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SHORT NOTE

Giant petrels (*Macronectes* spp.) prey on depredating sperm whales (*Physeter macrocephalus)*

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Abstract

Relationships between seabirds and cetaceans can vary from symbiotic to predatory. At high latitude seas in the Southern Hemisphere, giant petrels (*Macronectes* spp.) and male sperm whales (*Physeter macrocephalus)* are often solitary, but commercial longlining for Patagonian toothfish (*Dissostichus eleginoides*) provides consistent feeding opportunities that result in persistent aggregations of both. From ~ 1997 to 2019, we opportunistically photographed 23 events where individual giant petrels preyed on the flesh of live sperm whales that were depredating from Patagonian toothfish longliners near South Georgia, Crozet, and Kerguelen Islands. Both immature and adult southern (*M. giganteus*) and northern (*M. halli*) giant petrels were implicated in these predation events. Sperm whales reacted to attacks from one or more giant petrels by sinking or flinching, and then arching, rolling, diving, and snorkelling at the surface during subsequent predation attempts. Depredating sperm whales will dive deep, fast, and for long periods which can result in limited dive ability while replenishing oxygen stores at the surface. This behaviour, and the relatively high density of both species around longlining vessels may facilitate unique opportunities for giant petrels to exploit live sperm whales that are not likely as common under circumstances not sustained by longlining operations

Keywords Giant petrel · *Macronectes* · Sperm whale · *Physeter macrocephalus* · Prey · Depredation

Introduction

Associations between cetaceans and seabirds are widely reported (Au and Pitman 1986; Ridoux 1987; Pitman and Ballance 1992; Hawke 1994; Vaughn et al. 2008; Muirhead et al. 2013). Relationships between the two classes can often be considered commensal where birds take advantage of feeding opportunities provided by cetaceans (Martin 1986; Rossi-Santos and Flores 2009) or competitive where cetaceans take advantage of prey concentrated by diving birds (Hoelzel et al. 1989; Anderwald et al. 2011; McMillan et al. 2018). However, some cetaceans consume seabirds, either intentionally (Pitman and Durban 2010) or incidentally (Haynes et al. 2013), and some seabirds prey on cetaceans, dead (Evans 1982), or alive (Sironi et al. 2009).

Off the east coast of South America, the southern right whale (*Eubalaena australis*) is commonly fed on by kelp gulls (*Larus dominicanus*) in its coastal calving grounds (Rowntree et al. 1998; Thomas 1988; Groch 2001). The gulls gouge skin and blubber from the dorsal region of the whales while they are at the surface, causing them to adopt behavioural strategies to avoid attacks (Fazio et al. 2015). However, a major increase in the occurrence of this behaviour, especially on calves (Marón et al. 2015), may be compromising population health (Fiorito et al. 2016) and contributing to mass mortality events (Rowntree et al. 2013; Marón et al. 2015). This problem purportedly stems from the rapid growth of the kelp gull population in coastal Argentina due to increased access to and utilization of feeding opportunities on human and fishery waste (Bertellotti and Yorio 2000; Lisnizer et al. 2011; Stefanski and Villasante 2015).

In Subantarctic seas, industrial activities of Patagonian toothfish (*Dissostichus eleginoides*) longliners also lead to large aggregations of seabirds that feed on offal (Ashford

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et al. 1995; Cherel et al. 1996). This behaviour incidentally brings them into close proximity to considerable numbers of male sperm whales (*Physeter macrocephalus)* and killer whales (*Orcinus orca*) that depredate from the longlines while they are being retrieved (Tixier et al. 2019). In this paper, we present the first documentation of giant petrels (*Macronectes* spp.) preying on live sperm whales near toothfish longliners in Subantarctic waters of the Southern Hemisphere.

Methods

Observations of giant petrels preying on live sperm whales were made while documenting whale depredation from Patagonian toothfish longlining vessels on 39 days between 7 May and 15 June 2015 near South Georgia Island (see Towers et al. 2018) and opportunistically near Crozet and Kerguelen Islands from around 1997 to 2019 (Fig. 1; Table 1). This behaviour was observed with naked eyes or 8X42 binoculars and photographed with SLR and DSLR cameras outfitted with lenses up to 400 mm in focal length when it occurred within close enough proximity to the vessels to do so. Positions and dates for Kerguelen and Crozet were extracted from the Pecheker database (Pruvost et al. 2012). Predation events were defined as any occasion when giant petrels were photographed pecking a live sperm whale during one of its surfacing intervals. Consecutive predation events by a single bird over a short period of time were defined as predation bouts.

Giant petrels were identified based on their large size and body shape and the northern and southern species were differentiated from each other by the colour of their culmen (Carlos and Voisin 2008). Age classes of both species were assessed comparing images of birds involved in predation events to characteristics of giant petrel plumage provided in Carlos and Voisin (2008).

