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Short Note

Predation of Harbour Porpoises (*Phocoena phocoena*) by Grey Seals (*Halichoerus grypus*) in Wales

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When sympatric top predators of conservation concern compete for food, space, or have predatory interactions with each other, there may be the potential for conservation conundrums, particularly on how to best manage protected species (Stirling & Archibald, 1977; Crawford et al., 1989; Williams et al., 2004; Butler et al., 2006; Margaritoulis & Touliatou, 2011). The grey seal (*Halichoerus grypus*) and the harbour porpoise (*Phocoena phocoena)* are both species of considerable local, national, and international conservation interest that co-exist across most of their range within northern European waters (Reid et al., 2003; Baines & Evans, 2012; Special Committee on Seals [SCOS], 2013) and feed on similar prey (Hammond et al., 1994; Santos & Pierce, 2003; Gosch et al., 2014). Both species are listed under Annex II of the European Union Habitats & Species Directive (Council Directive 92/43EEC), which requires spatial management through the creation of Special Areas of Conservation (SACs). The harbour porpoise, as with all cetaceans, is also given strict protection as a European Protected Species under Annex IV of this Directive. Central to this Directive is the requirement to maintain or restore listed species and habitats to "Favourable Conservation Status."

Approximately 4% of the United Kingdom's grey seal population breed in Wales (Duck, 2009), where most are found in Pembrokeshire, the largest breeding population in the Irish Sea and southwest Britain at approximately 5,000 seals (Baines et al., 1995; Strong et al., 2006; Duck & Thompson, 2007). Here, grey seals are the primary feature of the Pembrokeshire Marine/Sir Benfro Forol SAC, with Ramsey Island being the main breeding site (Baines et al., 1995; Strong et al., 2006). The area is also locally known for its high density of harbour porpoises that make use of the strong tidal races around the island for foraging (Pierpoint, 2008). Harbour porpoise abundance is thought to be higher in summer than in winter, and there is a high proportion of juveniles during this time (Pierpoint et al., 1998; Baines & Evans, 2012)

Grey seals are generalist feeders, taking a wide variety of fish, mollusc, echinoderm, crustacean, and cephalopod prey (Bowen & Harrison, 1994; Hammond et al., 1994; Strong, 1996; Brown et al., 2012; Smout et al., 2013, 2014; Gosch et al., 2014). Other marine mammals are not a usual food source for grey seals, although cannibalism and predation on harbour seal pups (*Phoca vitulina*) has been reported (Bédard et al., 1993; van Neer et al., 2015).

In this short note, we report on four separate observations of grey seals directly predating and scavenging on harbour porpoises in the waters around Ramsey Island in Pembrokeshire, Wales. This is an unusual phenomenon that is receiving growing attention since lesions consistent with grey seal predation have been observed on stranded harbour porpoises in Belgium (Haelters et al., 2012), evidence of grey seal DNA has been found in wounds of harbour porpoises stranded on the Dutch coast (Leopold et al., 2014; van Bleijswijk et al., 2014), and direct observations of predation and scavenging have been recorded off France in the English Channel (Bouveroux et al., 2014).

We observed a first incident on 4 June 2014 from a boat (wildlife watching trip) at the southern end of Ramsey Sound (51.8520° N, 5.3240° W) during an ebbing tide. An adult male grey seal (sexed from the morphology of the head and body size) was witnessed eating the blubber, muscle, stomach, and intestines of the central, ventral section of an approximately 1-m-long harbour porpoise (likely a juvenile, based on size; Lockyer, 1995). Because

the harbour porpoise was dead when the grey seal was observed foraging, we are uncertain whether this was a predation or a scavenging event.

A second incident, which took place on 14 June 2014, was again observed from a boat at the southern end of Ramsey Sound, when the tidal state was approaching low water. This time, an adult male grey seal was seen directly predating (catching and killing) on an approximately 1.5-m-long harbour porpoise (likely an adult) (see Supplementary Figure 1, www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=10&Itemid=147). The grey seal consumed the central, lateral section of the harbour porpoise, including the skin, blubber, muscle, and stomach. Prior to the catch, the harbour porpoise was swimming and surfacing normally; it is unknown, however, whether the harbour porpoise was compromised by ill-health or disease because the carcass sank and could not be recovered to assess its nutritional status and condition.

