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Elasmobranch fishing in Spain: preliminary analysis based on European long-term data

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Elasmobranchs (sharks, rays and skates), are keystone species within marine ecosystems. Large-sized pelagic sharks are exposed to longline fisheries targeting tuna and swordfish (Clarke et al., 2014; Gallagher et al., 2014) and demersal elasmobranchs living in the continental shelf and slope are heavily exploited by the bottom trawling fleet (Carbonell et al., 2003). Their low fecundity and late maturity make most elasmobranchs vulnerable to fisheries. These features do not allow these species to have enough recruitment to regenerate their populations under the current fishing pressure (Stevens, 2000). All this, along with the mismanagement of the fisheries and the lack of data have driven most elasmobranch populations to a critical state of conservation (Baum et al., 2003; Dulvy et al., 2014).

The objective of this study is to provide an updated analysis of the main capture databases and to make a revision of the evolution and trend of the elasmobranch fisheries in the European Union and Spain. To this aim we employed the public databases from the European Commission (European Commission, 2014) the Food and Agriculture Organisation of the United Nations database (FAO, 2014) and the capture database of the Environment Ministry of Spain (MAPAMA, 2014). The captures of 15 species and the total elasmobranch captures were organized, to build a temporal series from 1950 to 2014 with tones as units.

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The available elasmobranch capture databases show a low degree of species-level identification in the past, a late actualization and a scarce historical register. Moreover, these data do not include the bycatch captures. Most of the European Union fishing fleet operated in the North Atlantic. The Spanish fleet is the most important of Europe being, along with Portugal, the most important countries in the elasmobranchs fisheries. In comparison with other countries, Spain has important fisheries in the Central and South Atlantic, as well as in the Pacific and Indian Ocean (Fig. 1A). In 1997 Spain registered for first time the species composition of its captures and thereby leading to an abrupt change in the species composition of the European capture data, with the dominance of *P. glauca* over the other species (Fig. 1B1 and B2).