Results

Giant petrels were photographed preying on male sperm whales during 14 occasions on four (15%) of 26 days that they were documented depredating near South Georgia Island. Near Crozet Islands this behaviour was opportunistically recorded during six occasions on three days and near Kerguelen Island during three occasions on two days (Fig. 1; Table 1). Giant petrels were constantly around the fishing vessels in all three regions, usually in the hundreds (Gasco et al. 2017), but sperm whales were documented from these vessels during 69%, 61%, and 41% of the time they spent fishing near South Georgia, Crozet, and Kerguelen Islands, respectively (see Towers 2015; Janc et al. 2018).

Giant petrels approached sperm whales on the wing and either landed directly on their backs as they surfaced or near their bodies just prior to their surfacing and then swam up to them (Fig. 2; Online Resource 1). They did not appear to target any specific part of the back and no other potential prey such as external parasitic or commensal organisms were observed on the bodies of any sperm whales. Predation events and bouts were not always recorded from beginning to end, but events that were well documented ranged from one to three seconds in duration due to the brief period of time that the backs of whales were exposed at the surface (Table 1). Reactions of sperm whales were recorded for 15 of 23 predation events. They ranged from no reaction to sinking, flinching, arching, rolling, diving, or surfacing with only their blowhole out of the water (snorkelling). When bouts of predation events by the same bird were recorded, the reactions of sperm

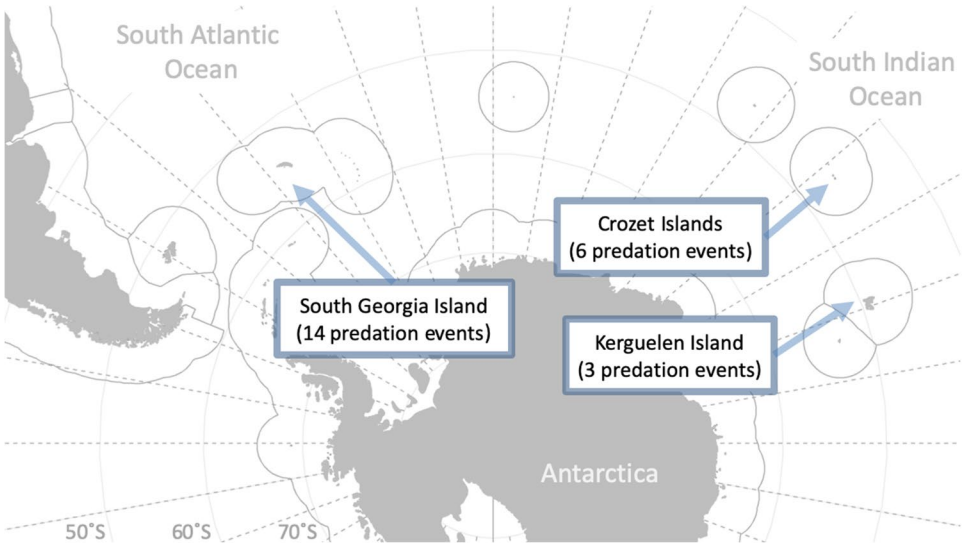

Fig. 1 Number of predation events and locations of South Georgia, Crozet, and Kerguelen Islands where giant petrels (*Macronectes* spp.) were documented preying on depredating sperm whales (*Physeter macrocephalus*)

Table 1 The number, date, time, and location of predation bouts and events as well as the species and age class of giant petrels (*Macronectes* spp.*)* implicated and the reactions of the sperm whales (*Physeter macrocephalus*) being preyed on (*n/a:* not available)

Predation bout	Predation event	Date	Time	Location	SPW reaction	GP species	GP age class
1	1	~ 1997	n/a	Crozet	n/a	Northern	H5
2	2	2010-10-18	16:29:43–16:29:44	Kerguelen	Arch, Flinch	n/a	Immature
2	3	2010-10-18	16:29:48	Kerguelen	Snorkel, Roll	n/a	Immature
3	4	2015-04-26	12:54:42–12:54:43	Crozet	n/a	Southern	G5
3	5	2015-04-26	12:54:54	Crozet	Sink	Southern	G5
4	6	2015-05-15	10:02:24–10:02:26	South Georgia	None	n/a	Immature
4	7	2015-05-15	10:03:05–10:03:07	South Georgia	Sink	n/a	Immature
4	8	2015-05-15	10:03:19	South Georgia	n/a	n/a	Immature
4	9	2015-05-15	10:05:41	South Georgia	Roll	n/a	Immature
5	10	2015-05-26	12:01:50	South Georgia	Roll	Northern	H6
6	11	2015-05-27	11:45:46	South Georgia	None	Northern	H4
6	12	2015-05-27	11:48:46–11:48:47	South Georgia	Sink, Arch, Dive	Northern	H4
7	13	2015-05-27	13:42:46	South Georgia	n/a	Northern	H4
7	14	2015-05-27	13:43:59	South Georgia	Flinch, Sink	Northern	H4
8	15	2015-05-27	14:10:14–14:10:15	South Georgia	Sink	Northern	H4
9	16	2015-05-27	14:43:59–14:44:00	South Georgia	Sink	Northern	H4
9	17	2015-05-27	14:44:05–14:44:06	South Georgia	Arch	Northern	H4
10	18	2015-05-28	14:03:46	South Georgia	n/a	n/a	Immature
11	19	2015-05-28	16:00:32	South Georgia	Dive	n/a	Immature
12	20	2019-02-08	n/a	Crozet	n/a	Northern	H8
12	21	2019-02-08	n/a	Crozet	n/a	Northern	H8
12	22	2019-02-08	n/a	Crozet	Snorkel	Northern	H8
13	23	2019-04-22	14:40:40	Kerguelen	n/a	n/a	n/a

