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# Escapement patterns of red mullet, sole, horse mackerel and hake facing two trawl selective devices

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**Abstract :**

The landing obligation implemented under the European Union Common Fisheries Policy prompted the development of selective devices for fishing gear to reduce unwanted catches. In the Bay of Biscay, a collaborative project between scientists and fishermen evaluated catch rates and length frequencies of caught species from two innovative trawl devices, which were compared to the gear that is currently used in the fishery. The experimental designs were: (1) a 90 mm square mesh bycatch reduction device inserted in the tapered section (SMBRD) and (2) a 70 mm T90 mesh codend and extension (T90). Each selective device was tested separately using the twin trawl method for catch comparison on board commercial vessels: SMBRD was tested on board vessels targeting Nephrops and T90 on board vessels targeting demersal fish. This study focused on hake (Merluccius merluccius), which is an important bycatch species, red mullet (Mullus surmuletus) and common sole (Solea solea), which have high commercial value, and horse mackerel (Trachurus trachurus), which is nearly never discarded. Horse mackerel and hake escaped through the two devices tested, resulting in fewer unwanted catches in the selective trawls without commercial loss. For sole, more individuals were caught with the SMBRD than with the standard gear. The T90 resulted in the escapement of most red mullet across its entire length range observed, resulting in significantly lower Catch Per Unit Effort of landings and unwanted catch, probably due to unsuitable mesh size and shape for that species. These results have direct application for multispecies fisheries in which fishermen have to appropriately select devices according to the specific characteristics and species composition of their fisheries.

**Keywords** : Gear technology, Bay of Biscay, Multispecies fisheries, Selectivity, Discard ban

## 1. Introduction

Discard levels from bottom trawl fisheries are a major concern from societal, ethical and ecological perspectives [1,2]. For several decades, gear technology has targeted the development and testing of trawl selective devices that meet biological and economic criteria to reduce discards while also maintaining landings [2–5]. To meet this objective, the design of selective devices should consider species behavior, morphology and size [6–8]. Consequently, a wide variety of trawl selective devices have been tested in European waters [9,10]. Escapement of unwanted catch can be facilitated by increasing mesh size [11], modifying mesh shape, such as square [12,13] or T90 meshes [14], or introducing a specific device such as a grid [15,16]. The position of the device within the trawl net [17] also influences the ability of species to escape by increasing the probability that individuals will make contact with the selective device [18–20].

To address the remaining discard issue, the European Union (EU) reformed its policy in 2013 (Common Fisheries Policy, CFP) with a new regulation including article 15 on the landing obligation [21]. The landing obligation stipulates that catches of stocks under Total Allowable Catch regulations must be landed, and thus prohibits throwing unwanted catches back into the sea. Through the discards ban, the new CFP encourages fishermen to adopt selective devices that are more effective at reducing unwanted catch. However, species diversity may vary from one fishery to another, mainly due to the different fishing grounds that are harvested. The species composition of unwanted catches and landings may also vary within a fishery [22] or between regions [23] depending on market demand or quota consumption [24], resulting in fisheries-specific bycatch issues. Under the current EU legislative context of zero discard, it is thus important to provide the fishing industry with a wide diversity of selective devices.

In the Bay of Biscay, the main bottom trawl fleets target *Nephrops* or demersal fish species [25]. These two fisheries have multispecies catches, and their discards levels remain high [26], despite the technical measures already enforced, such as the square mesh panel (SMP) [27].

The catch comparison method, using the standard commercial gear as a reference, is currently used in collaborative projects involving scientists, stakeholders, gear developers and the fishing industry [28] to assess gear selective performance. Vessels rigged with twin trawls are widely used in both *Nephrops* and demersal fish fisheries of the Bay of Biscay. The catch made with the selective gear is directly compared to the catch made with the standard commercial gear. This methodology is usually meaningful for the crews and skippers. If f the tested device is economically sustainable, it encourages them to voluntarily adopt the selective gears.

These two fleets catch common commercial and unwanted species [29], while targeting *Nephrops* spp. or demersal fish in the Bay of Biscay. Species include common sole (*Solea solea*) and red mullet *(Mullus surmuletus)*, which are preferred due to their high market value; horse mackerel (*Trachurus trachurus*), which is nearly never landed; and hake (*Merluccius merluccius*), which has many juveniles in the catches. This study proposes to reduce unwanted catch by testing T90 codend and extension on the demersal fish fishery and a square mesh bycatch reduction device in the *Nephrops* fishery.

## 2. Materials and methods

### 2.1. Vessels and sea trials

Sea trials were conducted in the Bay of Biscay on board three commercial vessels (Fig 1). Forty-seven hauls were used to test the SMBRD in June 2015 on board a 18.5 m long trawler (referred to as QG) targeting *Nephrops*. The T90 was tested on two vessels in November 2014: 25 hauls were conducted on board a 14.99 m long trawler (referred to as INS), and 19 hauls were conducted on board a 16.75 m long trawler (referred to as OUR), both targeting demersal fish. All three vessels were rigged with twin trawls, with the selective gear on one side and the Std on the other side for paired catch comparison. The trawls were switched half way through the sea trials to avoid any bias due to the gear side [30].

