

Mapping natural and man-induced untrawlable grounds (no-take zones, NTZs) in view of managing the fisheries of the Strait of Sicily.

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Abstract

Fishery reserves or no-take zones (NTZ), defined as limited areas in which fishing is temporarily or permanently restricted, are generally considered a suitable tool for fisheries management. Experimental bottom trawl surveys are a source of information to identify unsuitable bottoms, both natural (cliffs, rocky outcrops, boulders and coralligenous habitats) or man-induced (shipwrecks, "mazzare", etc.), which make fishing dangerous for the gear. This note presents, for the first time, a map of rough, hard-to-trawl or untrawlable patches, based on the occurrence of not-valid hauls (interrupted before scheduled time or with evidence of gear malfunctioning) over almost 20 years of surveying in the Sicilian Strait. This knowledge may be useful in assessing the quantitative importance of such refuges in the resilience of the resources to fishery, and to help establish regulated NTZs.

1. Introduction

Although the concept of "Marine Protected Area" (MPA) encompasses a wide range of definitions and applications, fishery reserves or no-take zones (NTZs) are usually distinguished from MPAs; the latter should be more oriented towards enhancement of the marine environment and conservation of biodiversity (Anon., 1999), whereas the former are generally designed within fishery scenarios (Horwood, 2000).

In fact, NTZs, herein defined as limited areas in which fishing is temporarily or permanently restricted, have been generally considered as a suitable mean of fisheries management, although their success depends on the specific context of application (Horwood, 2000).

The growing specific literature (e.g.: García Charton and Pérez Ruzafa, 1999; Horwood, 2000) has demonstrated the need for a proper spatial and dynamic evaluation before setting up NTZs. Both empirical and model-based assessments are difficult to deal with (Horwood, 2000); however, in data-limited situations, such as most Mediterranean fisheries, Setting up NTZs should be considered a feasible management tool in view of a precautionary approach to fisheries (Lindeboom, 2000).

A NTZ-based trawling ban may be of great relevance not only for the protection of nursery areas, but also because they represent a refuge (Agardy, 1997) for highly vulnerable, low mobility and seriously depleted species (such as rays or rockfishes; Ragonese *et al.*, 2003a, b).

Whatever the principle adopted in setting up NTZs, long-time monitoring is required to assess their effectiveness. Experimental bottom trawl surveys, like those which have been more or less regularly conducted in the Italian seas (Bertrand and Relini, 2000), might represent a good opportunity to monitor NTZs, without further costs. As a matter of fact, experimental

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tows are shorter than commercial ones and can be carried out also on hard-to-trawl bottoms. At the same time, these surveys represent a source of information for identifying “rough” bottoms, both natural (rocky outcrops and coralligenous habitats) or man-induced, such as shipwrecks or “mazzare” (stone blocks) fields (Bianchini and Ragonese, 1999).

Many bottom areas in the Sicilian Strait present “tormented” morphological features, i.e. steep declivities, vertical cliffs, narrow canyons, huge boulders and other geological accidents, which make the grounds difficult or impossible to trawl.

In the Sicilian Strait, the hard bottoms of the bathyal layer are characterized (Arena, 1985) by huge “buildings” produced by madrepores (*Madrepora oculata*, *Lophelia prolifera*) and barnacles (“denti di cane”, *Balanus* sp.), generally forming scattered clumps, that produce the “white coral assemblages” biocenosis (Pérès and Picard, 1964), locally known as “cannelleri”: they present strong, stony corms that form extended surfaces dangerous for the gear, or even absolutely untrawlable between 250 m and 500 m depth. Another yellow coral, *Dendrophyllia cornigera*, less hard but still representing an obstacle for fishing activity, lives at higher depths, colonizing rocky substrates exposed to hydrodynamism, while the former coelenterates prefer finer sediments.

Shipwrecks or other steel debris also prevent trawling and therefore represent another important cause of the bottoms' unvulnerability to trawls. The former, moreover, can be considered as important artificial refuges for many fish species (García Charton and Pérez Ruzafa, 2002; Tunesi and Diviacco, 2002). Work is in progress at IRMA (Ragonese *et al.*, in prep) to collect and map all available information on ship sinking in the Sicilian Strait; to date, data on more than 400 wrecks have been retrieved both from published (for an *ad hoc* publication, cfr. Semeraro, 2001) and unpublished (mainly fishermen's logs, also reporting over 1,000 additional fishing obstacles) sources.

A fourth important category of man-induced fishing obstacles is the presence of fields of large stone blocks (called “mazzare”), used as anchors for fish aggregating devices (FADs) and left behind after each fishing season; the fishery that creates the “mazzare” fields is most typical of the eastern Sicilian Strait. Incidentally, even the deepest fishing grounds in the Sicilian Strait are littered with anthropic wastes, as shown by the small percentage of the hauls that are “clean” (11%) or “almost clean” (25%) (Bianchini and Ragonese, 1999).

