First Record of Predation on False Killer Whales (*Pseudorca crassidens*) by Killer Whales (*Orcinus orca*)

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Abstract

The first record of killer whale (*Orcinus orca*) predation on false killer whales (*Pseudorca crassidens*) is reported here. On 25 March 2010, a group of 50 to 60 false killer whales, including approximately 15 calves and accompanied by three to five bottlenose dolphins (*Tursiops* sp.), were sighted in the Bay of Islands, New Zealand. Within 30 min, they were approached by a group of approximately eight killer whales. Five false killer whales were attacked, with at least three rammed from below, forcing them out of the water. After 29 min, the killer whales were milling at the surface and feeding on the carcass of a false killer whale calf, possibly the only individual killed. The killer whales had prolific fresh and healed oval wounds, which were attributed to cookie cutter shark (*Isistius* sp.) bites.

Key Words: feeding, predator, prey, mixed-species group, cetacean, killer whale, *Orcinus orca*, false killer whale, *Pseudorca crassidens*, cookie cutter shark, *Isistius* sp.

Introduction

The killer whale (*Orcinus orca*), as a species, is an eclectic feeder, taking a wide range of prey (Grachyov & Mymrin, 1986; Sarti et al., 1994; Similä et al., 1996; Ford et al., 1998; Hatfield et al., 1998; Visser & Bonaccorso, 2003; Jones, 2006; Matkin et al., 2007; Visser et al., 2008). However, in some areas, sympatric populations show different foraging strategies as well as prey preference (foraging ecotypes). Various foraging strategies for the New Zealand population have been described in detail, including removing fish from longlines and cooperative hunting for rays, sharks, and cetaceans, with 14 different species of prey recorded in their diet (Visser, 1999a, 1999b, 2000a, 2000b, 2005; Visser et al., 2000).

Although killer whales predate on cetaceans in various locations around the world (Jefferson et al., 1991; Ford & Ellis, 1999; Visser, 1999a; Saulitis et al., 2000; Ford et al., 2005; Steiger et al., 2008), and accounts of attacks or harassment have been reported for at least 23 different species (Jefferson et al., 1991; Visser, 1999a, 2000b; Pitman et al., 2003; de Oliveira Santos & Netto, 2005), such observations are relatively infrequent and generally only a small number of detailed descriptions of hunting tactics are available. False killer whales (*Pseudorca crassidens*) have not previously been recorded as a prey species for killer whales (Baird, 2008). Hereafter, scientific names will be used when referring to both individual animals and the species in question in order to reduce confusion between the similar common names "killer whale" and "false killer whale."

Materials and Methods

The observations reported here occurred to the east of the Black Rocks in the Bay of Islands, Northland, New Zealand, at approximately 35°13' S, 174° 09' E. The general area of the encounter is bounded on three sides by various islands and is open to the NE to the Pacific Ocean. Water depth in the area where the attacks occurred is between 30 to 40 m.

All but the first and last authors witnessed various stages throughout the events reported here, and they were either crew or guests aboard one of the seven vessels present. These vessels are tourist dolphin/whale watching boats, details of which are *Tutunui* (length overall [LOA] 11 m, observer deck height [OH] 1.4 m), *Dolphin Seeker* (LOA 22.5 m, OH 3.7 m), *Discovery III* (LOA 11.9 m,

OH 2.5 m), *Discovery IV* (LOA 18.9 m, OH 3.9 m), *Tangaroa* (LOA 19.7 m, OH 3.2 m), and *Carino* (LOA 15.2 m, OH 1.4 m). The second author (JZ) was present in a private vessel *Manawanui II* (LOA 4.1 m, OH 1 m).

In the Bay of Islands, it is standard operating procedure, as part of a Voluntary Code of Conduct, for dolphin/whale watching vessels to shut down their engines when *O. orca* are known to be in the proximity of other cetacean species (Halliday, unpub. data). Therefore, after first approaching the area, the position of each vessel, in relation to the moving animals, varied from a few meters to over 1 km. Regardless of proximity, the observations of the author(s) closest to the event were used, while the additional (distant) observations were used to corroborate the primary (closest) observations. The observations took place when sea conditions were Beaufort 2 or 3.