Table 1 here

Figure 1 here

### 2.2. Selective devices

#### 2.2.1. T90 codend and extension (T90)

The first device consisted of a codend and extension made of T90 netting tested for the fleet that targets demersal fish. To date, T90 meshes have been tested mainly in the codend [31,32], while other parts of the trawl, such as the extension section [14], might be suitable positions to increase fishing gear selectivity. The T90 netting was constructed with a circumference of 72 meshes and was 145 meshes long. The extension piece consisted of 100 single meshes of 70 mm (gauge), while the codend consisted of 45 double-twine meshes of 70 mm. The twine, 4 mm in diameter, was made of polyethylene. This selective device is referred to hereafter as “T90” (Fig. 2a).

#### 2.2.2. Square Mesh Bycatch Reduction Device (SMBRD)

The second selective device, an additional Square Mesh Bycatch Reduction Device (SMBRD) placed on the top side of the tapered section, was tested in the *Nephrops* fishery to reduce fish bycatch. Square meshes are known to be effective at letting unwanted fish escape, but it is usually placed in the extension piece or the codend [33,34]. Fish are known to be less exhausted and more active in the mouth of the trawl than in the codend [35,36]. The SMBRD was placed on the top side of the tapered section to avoid contact with the target species, *Nephrops,* which enters the trawl through the lower part of the gear [37]. The SMBRD had a trapezium shape and was made from meshes of 90 mm gauge (Fig. 2b). The SMBRD aims at increasing the square mesh area of the trawl to favour fish escapement.

#### 2.2.3. Standard commercial gear (Std)

Catches of each selective gear were compared to those of standard commercial gear ("Std"). The Std gear was made of a 70 mm double-twine meshes codend, an extension consisting of 70 mm single-twine meshes and a mandatory SMP of 100 mm gauge mesh of 1*2m placed on the top side of the tapered section [27] (Fig. 2c).

Figure 2 here

### 2.3. Sampling process

To sample the catch, the crew was asked to sort it as usual. An independent observer weighed the landing and unwanted fractions separately for each species and haul (because of the implementation of the landing obligation, the catch fraction that used to be discarded is named hereafter the "unwanted catch"). Individual length data were also recorded for both landing and unwanted fractions, except when catch haul sequencing was too fast to perform complete length samples (Table 1). When the catch was too large to measure each individual, a random sampling was carried out. The depth, date, time and location of each tow were recorded.

### 2.4. Data analyses

#### 2.4.1. Length-based selectivity model

The length-based selectivity model was based on catch comparison data. The underlying assumption is that for each length, the same number of individuals entered each trawl. This assumption is frequently not met when only a few individuals entered the trawls. To minimize this effect, data from lengths outside the lower and upper quantiles of 0.025 and 0.975, respectively, were removed. For each haul and length class, data were also removed when less than 5 individuals were observed in the selective and Std gears together [38].

Depending on species, the number of hauls available for size selectivity analysis was therefore lower than the number of hauls available for weight analysis (Table 2).

The proportion of each length retained was defined as the number of fish caught in the test gear divided by the total number of fish observed in the test and standard gears for a given length [39]. The proportion retained was modeled using a Generalized Linear Mixed Model (GLMM) [40,41] when length data were available for more than 15 hauls for a given species. Such a sample size allows for the estimation of the "haul" random effect variance. When length data were available for less than 15 hauls, a Generalized Linear Model (GLMM) was implemented. For both types of models, the total number of individuals of each length was used to weight the fitted values. The number of individuals retained in the selective gear was modeled using a binomial distribution, with a probability of success defined by the relative number of fish retained in this gear compared to the standard one. A logistic link was used to relate this proportion of fish retained to fish length. Both models were run with data previously raised with the sampling ratio. A logistic link was used to relate the relative proportion of fish retained to fish length. The confidence intervals were derived from the Maximum Likelihood estimators, using their asymptotically normal property and standard deviations. Polynomials of degrees 0-3 were tested, and models were selected using the Akaike Information Criterion [42]. When a GLMM was fitted, the random effect was tested by comparing the best GLM and GLMM with a chi-square test, testing the null hypothesis that the variance of the random effect is zero. Since vessels INS and OUR targeted demersal species in the same fishery with the same T90 test gear, length data for the T90 gear from both vessels were pooled.

#### 2.4.2. Catch weight comparisons

Since the catch data were collected under commercial conditions, tow durations varied among hauls. To compare catches of selective and Std gears, landing and unwanted catch weights were standardized by converting them into Catch Per Unit Effort (CPUE) [43,44]. To do this, species weight per haul and fraction was divided by the tow duration (kg/hour). For each combination of species and fraction, CPUE distributions were tested for normality using the Shapiro-Wilk test [45]. If normally distributed, the CPUE of Std and selective gears were then compared using the Student's *t*-test [46]; if not, the Wilcoxon signed-rank test was used [47] (Table 2). Since the size composition of each fraction can depend on the skipper's fishing strategy, the fishing area or fishing season, catch weights were compared separately for each vessel.

## 3. Results

### 3.1. T90 codend and extension

The T90 gear retained fewer horse mackerel than the Std (Fig. 3). The fitted proportion of fish retained decreased as length increased. The length of fish retained ranged from 11-23 cm. The length distributions contained a large cohort of small individuals 9-13 cm long. These small individuals were less numerous in the selective gear than in the Std, but the proportion of small individuals retained with the T90 was higher than that of larger individuals. The unwanted CPUE varied greatly with the T90 (Table 2).

