BIODIVERSITY CHANGES OF THE WATER COLUMN LARGE PELAGIC SPECIES IN THE ALBORAN SEA

Juan Antonio Camiñas [1] *, José Carlos Báez [2], Carlos García-Soto [2] and Raimundo Real [3]
[1] Instituto Español de Oceanografía, Centro Oceanográfico de Málaga, Spain - jacaminas@ma.ieo.es
[2] Instituto Español de Oceanografía, Centro Oceanográfico de Santander, Spain
[3] Universidad de Málaga, Departamento de Biología Animal, Spain

Abstract
The large pelagic species biodiversity variation of the Alboran Sea (Western Mediterranean) was analysed using data from on board observations in the Spanish longline fisheries. A relationship was found between the estimated H-value (Shannon-Weaver index) and lunar phases, which can be explained by the existence of vertical migrations within the water column in relation to lunar phases.
Keywords : Alboran Sea, Biodiversity, Fisheries, Pelagic.

The Alboran Sea (the Western Mediterranean zone connecting with the Atlantic Ocean through the Gibraltar Strait) is an outstanding area for marine biodiversity and constitutes an important corridor for many marine migratory species in the North Atlantic-Mediterranean region [1]. We studied the Spanish surface longline fleet fishing in the north Alboran Sea. This fleet, based in Mediterranean ports, targets Swordfish (*Xiphias gladius*), Bluefin tuna (*Thunnus thynnus*) and Albacore (*T. alalunga*), the latter two species mainly in summer. Surface longline gears targeting large pelagic species are considered the main threat for protected marine vertebrates (mainly marine mammals and turtles) because they are unspecific [2].

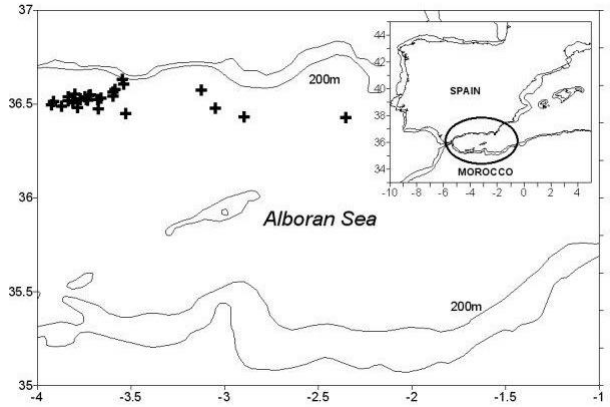

Fig. 1. Study area (Alboran Sea).

We assumed homogeneity in the configuration and components of each observed longline set and also that the probability of capture during each fishing operation was the same. Catches should deplete the abundance of vertebrates hooked (target and by-catch species) within the gear deployed area (the water column), particularly for species that have low rates of movement [3]. In this line of reason, if the gears are set in the same fishing area and depths (30 to 40 m), the biodiversity for each set's capture should be a reflection of the large pelagic species abundance/presence within the water column. This paper analysed the large pelagic species biodiversity associated with the surface longline targeted species in the Alboran Sea during the summer of 2004 and its relation with environmental and technical parameters. Environmental parameters included wind intensity and moon phase, satellite measurements of phytoplankton concentration (SeaWiFS), sea surface temperature (AVHRR), and sea surface velocity (altimeter), whereas the technical parameters included bait combination and boat strata. The study area extended from 36°- 37° N and 2°-5° W (Figure 1). The Spanish fishery is artisanal and fishes close to the coast, in an area where larger vessels do not operate because of the maritime traffic. During an EU LIFE02NAT Project (E/8610) we observed (onboard) 23 longline sets from 3 boats (15.34 m length and 20.75, register gross tonnage average).
Nine different species were caught during the observed period (27/06/04 to 27/09/04): Blue Shark, *Prionace glauca* , Bluefin tuna, *Thunnus thynnus*, Common dolphinfish, *Coryphaena hippurus* , Common stingray, *Dasyatis pastinaca*, Loggerhead *Caretta caretta*, Ocean sunfish, *Mola mola*, Shortfin mako, *Isurus oxyrinchus*, Swordfish, *Xiphias glaudius*, Thresher shark, *Alopias vulpinus*, and Tope shark, *Galeorhinus galeus*. We calculated the H-value [4] (biodiversity index of Shannon-Weaver) per fishing operation.
Linear multiple forward regressions, Generalized Linear Models, and second-degree polynomial regressions were applied to the captures by species using several technical or ecogeographical numerical factors as predictors, but no significant relationship was found. However when we selected four categorical factors (lunar phases, bait combination, boat strata, and wind) an H-value model was found in relation with Lunar phases (Figure 2). We tested the average of H-value between different moon phases using the Mann-Whitney test, and found significant differences between the H-value from longline set operating during waning Moon and the other longline sets (U= 32; P= 0.036). The higher H-value was obtained during waning Moon and the lower H-value during the New Moon phase. These results could be explained by vertical migrations of species within the water column according to lunar phases.

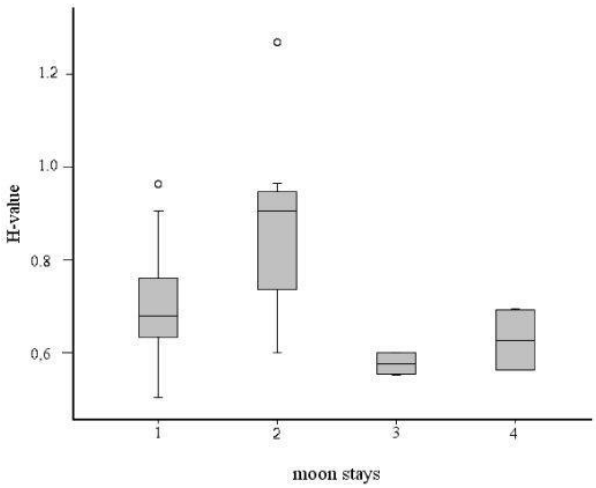

Fig. 2. The H-values per lunar phase. For each box the average H-value and its confidence interval are shown (individual square point: anomalous point). Key: 1, Full Moon; 2, waning Moon; 3, New Moon; 4, crescent Moon.

The by-catch in pelagic longlines represents an important conservation problem. If these results could be extended all over the Mediterranean Sea, effective management measures could be implemented to preserve threatened pelagic species.

References

1 - Camiñas J. A. 1995. The loggerhead *Caretta caretta* (Linnaeus, 1758) pelagic movements through the Gibraltar Strait. *Rapp Comm. Int. Mer. Médit*., 34: 238-239.
2 - Lewison R. L., Freeman, S. A. and Crowder, L. B. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. *Ecol. Lett*., 7: 221-231.
3 - Ward P., Myers R. A. and Blanchard W. 2004. Fish lost at sea: the effect of soak time on pelagic longline catches. *Fish. Bull*., 102:179-195.
4 - Magurran A.E. 1988. Ecological Diversity and its measurement. Princeton University Press. New Jersey, 179 pp.