The third incident, which took place on 24 June 2014, also occurred at the southern end of Ramsey Sound, when the tide was approaching slack low water. Again, an adult male grey seal was observed predating on a juvenile (approximately 1 m long) harbour porpoise. The live harbour porpoise was close to the surface when it was attacked. The grey seal struck the harbour porpoise hard from below, biting and submerging it, presumably in order to asphyxiate the animal. A few minutes later, the grey seal surfaced with the harbour porpoise and began to consume the now immobilised or dead harbour porpoise. The skin, blubber, muscle, and stomach of the central, ventral section of the harbour porpoise were consumed. The attack was observed for approximately 10 min. The last few moments of the encounter were captured on a mobile phone video (see Supplementary Video 1, https://vimeo.com/119776915), which clearly shows the size of the harbour porpoise, the freshness of the kill, and the tissues targeted in the predation event. It is uncertain whether this grey seal was the same individual observed in the previous two events as identification from photographs was inconclusive.

In a fourth incident, on 16 July 2014, an adult male grey seal (possibly the same seal as before, but unverified) was again observed predating on and consuming an adult harbour porpoise in much the same manner and location as described in the previous two cases (Figure 1; see Supplementary Video 2, https://vimeo.com/119776916). Figure 1 illustrates that the lower jaw of the harbour porpoise had severe lacerations, which may suggest that the grey seal first focused on the head during capture.

These observations are the first to be reported in the UK, and they expand the range for which these observations have been noted in European waters, although anecdotal evidence suggests that this phenomenon has been observed in Pembrokeshire in the past (C. Benson via UKCetnet, pers. comm., 21 August 2009; C. Benson, pers. comm., 8 August 2014; M. Rogers, pers. comm., 17 December 2014). Our observations confirm that grey seals are actively predating on juvenile and adult harbour porpoises at sea rather than only scavenging on carcasses. Consumption of other marine mammals is not unusual for some marine mammal species—for example, polar bears (*Ursus maritimus*),

Figure 1. Adult male grey seal (*Halichoerus grypus*) predating on and consuming an adult harbour porpoise (*Phocoena phocoena*) in Ramsey Sound, Pembrokeshire, Wales, on 16 July 2014 (Photos by Dafydd Rees)

killer whales (*Orcinus orca*), and leopard seals (*Hydrurga leptonyx*) (Stirling & Archibald, 1977; Walker et al., 1998; Williams et al., 2004; Weller, 2009)—and scavenging on cetaceans might be relatively common for some seal species (Walker et al., 1998). Direct predation on cetaceans, however, is thought to be uncommon for most seal species, although, recently, Leopold et al. (2014) suggested the cause of death of at least 17% of stranded harbour porpoises in The Netherlands was a result of grey seal attacks.

In previous accounts in the literature, grey seals appeared to selectively target skin and blubber, which has a high energy content, but were not observed consuming muscle, stomach, or intestines (Haelters et al., 2012; Bouveroux et al., 2014). Our observations provide clear evidence of these tissues being consumed (see Figure 1), with consumption of the stomach, perhaps, a deliberate preference in order to obtain its likely fish content.

All attacks reported here occurred during the summer in approximately the same location and around the same state of tide (ebbing tide) when harbour porpoises are frequently observed feeding in Ramsey Sound (Pierpoint, 2008). Co-occurrence of grey seals and harbour porpoises at this location and time is likely due to them both feeding on fish (their main prey), which might result in localised and seasonal competition for food that may trigger these unusual interactions. It has been postulated that the novelty of such observations might be due to a change in feeding strategy of a top predator in locations where the two species co-occur (Haelters et al., 2012). Although the reasons for such changes in prey are unknown, in UK waters, this might be due to the pressures on existing food sources from an increasing grey seal population (SCOS, 2013) and local increases in harbour porpoise abundance (Baines & Evans, 2012) such as that seen in the North Sea (Hammond et al., 2013).

As the phenomenon described herein was witnessed on four occasions in the same area, separated by a time period of only 1.5 mo, it might occur fairly commonly. It is possible that these behaviours have been learned by only a few rather than many grey seals, as is the case with some grey seals that predate Atlantic salmon (*Salmo salar*) at salmon farms in Scotland (e.g., Northridge et al., 2013). It remains uncertain whether this behaviour occurs in adult female grey seals or at other locations in Wales and the UK where densities of both top predators are high. Further reporting of similar predation events at locations throughout the overlapping range of grey seals and harbour porpoises would help us learn more about this unusual behaviour and inform the potential conflicting conservation management implications of this phenomenon.

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