The hake population sampled with the T90 ranged from 11-40 cm and contained one main cohort of fish ranging from 16-23 cm (Fig. 3). The proportion of that cohort retained averaged 0.1. Regardless of fish length in the range observed, the proportion of hake retained was significantly less than 0.5. The unwanted CPUE was significantly lower with the T90 than with the Std (Table 2). However, the landing CPUE was similar for both the T90 and Std due to the latter discarding a larger proportion of commercial-sized individuals (>27 cm) from the Std.

Red mullet retained with the T90 ranged from 13-21 cm (Fig. 3). Across this length range, the fitted proportion of red mullet retained increased slightly as length increased but was always significantly less than 0.5. This resulted in significantly lower CPUE of landings and unwanted catches with the T90 than with the Std (Table 2).

The data selection process resulted in only two hauls available to analyze the length of sole retained with the T90 (Fig. 3). The proportion of sole retained with the T90 depended on length, with individuals smaller than 29 cm more numerous in the Std and larger individuals more numerous in the T90. The GLM did not consider haul variability, but based on a larger number of hauls (43), the comparison of CPUE indicated that the landing CPUE of the T90 and Std did not differ significantly.

### 3.2. Square Mesh Bycatch Reduction Device (SMBRD)

The SMBRD retained fewer horse mackerel than the Std (Fig. 4). The fitted proportion of fish retained decreased as length increased. The length of fish retained ranged from 9-30 cm. The length distributions contained a large cohort of small individuals 9-12 cm long. These small individuals were less numerous in the selective gear than in the Std, but the proportion of small individuals retained with the SMBRD was higher than that of larger individuals. The unwanted CPUE decreased significantly with the SMBRD (Table 2).

Distribution of the hake population retained with the SMBRD revealed two main cohorts (Fig. 4). The smallest individuals (8-12 cm) were retained in equal numbers by the Std and SMBRD. The fitted proportion retained of that cohort ranged from 0.5-0.6. The second cohort (18-31 cm) was more numerous in the Std than in the selective gear. The associated fitted proportions retained ranged from 0.3-0.4. Although based on a smaller number of individuals, the proportion of larger fish (> 32 cm length) retained tended to increase towards 0.5 as length increased. For hake, CPUE of landings and unwanted catches were significantly lower with the SMBRD than with the Std. The QG vessel equipped with the SMBRD targeted *Nephrops*, but no significant reduction of either landing or unwanted catch was observed with the selective device (Table 2).

The GLM model indicated that the proportion of red mullet retained with the SMBRD reached 0.5 (Fig. 4) regardless of length (18-24 cm), but the number of hauls sampled and the number of individuals caught in each haul were extremely low. However, comparing the CPUE confirmed the observed trend: based on 33 hauls, CPUE of the SMBRD and Std did not differ significantly (Table 2).

Sole retained with the SMBRD ranged from 22-35 cm, and the proportion retained with the selective gear did not differ significantly from 0.5 (Fig. 4). Overall, the selective gear retained more sole than the Std. This was confirmed by comparing the CPUE of landings and unwanted catches, which was significantly higher with the SMBRD than with the Std.

The SMBRD did not induce any significant reduction of landing or unwanted catch of *Nephrops* (Table 2).

Table 2 here

Figure 3 here

Figure 4 here

## 4. Discussion

This experiment aimed at testing two innovative selective devices to reduce fish bycatch in two bottom trawl fisheries of the Bay of Biscay. The T90 codend was tested in the fish fishery and a bycatch reduction device made of square mesh netting in the tapered section was tested in the *Nephrops* fishery. Reducing unwanted catches without significantly reducing landings is a challenge for multispecies trawl fisheries, mainly due to the diversity of species behavior, morphology and the minimum conservation reference size (MCRS). The four species used for example show different selection patterns depending on the device tested.

Both selective devices decreased horse mackerel catches significantly across its entire length range. This species is almost never landed [48], and consequently, this result is beneficial for the stock and crews since it helps to reduce the time required to sort the catch. Horse mackerel is a pelagic species with schooling and aggregation behavior [49] that may have been responsible for the low proportion retained for both selective devices. Since individuals smaller than 15 cm are immature [50], and because this species cannot tolerate air exposure on deck [51], this direct escapement from the gear at sea may contribute further to stock replenishment.

Both selective devices significantly decreased hake unwanted catches. However, the proportion retained was larger for the first cohort of hake (<17cm) than for the larger individuals. Based on experiments with other fish species [52,53], we hypothesize that the smallest hake individuals had lower visual acuity or swimming ability, which made it more difficult to detect and orient themselves to escape the net. This indicates that a selective device such as the SMBRD requires fish to make a decision and voluntarily act to escape. The top SMBRD may therefore be less suitable for young individuals than for older ones since the former have not yet developed the physical ability to escape. Conversely, devices placed in the codend that enable escapement only through contact with the open mesh may be more suitable for small individuals, even if they arrive exhausted at this section of the net [36]. The design and position of the selective device, as well as the vertical opening of the gear, have a direct effect on fish contact probability, which is known to influence their escapement pattern [20,54]. The T90 codend resulted in a decrease in hake catches across its entire length range, including commercial sizes. However, depending on vessel practices, some hake larger than the MCRS may be discarded [29], and this sorting practice masks the influence of commercial-size escapement on the landing CPUE.

