1. Basking shark (*Cetorhinus maximus*)

Irish name: An Liamhán Gréine

Figure A10.1.1. Basking shark (*Cetorhinus maximus*) © Edward Farrell.

This case report has been updated from the western Irish Sea case report published in 2023. A new Web of Science literature review was conducted to assess whether any new research on the species had been conducted since the western Irish Sea report was published. The new relevant research alone (Dolton et al., 2023) does not change the previous assessment made in 2023, but the case report was updated to include the relevant new research.

Background

The basking shark is the second largest fish species in the world, reaching 12 m and 4 tonnes (Compagno, 1984; Sims, 2008). It filter-feeds on planktonic prey and has been the subject of several biologging studies which are starting to reveal its ecology and biology (Sims et al., 2003; Gore et al., 2008; Witt et al., 2012; Sims et al., 2015; Doherty et al., 2017; Hawkes et al., 2020; Rudd et al., 2021; Johnston et al., 2022; Dolton et al., 2023). It is a pelagic species that occurs primarily in the temperate and boreal waters of the Atlantic, and the Mediterranean Sea (Compagno, 1984). Long distance migrations south of the equator and across the Atlantic have been recorded recently which is likely facilitated by probable red muscle endothermy (Dolton et al., 2023) and there is large variation in movement patterns amongst individual sharks (Sims et al., 2003; Gore et al., 2008; Witt et al., 2012). Most data from the Irish Sea are related to sightings of sharks on the surface, however, sharks likely spend large amounts of time in deeper waters off the west coast feeding during the winter months (Sims et al., 2003). Basking sharks most likely share the reproductive traits of other lamoid shark species, bearing live young (Sims, 2008; Sims et al., 2015) after a long gestation period of 12 – 36 months (Compagno, 1984; Sims et al., 2015). Basking sharks reach maturity at approximately 5-7 m total length, with an estimated age of 12-16 years, reaching 8-10 m in length after 16-20 years (Pauly, 1978; Compagno, 1984). Their maximum length is estimated at between 13 and 14 m (Parker and

Stott 1965; Holden 1975), and maximum age is estimated at 40-50 years (García et al., 2008), with a generation time of 34 years.