Times reported here are based on the time codes embedded in the meta-data of digital photos and video collected from observers on the vessels. As these time codes were not synchronised, events were reconstructed based on the authors' observations in conjunction with the noncontiguous video recordings. Timings are approximate and rounded to the nearest minute.

Group composition of the *O. orca* was categorized by age/sex based on the features described for the species (Heyning & Dahlheim, 1988). We used four categories: (1) adult male (distinguishable by the large dorsal fin), (2) adult female (determined by the constant association of a juvenile), (3) juvenile (less than half the size of an adult female and observed to feed on solid food), and (4) uncategorised (adult females and subadult males). Because it is not always possible to distinguish between these two age/sex classes, unless their urogenital pigmentation is viewed (Bigg et al., 1987), both are included in category 4. There were no animals smaller than juveniles (i.e., calves).

Despite a number of mass strandings of *P. crassidens* on the New Zealand coast (Baker, 1981; Robson, 1984), data such as group composition and average length are unavailable for this population. However, as the presence of both sexes and a range of age classes appear to be common in *P. crassidens* groups (Stacey et al., 1994; Chivers et al., 2007; Ferreira, 2008), for the purpose of this report, and based on the observed range in body size, we assume that this was also the case in the group encountered. As young were seen swimming in both the echelon and infant positions (Mann & Smuts, 1999; Gibson, 2006) and, given that we could not easily distinguish between calves and juveniles, we refer to any *P. crassidens* less than half the size of presumed adults as calves, where

an average adult size is 5 to 6 m (Stacey et al., 1994; Ferreira, 2008).

Although bottlenose dolphins (*Tursiops truncatus*) are regularly observed in the coastal waters of the Bay of Islands (Hartel, 2010), those observed with the *P. crassidens*, and reported here, are readily distinguishable from the coastal bottlenose dolphins based on gross morphology. They are comparatively much larger, with a more robust body, and many bear fresh and/or healed oval scars (Zaeschmar, unpub. data), which are presumed to originate from cookie cutter sharks (*Isistius* sp.) (Jones, 1971). These scars have not been observed on the coastal bottlenose dolphins (Haliday, unpub. data). Additionally, the bottlenose dolphins accompanying the *P. crassidens* are considered pelagic in that they are not typically observed close to the coastline (Zaeschmar & Haliday, unpub. data). No morphological, behavioural or genetic research has been done on this pelagic population, so herein they are considered as *Tursiops* sp.

Photo-identification catalogues for the *O. orca*, *P. crassidens*, and *Tursiops* sp. are held by the first two authors. Standard photo-identification techniques for each species (e.g., see Bigg et al., 1987; Würsig & Jefferson, 1990; Baird & Gorgone, 2005) were used to match any photographs taken during the events reported here, to these catalogues.

Results

On 25 March 2010 at 0940 h, a group of between 50 to 60 *P. crassidens* were sighted at Te Nunuhe/Whale Rock (35°12' S, 174°12' E) in the Bay of Islands. There were approximately 15 calves in the group. When observers were within 10 m of the *P. crassidens*, vocalisations could be clearly heard above the water, without the aid of hydrophones. Accompanying the *P. crassidens* were three to five adult *Tursiops* sp. This mixed-species group was travelling in a general WNW direction at approximately 10 to 15 km/h and was followed by two dolphin/whale watching vessels (*Tutunui* and *Discovery III*). A further two dolphin/whale watching vessels (*Discovery IV* and *Dolphin Seeker*) were approximately 2 km away from the *P. crassidens*, with the remaining vessels at farther distances, but all heading towards the group.