Red mullet can provide a substantial income for French demersal trawling fleets [55] even though it is often caught as bycatch [29]. Since this species swims close to the bottom due to its foraging behavior [56], the top position of the SMBRD aimed to prevent it from escaping. The model indicates that the SMBRD and Std retained on average the same proportion of red mullet. However, more hauls are required to confirm this since the number of individuals caught is not enough to shape catch length distribution, which means that the proportion retained at length could differ with larger samples. An opposite trend was observed with the T90, indicating that significantly more red mullet escaped across its entire length range, resulting in a decrease in landings, and thus, income for skippers. Escapees may survive the fishing process, which may ultimately contribute to fish reproduction and subsequent stock replenishment.

Like red mullet, sole has a high market value [55] and as a flat fish it is also known to swim close to the bottom; therefore, it has a low probability of contacting the top SMBRD. The model also indicates that the SMBRD and Std retained the same proportion of sole, keeping sole-related income constant, but did not result in a decrease in unwanted catches. Some studies indicate that the contact probability of sole is not optimal when T90 meshes are placed in the codend. For example, Bayse *et al*. [31] tested a T90 codend with 80 mm meshes and observed less sole selectivity than with a diamond mesh codend of the same mesh size. [14] found that small sole (<17 cm) could escape through a T90 cylinder made of 100m meshes. Our results suggest that sole smaller than 29 cm can escape through the T90 codend made of 70 mm meshes. However, more hauls with larger numbers at different lengths are needed to make the estimates of the proportion retained more robust.

CPUE comparisons and size analyses are complementary approaches. CPUEs indicate how unwanted catches and landings change when using new selective devices and are directly applicable by the fishing industry. Landing weights are a proxy for fishing income, and sorting time is related to unwanted catch weight. However, landing and unwanted catch size compositions are related to crew sorting practices, quota consumption, fish quality and market value [24,57,58], which may vary among vessels, seasons and areas. In contrast, length distributions of the overall catch (landings and unwanted catches combined) are not related to sorting practices. Therefore, they are relevant for understanding fish behavior when using the selective device as a function of individual length. The hake length distribution observed with the SMBRD illustrates this nonlinearity. Within this context, polynomial models are particularly relevant for describing the ability of fish to escape as a function of their length.

Comparison of the two selective devices indicates that the SMBRD decreases bycatch of demersal or pelagic species, such as hake and horse mackerel. However, due to its position at the top of the net, it does not decrease undersized bycatch of species with benthic behavior, such as sole and red mullet. The T90 codend effectively decreased hake and horse mackerel bycatch, but its mesh size was poorly adapted to the commercial-size range of benthic species such as sole and red mullet. Our study indicates that intra-specific selectivity depends on the combination of fish length, fish physical abilities and contact probability with the selective device. Inter-specific selectivity is one of the main challenges in multispecies fisheries because it depends on species-specific behavior and ecomorphological traits. [59] showed that sole have relatively small eyes and large body surface area, while hake, horse mackerel and red mullet have large eyes. Streamlined species such as horse mackerel can also swim quickly. The characteristics of such functional traits determine the response of each species to each type of selective device.

The landing obligation implemented through the CFP, which has been enforced in EU member states since 2013, encourages skippers to adopt selective devices. Experiments such as ours provide fishermen with new techniques to reduce their bycatch based on the species composition they encounter throughout the year, the market and specific characteristics of the fishery. Besides their catch performance, the selective devices tested have technical simplicity and a moderate cost that may encourage skippers to adopt them voluntarily.

