# Study of the Portuguese Fleets catching hake (*Merluccius merluccius*) in Area IXa

# (HKE 8C3411)

Directorate-General for Natural Resources, Safety and Maritime Services

**Introduction**

Hake is one of the most important natural marine resources in Portugal, 12$^{th}$ overall in landed weight in 2016. The species is very abundant, from the shelf edge, at around 200m depth, to shallower waters around the outlets of rivers and estuaries. The population is always comprised of a large proportion of recruits, which are evenly distributed together with larger individuals.

The fisheries impact the species in different ways, from the more indiscriminate catches of small and large individuals derived from the bottom trawling fleet, to the highly size-selective catches of the gillnet and line and hook fisheries.

The impact of the catches of hake on the activity of these fleets also varies; with most of the vessels that catch hake in any year doing so in moderate to small quantities, below 5 tons, and often comprising less than 5% of the catches of the vessel.

In fact, few vessels if any, declare catches in any year that do not include hake as one of the species, but a much smaller number is responsible for most of the annual catches (3.6% of the vessels landed 83.4% of the hake in 2016).

**Methodology**

Landing data relate to all catches in Portuguese continental waters of ICES 9.a, including those landed outside of Portugal. Data pertaining to 117 vessels in total were selected, which represent all landings of hake for any vessel that catches at least 5 tons a year in at least one of 2015 or 2016.

Values of the sales were collected from landings at auction in Portuguese ports of the 117 vessels that have landed at least 5t of hake in one of the two latest full years. Data analized are therefore a sub-sample of the total sales, corresponding to 82.8% of the weight landed in 2015 and 64.6% of the weight landed in 2016.

To gauge the economic loss of the vessels by performing an increase in the mesh size from 70mm to 100mm or by using a 90º rotated mesh of the same size, both alternative strategies to reduce the catches of undersized hake, the results of the experiments performed in Spain for the OTB_MCF_>=70 and OTB_MPD_>=55_0_0 were used.

**Results**

Table 1 represents the basic data for the Portuguese fleets operating in area ICES 9.a., including the total number of vessels and landings per segment and those presently subject to the LO, with the total amount of the *de minimis* that is currently attributed to the total hake landings.

Table 1 – Fleet segments and hake landings in 2015 and 2016.

| Fleet segment | Total vessels | Vessels subject to LO | Hake as by-catch or target | Total hake landings | Landings subject to LO (tons) | Estimated discards (tons) | Estimated *de minimis* (tons) |
|---|---|---|---|---|---|---|---|
| 4K3 - Trawling | 74 | 55 | By-catch | 816,1 | 652,9 | 450,5 | 57,1 |
| 4K1 - Multi-purpose <12m OA | 2759 | 3 | By-catch | 7,3 | 5,8 | 0 | 0,5 |
| 4K2 - Multi-purpose >=12m OA | 264 | 59 | By-catch | 1046,4 | 837,1 | 0 | 73,2 |
| 4K4 - Purse-seine | 147 | 0 | No landings | 0 | 0 | 0 | 0 |
| **Total** | 3244 | 117 | | 1869,8 | 1495,8 | 450,5 | 130,8 |

The activity of most fleet segments in Portugal is very multi-specific in their targets. Even for those vessels which land >5t of hake, 207 other species (or higher taxa) have been identified in the landing compositions.

Table 2 shows the ranking position of the 10 most landed species in the landings of the 117 vessels subject to the LO. It is important to note that the fact that the fleet is multi-specific means that hake can generally be considered an “important” species but not truly a target species. However, for the LO vessels, where hake is an important catch, it is often the target species. For these 117 vessels, hake ranks 2$^{nd}$ overall, but it ranks 1$^{st}$ in some of the segments, as depicted in Table 3.

Table 2 – Species rankings in importance of landings for the 10 most landed species of the 117 vessels landing >5 tons of hake per year in either 2015 or 2016.

| Ranking | Taxon |
|---|---|
| 1 | *Trachurus trachurus* |
| 2 | *Merluccius merluccius* |
| 3 | *Micromesistius poutassou* |
| 4 | *Trachurus picturatus* |
| 5 | *Scomber scombrus* |
| 6 | *Trisopterus luscus* |
| 7 | *Octopus vulgaris* |
| 8 | *Scomber colias* |
| 9 | *Scyliorhinus stellaris* |
| 10 | *Pagellus acarne* |

Table 3 – Landings of hake in relation to all landings. Hake in volume as a percentage of total landings and how it ranks among all landed species (same 117 vessels, as above).

| | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|
| | 4K1 | 4K2 | 4K3 | 4K1 | 4K2 | 4K3 |
| All (Tons) | 18,5522 | 2790,739 | 14738,89 | 18,5522 | 2790,739 | 14738,89 |
| Hake (Tons) | 4,9652 | 814,9268 | 622,7891 | 6,6269 | 859,195 | 683,0528 |
| % Hake | 26,8% | 29,2% | 4,2% | 35,7% | 30,8% | 4,6% |
| Ranking Hake | 1 | 1 | 4 | 1 | 1 | 4 |