Three of the *O. orca* involved in the events reported here were subsequently matched to the *New Zealand Orca Identification Catalogue* (*NZOIC*) (Catalogue Numbers NZOP-002, NZOP-003, NZOP-004 [all uncategorised], and NZOP-005 [adult female]; Orca Research Trust, unpub. data).

Within 30 min of the *P. crassidens* first being sighted, a group of approximately eight *O. orca*, including one adult male, two juveniles, one adult

female (newly entered into the catalogue as NZOP-006; Visser, unpub. data), and four uncategorized animals, travelling slightly faster than the vessels, were seen approaching from behind *Tutunui* and *Discovery III*. The *O. orca* followed the mixed-species group for approximately 200 m and, while still some distance behind them (at least 500 m), dove below the surface. Concurrently, the mixed-species group dove simultaneously and, upon surfacing, began fast milling in a tight group, thereby creating an agitated water surface. From subsequent observations as well as the number of individuals that next surfaced in this mixed-species group, it appeared that at this point a number of individuals broke away from the main group as approximately 20 to 30 *P. crassidens* with one or two *Tursiops* sp. remained. The other members of the mixed-species group were not seen again.

At 1008 h, and following this period of milling, the mixed-species group began accelerating in a SW direction, porpoising clear of the water at high speed (estimated at more than 20 km/h based on video). At least one *O. orca* approached the mixed-species group underwater and rammed an adult *P. crassidens* from below, forcing it out of the water. This *P. crassidens* was travelling at the trailing edge of the mixed-species group. The *O. orca* also left the water, allowing us to establish that it was not an adult male or juvenile. It was not apparent if the *P. crassidens* escaped. Within that same minute, a *P. crassidens* calf was rammed from below and forced upwards—in this instance, to approximately 2 m clear of the water. During this time, the other *O. orca* had increased speed to approximately match the speed of the *P. crassidens*, and some of the *O. orca* group were travelling close to and parallel with the mixed-species group. The adult male *O. orca* was not observed during this period.

The third attack (at 1008 h) involved two *P. crassidens* simultaneously leaving the water. One, a presumed adult (based on its size, comparative to an *O. orca*), appeared to leave the water voluntarily, with its head pointed skywards (Figure 1a). An adult female *O. orca* (NZOP-006) followed closely and launched itself at the adult *P. crassidens* at such speed that the *P. crassidens* was knocked upwards and its body contorted at the impact site (Figure 1b). This ramming rotated the *P. crassidens* in a tail-over-head direction (Figure 1c). The force of this ramming also propelled the *P. crassidens* further into the air so that its head was approximately 8.5 m (and the tail approximately 12.5 m) clear of the water at the apex of the curve. These height estimates are based on the average body lengths of the two species.

The *O. orca* (NZOP-006) completely left the water in a high arch (clearing the water by approximately 4 m) and re-entered the water while the adult

P. crassidens was still airborne. The *P. crassidens* continued to rotate (Figure 1d) and re-entered the water tail first. This *P. crassidens* was observed to then swim off towards the mixed-species group, which was at that stage approximately 50 m away.

The *P. crassidens* simultaneously involved in this attack was a calf. Figure 1a shows the calf already in the air and upside-down. No *O. orca* was seen attacking the calf above the water, nor below when it re-entered the water. However, given that the calf followed a similar trajectory path as that observed for the adult *P. crassidens* in Figure 1, it may have been rammed while still underwater.

The fourth attack (but involving the fifth *P. crassidens*) was made at 1009 h on a single adult *P. crassidens*, while the mixed-species group continued to move at high speed in a southerly direction towards Tapeka Point (35° 14' S, 174° 07' E). The *P. crassidens* made a similar rotating pivot as the adult in Figure 1; however, we could not ascertain if this *P. crassidens* was directly hit by an *O. orca* despite one (which was not an adult male or juvenile) porpoising clear of the water.