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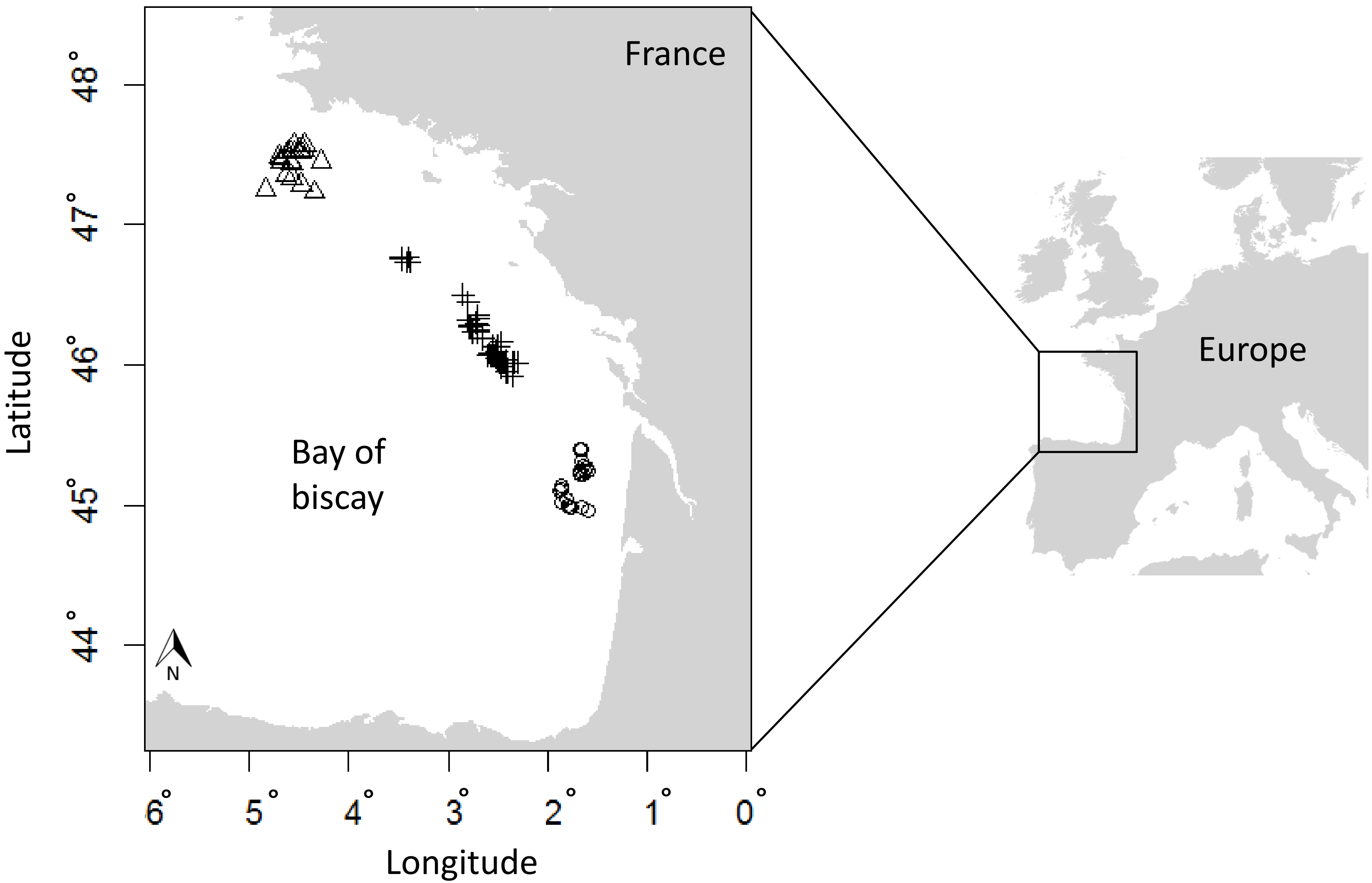
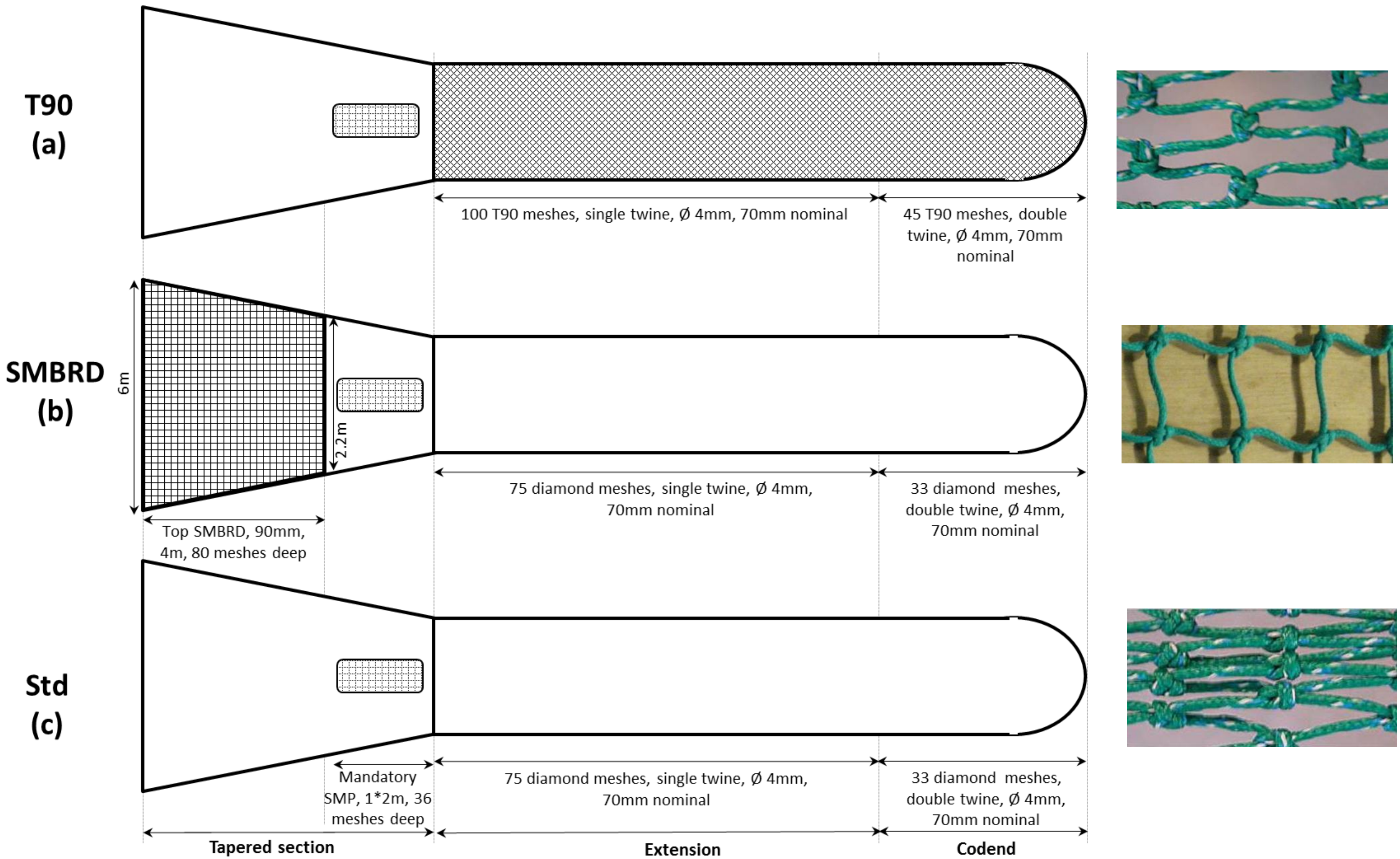
Figure 1. Sampling locations of the two selective devices in the Bay of Biscay, France (vessels: +: QG with SMBRD, o: INS with T90 codend, Δ: OUR with T90 codend)

