

Title: Questioning the effectiveness of a minimum landing size on Mediterranean swordfish and suggesting possible alternatives with implications on the population and the fishery.

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Adoption of a minimum landing size (MLS: 120cm lower jaw fork length) on Mediterranean swordfish was in action till recently (2006). Data from the Greek swordfish longline fishery between 1998 and 2005 confirmed the inadequacy of this technical measure for a series of reasons: (1) average size of catches kept plummeting throughout the years, (2) undersized fish discarding was rarely practiced, (3) official landings size distributions were biased due to non-reported undersized catches, (4) plausible survival rate of released specimens was estimated to be less than 30%, (5) although Mediterranean swordfish mature at a smaller size (Length at first maturity =123 cm for males; 150 cm for females), the applied MLS was similar to that enforced on the Atlantic populations.

Gonadosomatic indices as well as heavily biased Sex Ratios at Size indicated that the spawning season peak was from May to July. Higher concentrations of juvenile swordfish were observed closer to the coastline and around wintertime. As an alternative to the ineffective MLS regulation we suggest the introduction of a combined seasonal and spatial closure for the swordfish longline fishery, as already in action for the trawler and purse seine fleets. Seasonal ban during winter and within a 6 miles coastal zone will reduce fishing pressure on the immature portion of the population, while seasonal closure during the spawning season will allow the mature specimens to spawn. Introduction of Vessel Monitoring System on all commercial boats will discourage illegal fishing practices and facilitate control by the authorities.

EFFECTIVENESS OF A MINIMUM LANDING SIZE ON SWORDFISH AND POSSIBLE ALTERNATIVES WITH IMPLICATIONS ON THE POPULATION AND THE FISHERY IN THE MEDITERRANEAN

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Introduction – Materials & Methods

Swordfish, *Xiphias gladius*, is a large pelagic species, with a high market value. Despite the enforcement of a minimum landing size (MLS) for all swordfish (120 cm lower jaw fork length) caught by the EU member state fleets, which was in action till recently (EC, 2006), still a large portion (> 50%) of the Mediterranean landings consisted of immature fish. In this study, we question the effectiveness of MLS as a technical management measure for Mediterranean swordfish, based on certain aspects of the fishery as well as the specific life history characteristics of the species. Furthermore, we recommend some management alternatives that are more likely to have a positive effect on the stock.

To reach our goals, we followed a subset of the commercial fleets targeting large pelagics in the eastern Mediterranean Sea (Fig. 1). Length measurements (LJFL) were recorded for all specimens. Parametric analysis of variance (ANOVA) was performed to compare the length means of the samples by various groups (year, month, fishing gear, distance from coast, sampling type). Swordfish vitality was evaluated on the basis of motility and the ability to respond to external stimuli, performing a *Chi-square* test to investigate variations in vitality composition.

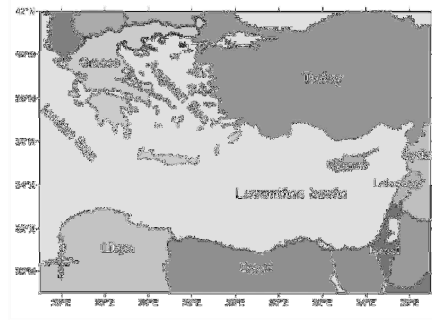


Fig. 1. Map of the studied area

Results & Discussion

- Annual size of specimens caught decreased significantly from 136 cm in 1998 down to 122 cm in 2005 (Fig. 2A).
- On a monthly basis, juvenile swordfish exceeded 30% of the total catch during the start and end of the fishing period (Fig. 2B).
- 37% of fish landed were under 120 cm, with this proportion ascending to 50% in the on board observations (Fig. 2C).
- 60% of the catch in areas less than 6 nautical miles (n.m.) from the coast, consisted of undersized fish. Out of the 6 n.m. buffer zone, in the open sea, the adults prevailed (67% of the catch) (Fig. 2D).
- Only 18% of the swordfish brought on board showed vigorous vital signs, giving the impression that they have good chances of surviving if released from the hooks back to the sea (Fig. 3).

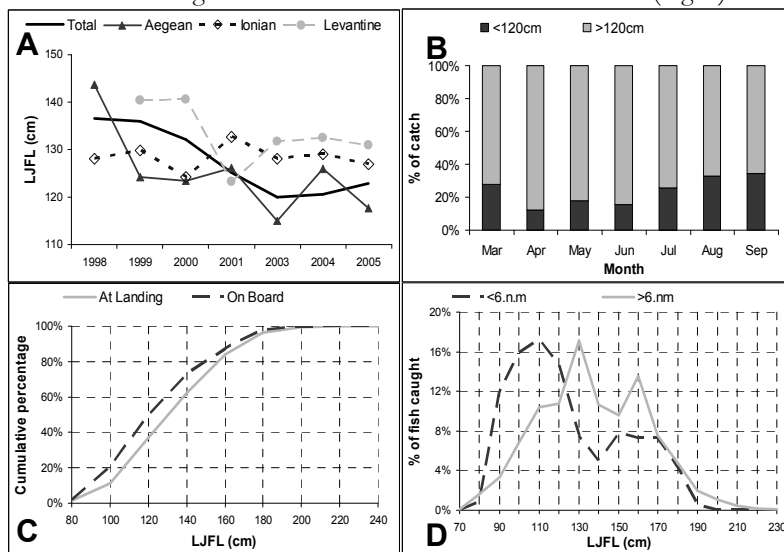


Fig. 2. (A): Size trends of swordfish catches in the eastern Mediterranean Sea by Year (B): Monthly composition of catches by size class (C): Cumulative size distribution of swordfish landed and caught (D): Size distribution for the coastal zone (< 6 n.m.) and distant waters (> 6 n.m.)

Based on our findings, what seems as the most realistic approach is the introduction of a **combined seasonal and spatial closure** for the swordfish fishery. In a recent work, Tserpes & Peristeraki (2007) concluded that annual catch will increase by 6 % in a period of 5 to 6 years after a four months winter closure. Moreover, catch reduction in juveniles will reach 18-23% of their total catch number.

Even if we acknowledge that the system suffers from incomplete monitoring and control, we must comprehend that the labyrinth of overlapping regulations, hinders or discourages the authorities from impelling them satisfactorily.

References

- European Commission (2006). Concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. Council Regulation (EC) No 1967/2006, amending Regulation (EEC) No 2847/93 and repealing Regulation (EEC) No 1626/94.
- ICCAT (2008). Report for biennial period, 2006-07 Part II (2007) - Vol. 2 English version SCRS 262 pp.
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The most recent stock assessment session on Mediterranean swordfish (ICCAT, 2008) concluded that all forms of multi-annual assessment conducted, gave a consistent view of declining stock abundance.

From this study, the ineffectiveness of MLS as a regulatory measure can be summarized in the following lines:

- Average size of catches kept plummeting throughout the years,
- release of undersized fish was rarely practiced,
- official landings size distributions were biased due to non-reported undersized catches,
- plausible survival rate of released specimens was estimated to be less than 18%,
- although Mediterranean swordfish mature at a smaller size, some of the applied MLS (120 cm) were similar to that enforced on the Atlantic populations

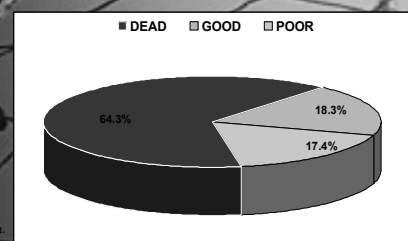


Fig. 3. State of vitality for swordfish caught