whales to predation would often evolve from no reaction or simply sinking on the first event to flinching or rolling during subsequent events followed by an arch and dive and snorkelling behaviour on following surfacings. Sperm whales were not observed flinching, rolling, and snorkelling unless being attacked by giant petrels. Only single birds were documented preying on sperm whales, but two to four giant petrels were observed simultaneously targeting individual sperm whales during two predation bouts.

Individual northern (*M. halli*) and southern (*M. giganteus*) giant petrels were identified in seven and one predation bouts, respectively, and both species were implicated in repeated predation events. Based on plumage, we infer that a single northern giant petrel was involved in all seven predation events during four bouts on one day (Table 1). The single southern giant petrel confirmed in a predation bout was of breeding age (Online Resource 2) (G5, see Carlos and Voisin 2008). Of the four northern giant petrels documented preying on sperm whales, all were of breeding age (H4–H8, see Carlos and Voisin 2008). A total of eight predation events were made by four immature giant petrels that could not be classified to species (Table 1).

Discussion

This note presents data indicating that both northern and southern giant petrels will feed on the flesh of live male sperm whales in different Subantarctic regions of the Southern Hemisphere where commercial longline fisheries for toothfish are active. Giant petrels are known to feed opportunistically on a wide variety of prey including fishery bycatch, squid, seabirds, pinniped carrion (Hunter 1983; Hunter and Brooke 1992; Ryan et al. 2008), and even live sheep (Réale et al. 1996). This is the first report of them feeding on live sperm whales. However, giant petrels have rarely been observed feeding on southern right whales in their calving grounds at Peninsula Valdes, Argentina (M. Sironi pers. comm.) where this whale species is also preyed on by kelp gulls (Sironi et al. 2009). These are the only other cetaceans documented as live prey for avian predators that we are aware of and their strong behavioural responses to kelp gull attacks (Thomas 1988; Rowntree et al. 1998) are very similar to the reactions of sperm whales when preyed on by giant petrels.

Fig. 2 Image sequence from predation event 15 showing an H4 age class northern giant petrel (*Macronectes halli*) approaching a surfacing sperm whale (*Physeter macrocephalus*) near South Georgia Island at 14:10:13, landing on and pecking its back at 14:10:14 and retreating with a piece of flesh at 14:10:15 while the sperm whale sinks. Note the other northern giant petrel that approached the sperm whale in the water but lifted off as the sperm whale began to sink

Although every giant petrel observed preying on sperm whales could not be identified to species, northern giant petrels were most often implicated in this behaviour at Crozet Islands and the only species implicated at South Georgia Island, even though most birds around the vessels each day off Crozet, South Georgia, and Kerguelen Islands were southern giant petrels (Gasco et al. 2017; J. Towers pers. obs). This is not entirely surprising considering that of the two species, northern giant petrels are more often documented instigating novel feeding behaviour (Ryan et al. 2008; Dilley et al. 2013) and that mammals constitute a greater part of their diet (Hunter 1983; Hunter and Brooke 1992). Male giant petrels are known to feed more often on mammals than females (Hunter and Brooke 1992; González-Solís et al. 2000), but because the sexes of giant petrels are not distinguishable by plumage (Carlos and Voisin 2008), the sexes of individuals involved in this behaviour were not discerned. In any case, it is possible that this behaviour is more common than our results indicate, especially because effort at Crozet and Kerguelen Islands was largely opportunistic.

Giant petrels may prey on sperm whales opportunistically under natural circumstances, but this behaviour could be facilitated and perpetuated by longlining operations. For example, giant petrels and male sperm whales are usually solitary at high latitude seas but commercial longlining at South Georgia, Crozet, and Kerguelen Islands provides consistent feeding opportunities that result in persistent aggregations of both (Ashford et al. 1995; Delord et al. 2005; Clark and Agnew 2010; Janc et al. 2018). Since the development of this industry in the 1990s, northern giant petrel populations have grown throughout their range (Patterson et al. 2008) and in recent years depredation rates by sperm whales have risen at South Georgia and been consistently high at Crozet and Kerguelen Islands (Clark and Agnew 2010; Towers 2015; Janc et al. 2018). Competition between

depredating sperm whales can cause them to dive deeper, faster, and longer than when foraging naturally (Towers et al. 2018) which may result in extended periods near the surface to replenish oxygen stores. During this time, individuals are vulnerable to aerial predation while their diving ability is limited. These unique opportunities for giant petrels to exploit live sperm whales are not likely as common under circumstances not affected by large-scale resource extraction.

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Compliance with ethical standards

Conflict of interest We declare no conflict of interest.

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