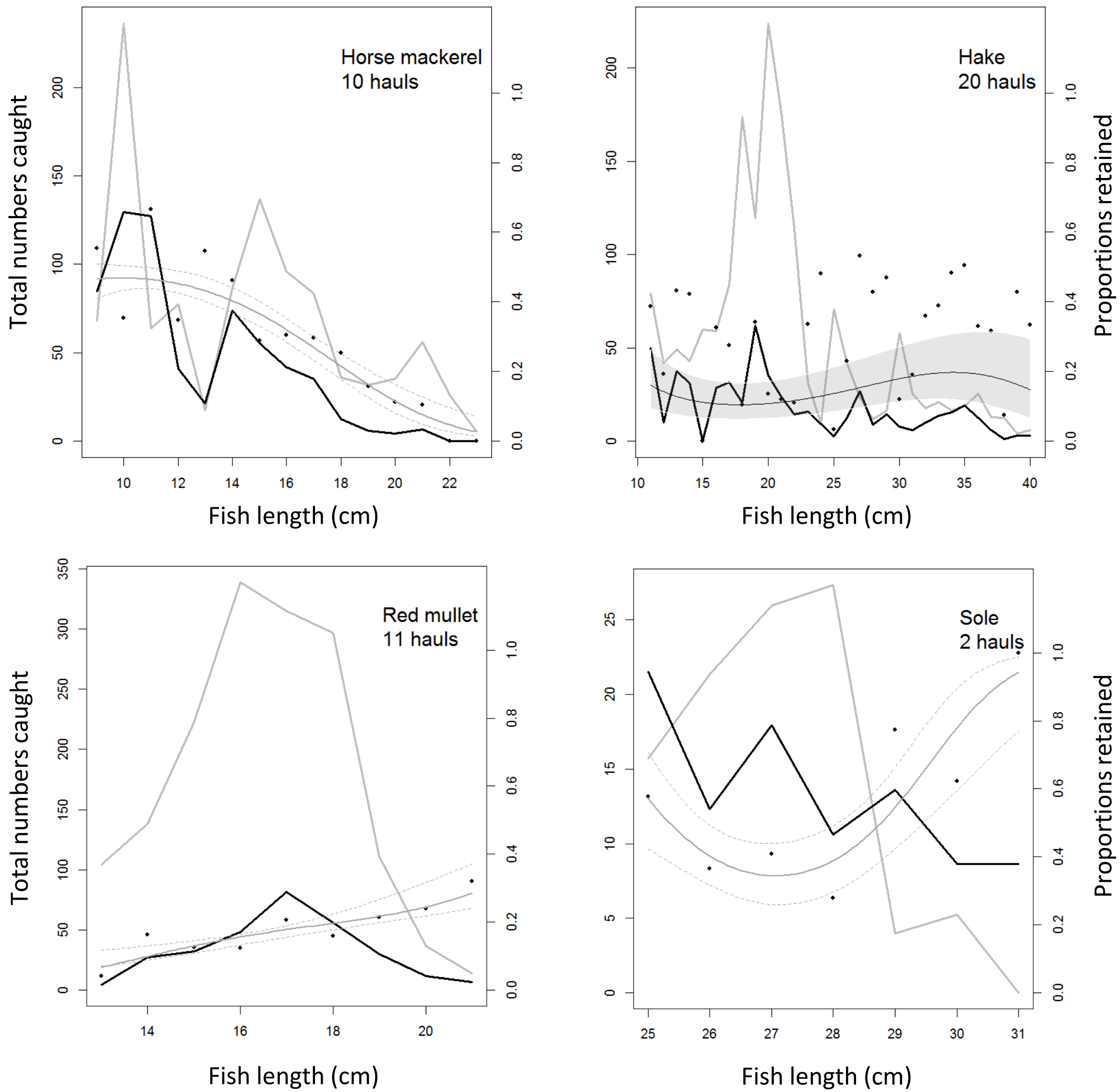
Figure 2. The selective gear tested. (a) : T90 codend and extension. (b) : Square Mesh Bycatch Reduction Device (SMBRD). (c) Standard commercial gear used as a reference (Std) for catch comparison between (a) and (c) in the demersal fish fishery and (b) and (c) in the *Nephrops* fishery. Mesh type of the selective device are presented on the right side. (a) : T90 mesh.(b) square mesh. (c) : diamond mesh.