Table 4 lists all of the landings of the 10 most important species and the value in 1000 € of those landings per fleet segment and year. If we examine these numbers, hake stands out much more as an economic return for all fleet segments, than in the volume of landings. This is evidenced in Table 5, particularly for fleet segments 4K1 and 4K2, which however perform a very selective hake catch. Nonetheless, these fleet segments also depend significantly on the catches and sales of other minority species (more than 60%), further demonstrating the truly multi-specific nature of their activity.

For the trawling segment (4K3), the situation is quite different and somewhat more challenging from a management standpoint in what regards the Landing Obligation. In this segment, the returns derived from hake amount to a mere 12-13% of the 10 most important species and only 7-8% overall, due to the relative overweight of horse mackerel, compounded by the minority species together. This is the segment where the most significant unwanted hake catches are observed, but also that which depends more directly from other catches as a source of return.

Table 4 – Landings of the 10 most important species in volume for the 117 vessels subject to the LO and the economic gross returns of the sales, in 2015 and 2016.

| Weight (Tons) | 2015 | | | | Weight (Tons) | 2016 | | |
|---|---|---|---|---|---|---|---|---|
| **Taxon** | **4K1** | **4K2** | **4K3** | | **Taxon** | **4K1** | **4K2** | **4K3** |
| *Scyliorhinus stellaris* | 1,010 | 63,031 | 216,375 | | *Scyliorhinus stellaris* | 0,665 | 56,441 | 263,169 |
| *Merluccius merluccius* | 4,965 | 814,927 | 622,789 | | *Merluccius merluccius* | 6,627 | 859,195 | 683,053 |
| *Micromesistius poutassou* | 0,000 | 3,724 | 1335,308 | | *Micromesistius poutassou* | 0,000 | 0,899 | 1489,231 |
| *Scomber colias* | 0,000 | 14,220 | 278,076 | | *Scomber colias* | 0,138 | 16,929 | 459,351 |
| Octopus vulgaris | 0,231 | 228,805 | 91,865 | | Octopus vulgaris | 0,262 | 439,009 | 248,180 |
| *Pagellus acarne* | 0,067 | 26,649 | 244,496 | | *Pagellus acarne* | 0,028 | 20,509 | 190,323 |
| *Scomber scombrus* | 0,010 | 23,894 | 592,016 | | *Scomber scombrus* | 0,000 | 6,471 | 556,809 |
| *Trachurus picturatus* | 0,000 | 9,324 | 909,387 | | *Trachurus picturatus* | 0,000 | 10,249 | 1192,592 |
| *Trachurus trachurus* | 0,256 | 591,177 | 8631,158 | | *Trachurus trachurus* | 0,456 | 525,192 | 11375,207 |
| *Trisopterus luscus* | 0,327 | 118,809 | 321,358 | | *Trisopterus luscus* | 0,184 | 115,542 | 432,485 |
| | | | | | | | | |
| Value (€ x103) | 2015 | | | | Value (€ x103) | 2016 | | |
| **Taxon** | **4K1** | **4K2** | **4K3** | | **Taxon** | **4K1** | **4K2** | **4K3** |
| *Scyliorhinus stellaris* | 0,692 | 47,770 | 162,824 | | *Scyliorhinus stellaris* | 0,481 | 43,466 | 208,511 |
| *Merluccius merluccius* | 21,621 | 2360,225 | 1888,975 | | *Merluccius merluccius* | 25,309 | 2328,457 | 1961,368 |
| *Micromesistius poutassou* | 0,000 | 1,366 | 628,319 | | *Micromesistius poutassou* | 0,000 | 0,427 | 625,838 |
| *Scomber colias* | 0,000 | 9,039 | 122,608 | | *Scomber colias* | 0,293 | 15,810 | 201,492 |
| Octopus vulgaris | 0,000 | 0,000 | 4,412 | | Octopus vulgaris | 0,000 | 0,000 | 1,782 |
| *Pagellus acarne* | 0,326 | 105,310 | 984,979 | | *Pagellus acarne* | 0,120 | 92,478 | 869,976 |
| *Scomber scombrus* | 0,007 | 16,154 | 445,061 | | *Scomber scombrus* | 0,000 | 6,651 | 513,447 |
| *Trachurus picturatus* | 0,000 | 8,419 | 347,983 | | *Trachurus picturatus* | 0,000 | 8,995 | 415,446 |
| *Trachurus trachurus* | 0,381 | 624,738 | 10260,159 | | *Trachurus trachurus* | 0,738 | 454,650 | 9891,480 |
| *Trisopterus luscus* | 0,729 | 184,407 | 495,756 | | *Trisopterus luscus* | 0,326 | 178,388 | 564,521 |