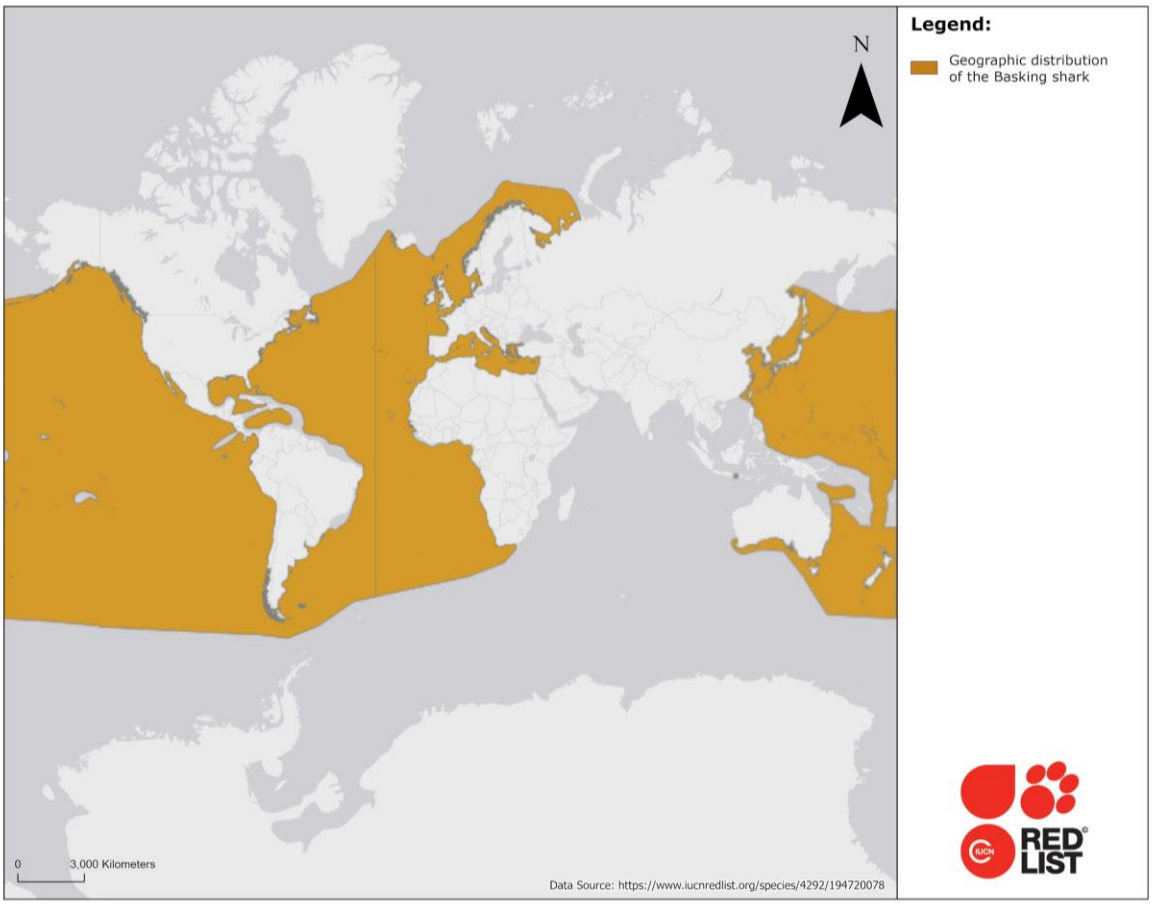

Figure A10.1.2. Geographic distribution of the basking shark (*Cetorhinus maximus*). (https://www.iucnredlist.org/species/4292/194720078)

Rationale for spatial protection in the southern Celtic Sea

Basking sharks have a long history of exploitation in the Northeast Atlantic and the population was severely depleted in a short period by overfishing (Clarke et al., 2016). They have been on the OSPAR List of Threatened and/or Declining Species and Habitats since 2003 (OSPAR Commission, 2008). Basking sharks are listed as Endangered on the Irish Red List of cartilaginous species (Clarke et al., 2016), and the IUCN Red List assesses the species as Endangered globally and in Europe (Sims et al., 2015). Basking sharks were also added to the Wildlife Act 1976 (Protection of Wild Animals) Regulations 2022 under Section 23. Despite the protection conferred on the species and although there is some increase in sightings in recent years, there are large uncertainties over the population trend (OSPAR Commission, 2008; Sims et al., 2015) and thus spatial protection is warranted.

The Celtic Sea Area of Interest has historically hosted good sightings of basking sharks (<40 in 1993; Berrow & Heardman, 1994), and in recent years (<3 years), the coastal waters around Clonakilty and Courtmacsherry Bay, have hosted hundreds of basking sharks gathering close to shore (pers. obs. H. Dolton; D. Orrell). Within these groups, close associations between basking sharks are regularly observed (pers. obs. H. Dolton), which is thought to facilitate efficient feeding or courtship behaviour, showing the current importance of this area to basking sharks (see Sims et al., 2022 for a detailed explanation of these behaviours). However, the data available for our analysis did not highlight this hotspot along the south coast of Ireland.

Basking sharks are currently managed under several national, European, and Global measures. Basking sharks are on the prohibited species list in the common fisheries policy. They are also included in the EU finning regulation, listed by Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Conservation of Migratory Species of Wildlife Animals (CMS).

Based on current knowledge basking sharks are amenable to spatial protection. Basking sharks are recorded in the Celtic Sea (Clarke et al., 2016). Basking sharks are filter feeders and are often associated with frontal systems which promote enhanced primary productivity and aggregate their zooplankton prey. The Celtic Sea is bordered by the well mixed Irish Sea containing multiple fronts driven by riverine outputs, tides and seasonal difference in temperature and density (Le Fevre, 1987; Hill et al., 2008), many of which are predictable, occurring in the same positions daily, monthly, or annually. The Celtic Sea is a temperate shelf system with seasonal changes in stratification and mixing from tidal currents, wind stress and convective mixing (Ruiz-Castillo et al., 2019). It has multiple fronts (the Irish Shelf, Celtic Sea and Ushant front) with phytoplankton blooms occurring from April to October (ICES, 2008). These features present reliable feeding opportunities for basking sharks (Sims, 2008; Miller et al., 2015), and thus are amenable to spatial protection.