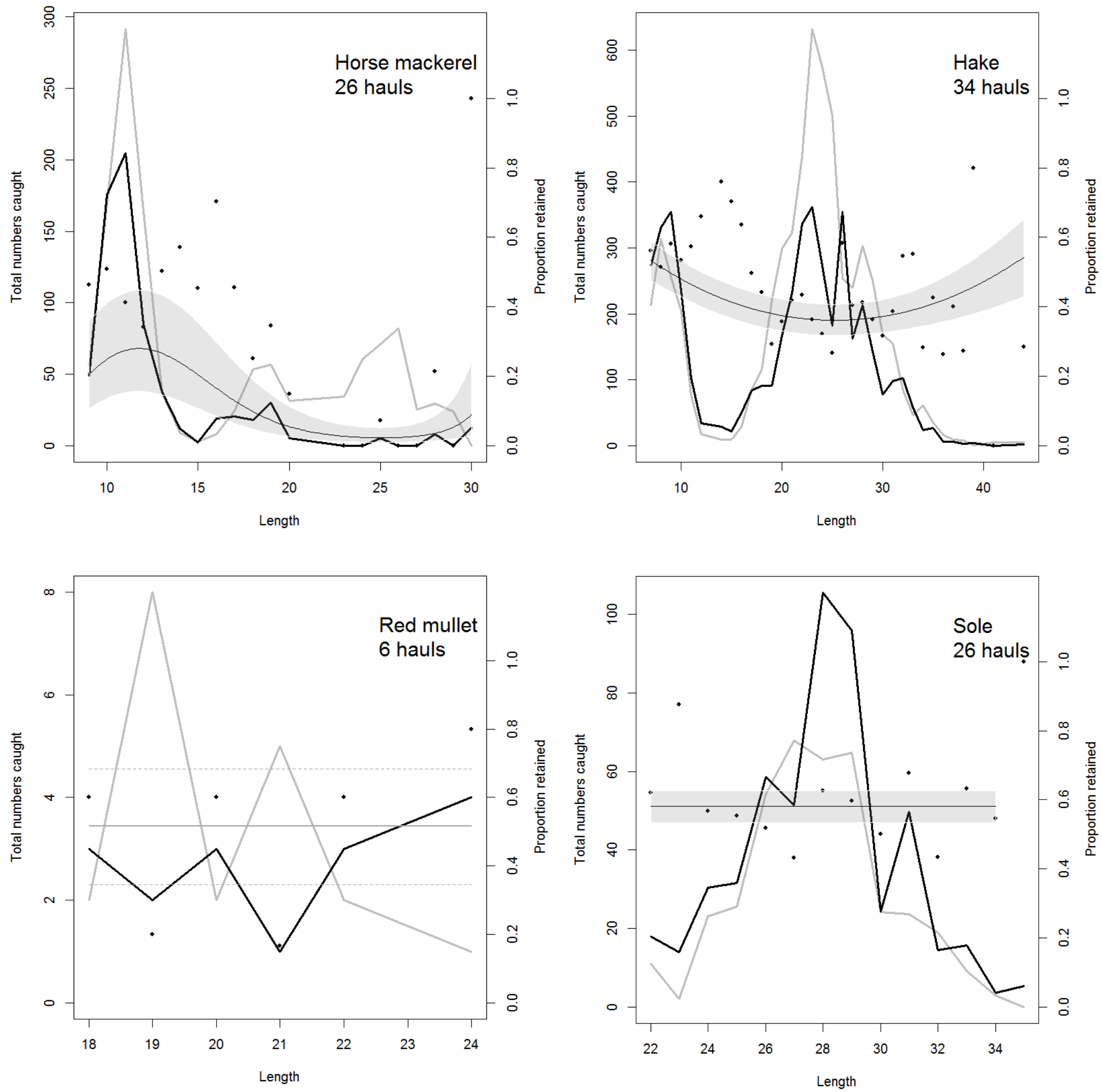
Figure 3: Catch profiles and proportion of fish retained with the T90 selective device. Gray line: cumulative catch from standard tows. Black line: cumulative catch from T90 tows. Black dots: observed proportion retained with the T90. Grey line within dashed line: proportion retained within the 95% confidence interval (c.i.) fitted with a Generalized Linear Model. Gray line within shaded area: proportion retained within 95% c.i. fitted with a Generalized Linear Mixed Model.

Figure 4: Catch profiles and proportion of fish retained with the SMBRD selective device. Gray line: cumulative catch from standard tows. Black line: cumulative catch from T90 tows. Black dots: observed proportion retained with the SMBRD. Grey line within dashed line: proportion retained within 95% confidence interval (c.i.) fitted with a Generalized Linear Model. Gray line within shaded area: proportion retained within 95% c.i. fitted with a Generalized Linear Mixed Model.


