118 | 0.078 | 0.152 | 0.02 | 1.04 | 123% | 0.364 | 0.37 | 0.30 |

**Porbeagle (L.nasus) Standardized CPUE Longline Spain Zones 4 & 5**