Table 5 – Percent value of the first sale of each of the most important landing species of the 117 vessels subject to the LO, divided by fleet segment.

| Value (€ x103) | 2015 | | | | Value (€ x103) | 2016 | | |
|---|---|---|---|---|---|---|---|---|
| **Taxon** | **4K1** | **4K2** | **4K3** | | **Taxon** | **4K1** | **4K2** | **4K3** |
| *Scyliorhinus stellaris* | 3% | 1% | 1% | | *Scyliorhinus stellaris* | 2% | 1% | 1% |
| *Merluccius merluccius* | 91% | 70% | 12% | | *Merluccius merluccius* | 93% | 74% | 13% |
| *Micromesistius poutassou* | 0% | 0% | 4% | | *Micromesistius poutassou* | 0% | 0% | 4% |
| *Scomber colias* | 0% | 0% | 1% | | *Scomber colias* | 1% | 1% | 1% |
| Octopus vulgaris | 0% | 0% | 0% | | Octopus vulgaris | 0% | 0% | 0% |
| *Pagellus acarne* | 1% | 3% | 6% | | *Pagellus acarne* | 0% | 3% | 6% |
| *Scomber scombrus* | 0% | 0% | 3% | | *Scomber scombrus* | 0% | 0% | 3% |
| *Trachurus picturatus* | 0% | 0% | 2% | | *Trachurus picturatus* | 0% | 0% | 3% |
| *Trachurus trachurus* | 2% | 19% | 67% | | *Trachurus trachurus* | 3% | 15% | 65% |
| *Trisopterus luscus* | 3% | 5% | 3% | | *Trisopterus luscus* | 1% | 6% | 4% |
| Percentage of 10 taxa above relative to total | 19,25% | 40,25% | 62,73% | | Percentage of 10 taxa above relative to total | 21,76% | 34,79% | 58,36% |

Table 6 represents the sizes at maturity of the 10 most important landed species, as a proxy to a future "ideal" MCRS, in face of the impracticality of listing all 206 taxa. From these it is possible to see that hake is significantly larger at maturity than all but one (*Scyliorhinus stellaris*) of the other 9 taxa, meaning that any increase in the mesh size of the trawling gear to accommodate catches of larger hake, will have a disproportionate toll on the other species, which represent a much larger return for the fleet than does hake.

Table 6 – Length at first maturity for the 10 most landed species by the 117 vessels subject to the LO for hake. MCRS are included when available.

| Ranking | Taxon | L50% Mat (cm) | MCRS |
|---|---|---|---|
| 1 | *Trachurus trachurus* | 23,9 | 15 |
| 2 | *Merluccius merluccius* | 42,8 | 27 |
| 3 | *Micromesistius poutassou* | 15 | - |
| 4 | *Trachurus picturatus* | 24,7 | - |
| 5 | *Scomber scombrus* | 28,7 | 20 |
| 6 | *Trisopterus luscus* | 21,6 | - |
| 7 | *Octopus vulgaris** | 15 | - |
| 8 | *Scomber colias* | 21,5 | - |
| 9 | *Scyliorhinus stellaris* | 77-79 | - |
| 10 | *Pagellus acarne* | 16 | - |
| Data from Fishbase.org and EU TACs & quotas | | | |
| * approximately equivalent to 1250g | | | |

Reports of the experiments undertaken by Spain for the OTB_MCF_>=70 and OTB_MPD_>=55_0_0 gear, the ones most like the Portuguese OTB_DEF_0_0_0 (collectively representing trawling for demersal cephalopods, fish and crustacea), demonstrate significant losses of valuable hake with even slight changes in the size or geometry of the mesh.

In fact, studies of the increase in mesh size from 70 to 86mm and from 70 to 100mm, demonstrate that even at losses of commercially sized fish may reach 7,5%. On the other hand, the turned mesh experiments conducted by IEO for OTB_MPD_>=55_0_0 demonstrate a commercial size loss of 5% in relation to the unturned mesh.

Even though it is not clear what effect these changes may have on other species, we will assume that such changes will operate a proportional loss on the remaining species' catches. Therefore, considering that for this fleet segment hake catches amount to, at most, 8% of the total, we could expect losses in the order of 71% of the total value of the hake catch, or the equivalent loss of the fourth to fifth most important species in weight for this segment.

**Conclusion**

Analyses suggest that results of the current research on selectivity improvements of the trawling segment operating most directly at hake catches, would result in overall losses of all catch returns to a value equivalent to the loss of 71% of hake catch returns, or the equivalent loss of a top 5 catch species in volume. This is a consequence of the multi-specific nature of the caches of this fleet, and of the fact that the most important species landed tend to be smaller than hake.