France
Europe
Bay of
biscay
Latitude
Longitude
48°
47°
46°
45°
44°
6°
5°
4°
3°
2°
1°
0°
N


T90
(a)
100 T90 meshes, single twine, Ø 4mm, 70mm nominal
45 T90 meshes, double twine, Ø 4mm, 70mm nominal
SMBRD
(b)
6m
2.2 m
75 diamond meshes, single twine, Ø 4mm, 70mm nominal
33 diamond meshes, double twine, Ø 4mm, 70mm nominal
Top SMBRD, 90mm, 4m, 80 meshes deep
Std
(c)
Mandatory SMP, 1*2m, 36 meshes deep
75 diamond meshes, single twine, Ø 4mm, 70mm nominal
33 diamond meshes, double twine, Ø 4mm, 70mm nominal
Tapered section
Extension
Codend


Horse mackerel
10 hauls
Hake
20 hauls
Red mullet
11 hauls
Sole
2 hauls
Total numbers caught
Proportions retained
Fish length (cm)



Horse mackerel
26 hauls
Hake
34 hauls
Red mullet
6 hauls
Sole
26 hauls
Total numbers caught
Proportion retained
Length

Table 1. Details of tows made with the selective gears (sd : standard deviation).

| Device*Vessel | Total number of hauls with weight data | Tow duration (hours, mean ± sd) | Tow depth (m, mean ± sd) | Period of trials |
|---|---|---|---|---|
| SMBRD*QG | 47 | 2.88 ± 0.36 | 97 ± 9 | June 2015 |
| T90*INS | 25 | 3.56 ± 0.16 | 72 ± 14 | Nov. 2014 |
| T90*OUR | 19 | 3.40 ± 0.30 | 114 ± 6 | Nov. 2014 |

Table 2. Comparison of Catch Per Unit Effort (CPUE) for each species, gear (Std: standard. Sel: selective (T90 or Square Mesh Bycatch Reduction Device (SMBRD)), vessel (QG, INS, OUR) and fraction (LAN: landings. UC: unwanted catch.). (*t*): *t*-test. (W): Wilcoxon test. sd: standard deviation. (-): no data. Bold text indicates significant differences.

| Species | | T90*INS | | | | T90*OUR | | | | SMBRD*QG | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LAN | | UC | | LAN | | UC | | LAN | | UC | |
| | | Std | Sel | Std | Sel | Std | Sel | Std | Sel | Std | Sel | Std | Sel |
| Horse mackerel | no. of hauls | 1 | | 10 | | 0 | | 7 | | 0 | | 28 | |
| | mean CPUE | 0.56 | 0 | 0.76 | 0.30 | - | | 0.15 | 0.26 | - | | 1.17 | 0.41 |
| | sd CPUE | - | | 0.72 | 0.57 | - | | 0.28 | 0.27 | - | | 1.41 | 0.91 |
| | *p*-value (test) | - | | 0.05 (W) | | - | | 0.47 (W) | | - | | **<0.001** (W) | |
| Hake | no. of hauls | 25 | | 11 | | 19 | | 17 | | 47 | | 35 | |
| | mean CPUE | 1.53 | 1.67 | 1.96 | 0.41 | 1.13 | 1.16 | 1.30 | 0.35 | 4.59 | 3.61 | 5.25 | 3.26 |
| | sd CPUE | 1.14 | 1.45 | 0.99 | 0.50 | 1.11 | 1.14 | 1.53 | 0.30 | 3.83 | 2.73 | 7.11 | 5.71 |
| | *p*-value (test) | 0.62 (W) | | **<0.001** (*t*) | | 0.70 (W) | | **<0.001** (W) | | 0.03 (W) | | **<0.001** (W) | |
| Red mullet | no. of hauls | 25 | | 11 | | 2 | | 0 | | 33 | | 1 | |
| | mean CPUE | 2.93 | 0.87 | 0.26 | 0.07 | 0.01 | 0.01 | - | - | 0.29 | 0.27 | 0.15 | 0 |
| | sd CPUE | 2.22 | 0.82 | 0.35 | 0.11 | 0.02 | 0.02 | - | - | 0.21 | 0.19 | - | - |
| | *p*-value (test) | **<0.001** (W) | | **0.03** (W) | | - | | - | | 0.60 (*t*) | | - | |
| Sole | no. of hauls | 25 | | 25 | | 18 | | 1 | | 47 | | 8 | |
| | mean CPUE | 1.82 | 1.98 | - | - | 0.73 | 0.58 | 0 / 0.1 | 0.1 | 1.27 | 1.72 | 0.09 | 0.16 |
| | sd CPUE | 1.44 | 1.54 | - | - | 0.61 | 0.43 | - | | 1.14 | 1.45 | 0.11 | 0.16 |
| | *p*-value (test) | 0.18 (W) | | - | | 0.24 (W) | | - | | <0.001 (W) | | 0.55 (W) | |
| *Nephrops* | no. of hauls | 0 | | 0 | | 0 | | 0 | | 47 | | 36 | |
| | mean CPUE | - | - | - | - | - | - | - | - | 7.00 | 6.40 | 4.68 | 4.01 |
| | sd CPUE | - | - | - | - | - | - | - | - | 5.78 | 5.59 | 3.78 | 2.77 |
| | *p*-value (test) | - | | - | | - | | - | | 0.38 (W) | | 0.15 (W) | |