The aim of the present note is to present, for the first time, a map of the untrawlable bottoms, drawn on the basis of the not-valid hauls recorded over almost 20 years of scientific trawl surveying.

2. Materials

The results of 26 seasonal surveys, carried out in the framework of the Grund (since 1985) and Medits programs (since 1994) by the Institute of Marine Resources (IRMA-CNR) in Mazara del Vallo, were examined.

All hauls of the data set are comparable between them, given that the same sampling unit, *i.e.* the commercial stern trawler “Sant'Anna” (198 GRT, 32.2 m long, 1,012 HP engine) with the same net (the “di fondale” trawl gear) and using standardized fishing procedures, has been consistently used in all the surveys.

Not-valid hauls interrupted before the scheduled time because of “grasping” obstacles (“afferrature”), or presenting once on deck extended net tearing and/or gear damages due to hard invertebrates and rock spikes, or impossible to finish because of too rocky or rough landscapes were selected and mapped, under the above categories.

3. Results and discussion

Summary results are reported in Table 1. Of more than 3,100 hauls made in 26 surveys, 7.4% were not-valid; of these, half were considered as "afferrature", one third as "gear damage" and the rest were due to rough bottom morphology.

Table 1. Not-valid hauls recorded during the Grund and Medits surveys carried out in the Sicilian Strait (1985-2002).

Reason for invalidation	Number of hauls
grasping ("afferratura")	113
net tearing and/or gear damage	77
unsuitable bottoms	36

The geographical localization of the not-valid hauls is presented in Fig. 1. The scarcity of points outside the Italian area may be ascribed to lesser coverage due to a limited sampling effort (only two surveys); matter-of-factly, the Italian bottoms were extensively covered with a random-stratified design, and the representation reflects the real "density" of invalidating occurrences. It is therefore evident that grasping events are concentrated in shallower areas, i.e. on the western banks, on the eastern platform and near the coast; on the contrary, net tearing and gear damages often occurred in deeper grounds, where the “white coral assemblages” are present.

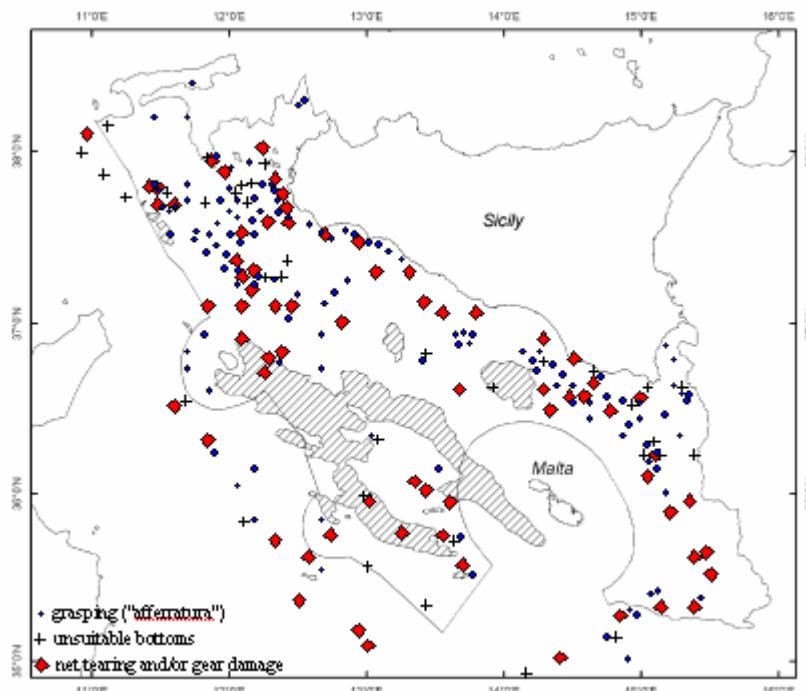


Figure 1. Not-valid hauls occurred during the Grund and Medits surveys carried out in the Sicilian Strait (1985-2002). (dots: grasping; diamonds: gear damage; crosses: rough morphology)

4. Conclusion

"There are undoubtedly many potential benefits that might be derived from the creation of protected areas in the marine environment. Nature conservation calls for them, scientific research desperately needs them and even fisheries might benefit from them" (page 299, in Lindeboom, 2000).

The facts presented in this paper may be useful for assessing the quantitative importance of such refuges in the resilience of the resources to trawl fishery. In fact, even a qualitative analysis of the species (and size) composition in the catch of not-valid hauls may show significant differences *vs.* the catch from neighboring grounds; unfortunately, the catch in not-valid hauls has been irregularly or seldom recorded until recently. In the future, this oversight will be corrected, and detailed information will be recorded to allow some sort of comparison (not-valid hauls are *per se* not strictly comparable with valid hauls) between assemblages.

Finally, the presence of already untrawlable patches should make establishing regulated protected areas around them more acceptable for trawl fishermen, who use the most impacting gear, while a limited and sustainable use may still be allowed to other forms of exploitation (Agardy, 1997).

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