Sensitivity assessment

The highest associated sensitivity scoring for the basking shark was in relation to its targeted and non-targeted removal (bycatch) by fishing (high confidence). The main threat to basking sharks is from fisheries, primarily through the targeted removal of the species. Historically, landings of over 1000 individuals per year were recorded in Irish waters from 1951 to 1955, with peak landings of 5266 tonnes across the Northeast Atlantic in 1979 (ICES, 2016). The overall result of fishery efforts was thought to have reduced the basking shark population to less than half of its original size over a 100 year period (Sims et al., 2015). Basking sharks have long generation times and slow maturity which makes them sensitive to exploitation and the population is still recovering from exploitation in the 19th and 20th centuries. Additionally, recent ICES advice highlights the difficulties of accurately recording the bycatch risk factor associated with endangered, threatened, and protected species, especially from setnet gillnet and bottom otter trawls (ICES, 2024), suggesting accidental bycatch has historically been underestimated for species such as basking sharks.

Following a precautionary principle, basking sharks were assessed as sensitive to some shipping related pressures (low confidence). Due to their feeding behaviour, remaining on the surface for long periods, basking sharks were assessed as having a medium sensitivity to death or injury by collision. In general sharks are resilient to injury, however, basking sharks are likely to be vulnerable to vessels of all sizes, particularly when travelling at high speed, although quantitative evidence of rates of injury, death and possibly recovery are lacking, and this is assessed as low in confidence. Basking sharks were assessed as Not Sensitive to underwater noise, however, the impacts of anthropogenic noise on elasmobranch species are very poorly understood. Lab-based studies suggest noise can increase swimming activity (de Vincenzi et al., 2021), whereas research in the wild indicates an equivocal response to boat traffic (Rider et al., 2021). Contemporary research suggests shark species such as tope (juveniles) respond to noise within the ranges of those produced by wind turbines and shipping activities (80-600 Hz; Nieder et al., 2023). How large, mobile species such as the basking shark will respond to this noise pressure is unknown.

Offshore energy impacts on elasmobranchs are poorly understood with the species deemed either not sensitive to relevant pressures, or those pressures deemed not relevant. An expansion of offshore energy development will likely result in increased vessel traffic in specific areas, and this sensitively is mentioned in the previous section. Basking sharks are deemed not sensitive to most physical, chemical, and biological pressures, or there is not enough evidence available to assess their

sensitivity. For instance, although sharks in general are considered electrosensitive and basking sharks are not considered an exception, they are deemed not sensitive to electromagnetic fields (EMF) due to their pelagic nature. This assessment has low confidence, as all research to date has studied EMF with respect to demersal and benthic species, including catsharks and skates/rays (Gill et al., 2009; Hutchison et al., 2020).