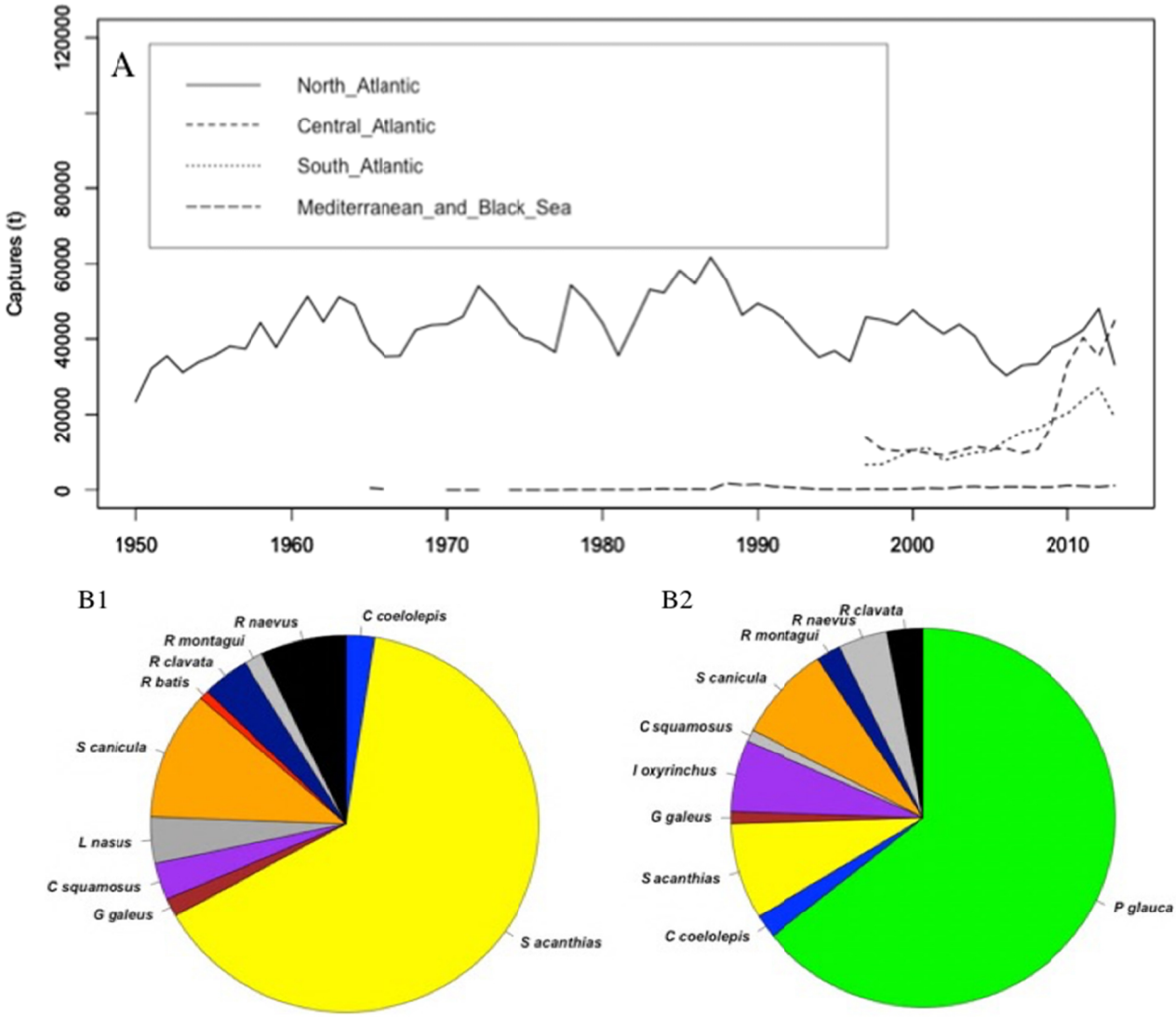

FIGURE 1. A) Elasmobranch captures in tones by European fisheries in the Atlantic, Pacific and Indian oceans. B.1) Main European captures of elasmobranchs before the report of Spain's captures in 1997 and B.2) after the addition of the Spanish captures.

Prionauce glauca captures had a maximum in 2012, almost reaching the 100,000 tones, of which 90,000 corresponded to Spain. The next species in order of importance is *Squalus acanthias*, but, although its catches were important until 1990, it suffered a strong decline until the species practically disappeared of the captures. *Scyliorhinus canicula* and *Isurus oxyrin-*

chus show an increase of captures too, while all the other shark captures show a constant decline. Two species of rays stand out of the rest, *Raja clavata* and *Leucoraja naevus*, having an irregular historical captures with an increase in the last years for both species. In the case of Spain, the temporal data series are too short to appreciate trends in the captures.

Taking in consideration the gap of information left by the lack of data register, the decrease of captures is a reality with the exception of some species. This is mainly because of the current fishing effort that does not allow the recovery of the most vulnerable species. It is the case of *Squalus acanthias*, which has the longest gestation period of the vertebrates (18-24 months) and small litters (1-24 individuals) or *Lamna nasus* with an even smaller offspring (1-5 individuals) and a long gestation period (8-9 months) (Compagno, 2001). On the other hand, species like *S. canicula* are able to resist the human pressure (Navarro et al., 2016) due to their reproductive mode, laying eggs and avoiding the gestation period. *Prionace glauca* is a particular case; their captures can resist and even grow despite being exploited. This is because they usually have litters of 80 individuals and a high growing rate (Froese and Pauly, 2016). However, these increases in captures are not necessarily related to an increment of the elasmobranchs population. This is the case of the species *P. glauca*, *S. canicula* and *I. oxyrinchus*. This increment is mainly related with the expansion of the Spanish fleet out of the traditional fisheries in the North Atlantic, to new underexploited fishing zones. So, the same data that reflects an increase of the captures shows a decrease in the traditional zones and the beginning of the exploitation in new areas. New studies would be necessary to determine what species of elasmobranchs are most appropriate to carry out a sustainable fishing, implement management and control of fishing plans and to improve the selectivity of fishing gears to reduce the bycatch of most vulnerable elasmobranch species.

We conclude that an improvement in the data register and the inclusion of the bycaught species in the databases are essential to improve the management of elasmobranchs and, that strong measures have to be established to stop the global and regional decrease of shark populations.

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