PROJECT Nº 94/086: TRAMMEL AND GILL-NET SELECTIVITY IN THE ADRIATIC AND TYRRHENIAN SEA

KEY WORDS

Trammel net, gill-net, Adriatic Sea, Tyrrhenian Sea, selectivity.

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OBJECTIVES

To investigate the selectivity of trammel nets and gill-nets in two coastal areas, the central Adriatic Sea and the northern Tyrrhenian Sea.

APPROACH AND METHODOLOGY

Gill-nets and trammel nets are passive gears largely used along the Italian coast for the catch of a high number of demersal, benthic and pelagic species. A gill-net consists of a single wall of net, generally made of mono-filament. A trammel net is constituted by three panels of nets: the inner panel may be either of twisted or mono-filament nylon, while the outer panels have a larger mesh size than the inner one and are generally made of twisted nylon filament. Both types of net are held vertically in the water by weights on the bottom (lead line) and floats on the top (float line).

Three different ways of catching have been commonly recognised for fish in these types of nets: (a) wedged, held by the mesh around the body; (b) gilled; and (c) tangled, held by teeth, spines or other protrusions without necessarily penetrating the mesh. In addition, the trammel net can capture fish in a bag or pocket of netting: a fish passing through the large meshed outer panel hits against the small meshed inner panel which carries through one of the large openings of the opposite large meshed outer wall. Because of this, trammel nets are generally known to be less selective than gill-nets.

The selection curves of set nets are bell shaped and can be described by the normal distribution defined by a mode, corresponding to the optimal length of the caught specimens, a width corresponding to the selection range and by a height representing the net efficiency of catching the optimal length class. The shape of the curve depends either on the morphological characteristics of the species (e.g. body shape, occurrence of spiny rays, teeth, etc.) and on the technical features of the net (e.g. materials, hanging ratio, etc.). The reduced selectivity of trammel net is reflected in a skew either on the right or on the left side of the catch length-frequency distributions.

In the present study the selectivity of a traditional trammel net, a mono-filament trammel net and a gill-net was investigated in two coastal areas (central Adriatic Sea and northern Tyrrhenian Sea) on samples collected during one year. Three mesh sizes for each set net were tested: 45, 70 and 90 mm (stretched mesh size).

Catch efficiency, modality of capture and selection parameters for each net and each mesh size were estimated on some abundant species of the fish assemblage occurring in the two coastal sampling areas.

Comparison of the catches obtained with the different set nets and mesh sizes was accomplished through statistical tests. Catch modality and selectivity were studied through an indirect and a direct method. The former was the Sechin model, consisting in the estimation of the selection parameters based on maximum girth and head girth data of the considered species. This method was developed for gill-nets, but the present study showed that it could also be suitable for trammel nets, when the tangling effect was limited. As the selection curves estimated with this method took into account only the specimens exclusively caught by gilling and wedging, comparison with the catches allowed an evaluation of the most important way of capture. It showed the importance of tangling and/or the pocket effect on the total catch for the three types of nets used.

The direct method compared the length-frequency distributions of set net catches (i.e. gill-nets and trammels) with the length-frequency distributions of the fish population at sea sampled through a bottom trawl net and took into account also the specimens caught by entangling. Because of this, the selection ranges were generally broader then those computed with the Sechin method and the tangling effect was evidenced by a skew of the selection curves either on the left or on the right side, depending on whether the tangled effect occurred on the small or on the big individuals.

MAIN FINDINGS AND CONCLUSIONS

The catches obtained with the three types of net tested were generally constituted by a high variety of species. This is because the coastal areas of the Adriatic and the Tyrrhenian Sea are constituted by a large number of species, whose importance can vary among the seasons and among the areas.

The highest number of species in catches was recorded in the Tyrrhenian Sea, due to there being the largest variety of habitats, while the highest yields were obtained in the Adriatic Sea, in agreement with the well-known greatest fish abundance. As regards the target species, the highest yields (number of individuals per 1,000 m of net) of striped seabream (*Lithognathus mormyrus*), thin-lip mullet (*Liza ramada*), red mullet (*Mullus barbatus*), blotched picarel (*Spicara flexuosa*), common sole (*Solea vulgaris*), tub gurnard (*Trigla lucerna*) and common cuttlefish (*Sepia officinalis*) were recorded in the Adriatic sea. While the highest catches of annular seabream (*Diplodus annularis*), common pandora (*Pagellus erythrinus*) and axillary seabream (*Pagellus acarne*) were obtained in the Tyrrhenian Sea.

In both sampling areas the set nets tested showed a similar behaviour towards most of the target species. They had the same catch efficiency for *Pagellus acarne*, *Mullus barbatus* and *Spicara flexuosa*, while the two trammel nets gave similar catches, higher than those recorded with the gill-net, for *Pagellus erythrinus*. Gill-net was the most efficient gear for *Diplodus annularis*, the mono-filament trammel net for *Liza ramada* and, finally, the standard trammel net for *Sepia officinalis* and *Solea vulgaris*.