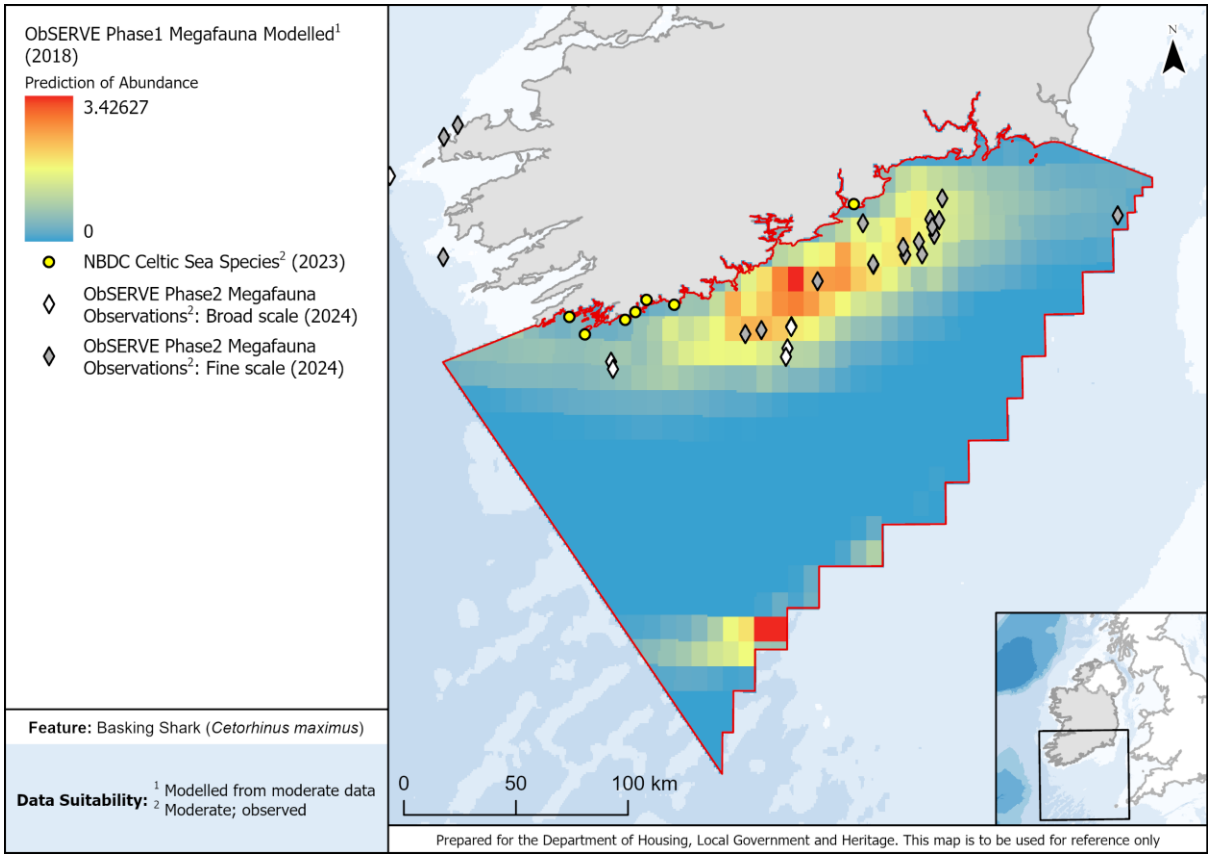

Figure A10.1.3. Data available for basking sharks (*Cetorhinus maximus*) in the Celtic Sea.

Data sources available

Sightings of basking sharks close to shore collected by citizen science are available from the National Biodiversity Data Centre. Dedicated broadscale and finescale aerial surveys under the ObSERVE programme have generated more spatially extensive data (Figure A10.1.3). There are no predicted (modelled) distributions yet available from the latest (Phase 2) ObSERVE programme, but modelled data from ObSERVE Phase 1 were available and were used in conservation prioritization. For explanation of data suitability, refer to Table 3.2.1 Main Report. For information on how data were prepared for use in prioritization analyses, and for visualisation of the layer used, see Appendix 5e, section 5e.4.

Further research needs

Further work is required to identify population size, population trends, migrations and movements, essential habitats, spawning and nursery areas. Equally, discard quantity and survival require further investigation. Additionally, the basking shark is an enigmatic species that attracts much attention in the spring and summer in Irish waters. The Irish Basking Shark Group and the Shark Trust advise communities to follow a specific code of conduct when interacting with this species to avoid disturbance to the species, and recent research highlights the need to consider disturbance within research projects (Gore et al., 2019, Hawkes et al., 2020; Sims et al., 2022; Dolton et al., 2023). Also, it is now an offence to capture or disturb this species in Irish waters under the Wildlife Act 1976

(Protection of Wild Animals) Regulations 2022 under Section 23, however the impact of disturbance to this species is yet to be quantified, even when following suggested guidelines which minimise disturbance. With the new finding of consistently elevated body temperature above ambient of this species, which in turn, suggest higher routine metabolic rates (Dolton et al., 2023), quantifying disturbance is necessary to fully understand the impact of cumulative unintentional disturbance events. Although this is not a specific pressure considered by MarESA guidelines, it should be noted unintentional human disturbance has the potential to greatly affect feeding and courtship behaviours of this species. In addition, evidence to identify the potential effect of multiple pressures was insufficient to form an assessment, or relieved heavily on expert judgement. These pressures included the effects of changes in suspended solids (water clarity), smothering and siltation changes (light and medium), electromagnetic energy, death or injury by collision, transition elements and organo-metal contamination, hydrocarbon and PAH contamination, synthetic compound contamination, introduction of other substances and the introduction or spread of invasive non-indigenous species.

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