Only for *Trigla lucerna* and *Lithognathus mormyrus*, there were differences between the two areas. In the Adriatic Sea, the highest yields of *Trigla lucerna* were obtained with the gill-net, whereas the three nets were equally efficient in the Tyrrhenian Sea. In this last area, the traditional trammel net was the most efficient gear for *Lithognathus mormyrus*, while the three set nets showed a similar efficiency for this species in the Adriatic Sea.

The 45 mm mesh size of each type of net was much more efficient than the two larger mesh sizes, because most of the species occurring in the two sampling coastal areas had small dimensions or, were mainly represented by small size classes. The same was also so for the target species, with the exception of *Solea vulgaris* and *Sepia officinalis*, for which the 70 mm mesh-size was either similar or more efficient than the 45 mm mesh. The 70 mm mesh-size gave satisfactory yields

also for *Lithognathus mormyrus* and *Liza ramada*. On the contrary, the 90 mm mesh-size of each type of net resulted too large for the fish populations present in both areas and the catches were always very low.

Both selectivity methods showed that the mono-filament and standard trammel net had a similar selectivity as gill-net only for *Spicara flexuosa*, that was caught exclusively by gilling and/or wedging. For the other species, a percentage of tangled and/or pocketed individuals generally occurred. This portion was generally negligible in gill-net catches and it gradually increased going to the mono-filament and to the standard trammel net, causing a gradual widening of the size catch range and confirming that this last type of net was the least selective among the three set nets.

Comparison between the two areas showed that the tangling effect on the larger specimens was generally more evident in the Adriatic Sea, while it often occurred on the small individuals in the Tyrrhenian Sea. This was due to the different demographic structure of the populations in the two areas, consisting in the fact that the great size classes were generally better represented in the former area, while in the latter one the small individuals were generally more abundant and belonged to a wider size range.

In spite of this tangled effect, gilling and/or wedging were found to be the most important ways of capture for most of the target species, while *Liza ramada, Trigla lucerna* and *Sepia officinalis* were mainly caught by tangling and/or pocketing. This was expected for the two last species, because of the occurrence of protrusions (large pectoral fins, spines, etc.) in the former and of tentacles and suckers in the latter one. On the contrary, it was not predictable for *Liza ramada* that has a hydrodynamic body shape.

A clearly tangling effect only on larger individuals was recorded for *Lithognathus mormyrus*, *Liza ramada*, *Diplodus annularis* and *Pagellus erythrinus*. Increasing the mesh size, the catches gradually shifted towards the highest length classes and the tangled effect occurred on the left in respect to the selection curves. This last effect was evident in the 70 mm mesh size for *Lithognathus mormyrus*, *Diplodus annularis* and *Pagellus erythrinus*, because their population in both areas was mainly constituted by small individuals, whereas for *Liza ramada* it became particularly consistent only in the 90 mm mesh size, as a consequence of the highest dimensions of this last species. *Solea vulgaris* showed a similar overall behaviour to that described for the above mentioned species even though, in the Tyrrhenian sea, a tangled effect on the small individuals was also recorded in the catches obtained with the 45 mm mesh size, likely because the population occurring at sea included a wide size range and the smallest length classes were better represented than in the Adriatic sea. Moreover, the specimens caught by tangling either on the left and on the right side of the selection curves were more abundant in the gill-net that in the two trammel nets.

Each type of set net and each mesh size showed a good selectivity towards the small specimens of *Sepia officinalis*. In fact, in spite of the great abundance of juveniles at sea in both sampling areas, the direct comparison with trawling showed a gradual shifting of the catch capacity of both trammel nets towards the highest size classes. An increased tangled effect on the left side of the selection curves occurred in the two largest mesh sizes, but it became noticeable only in the 90 mm mesh. Finally, as regards *Trigla lucerna*, the three set nets and the three different mesh sizes captured the same length classes in both areas, showing that selectivity of this species is not based on the size differentiation, but only on the different catch efficiency of the various mesh sizes.

For management purposes, the 45 mm mesh size was in agreement with the actual regulated minimum landing size and/or with the length-at-first-maturity of most of the target species considered in the present study and appeared the most suitable among the three mesh sizes tested for the exploitation of these species. In fact, it caught the highest number of individuals but at the

same time, protecting the juveniles. As regards *Diplodus annularis*, a small dimensioned species, the optimal catch size estimated for the 45 mm mesh was lower than the minimum landing size established for this species, but it agreed with the length-at-first-maturity. In fact, the percentages of sexual immature specimens in the catches were very low. Therefore, the actual minimum landing size (15.0 cm TL) could be adequate for other species of the *Diplodus* genus, but it appears too high for *Diplodus annularis*.

On the other hand, the 70 mm mesh size seemed more adequate for *Solea vulgaris*, *Liza ramada*, *Trigla lucerna* and also for *Sepia officinalis*, taking into account that this mesh showed a higher efficiency than the smaller one for this cephalopod.