This final attack was made on an adult *P. crassidens*, which was at the trailing edge of the mixed-species group, as the group fled. Following this, the mixed-species group accelerated for 15 s (timed from video), and then all dove simultaneously. Two *P. crassidens* then surfaced, turned, and were swimming towards the *O. orca* that were milling at the surface, while one uncategorized *O. orca* held the *P. crassidens* calf (from attack 3) in its mouth. The two *P. crassidens* approached within approximately 10 m of the *O. orca*, then at least one, possibly both, *P. crassidens* remained in close proximity to the *O. orca* until at least 1013 h, after which they were not seen and may have returned to the mixed-species group. The mixed-species group (containing at least four calves) then turned and headed SE at approximately 10 to 15 km/h towards Roberton Island (35° 14' S, 174° 09' E).

The *O. orca* continued to hold the calf until at least 1014 h, during which time it was still alive. The *P. crassidens* calf was then passed among various members of the *O. orca* group, including to both of the juveniles and the adult male, each of which carried it in its mouth while swimming at the surface. By 1043 h, the *P. crassidens* calf was presumed to be dead while it was carried in the mouth of one of the *O. orca* (uncategorized age/sex) as a small amount of blood was seen and, shortly thereafter, unidentified internal organs were seen through the water surface. Subsequently, both juveniles and the female *O. orca* (NZOP-006) were seen to food-share by feeding from the carcass at the same time, as well as by passing the carcass between them. The *O. orca* not involved in consuming the *P. crassidens* calf were milling and diving in the area. After

Figure 1a. Sequence of events of ramming two *Pseudorca crassidens*; a calf rotates through the air, while an adult starts to breach from the water. Photo © Tommy Hatwell/Explore Images

Figure 1b. An *Orcinus orca* (NZOP-006) rams the adult *P. crassidens*; note the body contortion from the impact. The calf continues to rotate through the air. Photo © Tommy Hatwell/Explore Images

approximately 10 min of food sharing and diving, the *O. orca* headed north at approximately 9 km/h.

During the period in which the *O. orca* were food sharing, the mixed-species group, upon reaching the coastline of the island, began travelling close to the shore at less than 10 km/h. At approximately 1050 h, once they reached Whale Rock, the group increased speed to approximately 20 km/h and headed due north. They were followed for at least 45 min by JZ, during which time they

were within one body length of each other, until they slowly began dispersing, covering an area of approximately 500 × 500 m.

Three *P. crassidens* from the mixed-species group have been matched to a photographic catalogue established in 2005 (Catalogue Numbers NZPC-027, NZPC-034, and NZPC-054) (Zaeschmar, unpub. data). No matches were made for the *Tursiops* sp. (photographic catalogue established in 2005; Zaeschmar, unpub. data).

Figure 1c. The *O. orca* is almost at the apex of its curve, while the adult *P. crassidens* continues upwards. The calf is about to re-enter the water. Photo © Tommy Hatwell/Explore Images

Figure 1d. The *O. orca* and the adult *P. crassidens* are both past the apex of their curve, with the *O. orca* about to re-enter the water and the *P. crassidens* pivoting to re-enter tail first. Photo © Tommy Hatwell/Explore Images

Of note is the number of fresh cookie cutter shark bites on the *O. orca* reported here. The *O. orca* in Figure 1 (NZOP-006) had at least 10 fresh bites on its left side, while the others also had numerous bites on their bodies. Another *O. orca* (NZOP-007) (Figure 2) had at least two fresh wounds on the dorso-thorax area as well as a further two on the caudal peduncle (not shown here). Examination of high-resolution photographs of this animal shows at least five healed scars on the right saddle patch

and 10 healed wounds of similar size and shape on the dorso-thorax area (a total of 19 fresh and healed wounds on the right side).

Discussion

Jefferson et al. (1991) recorded a non-aggressive interaction in the 1970s between a single *P. crassidens* and a group of *O. orca* in the waters of Alaska. There is also one non-aggressive record

of *P. crassidens* and *O. orca* in the waters of the Bay of Islands in April 2005, during which the *P. crassidens* (accompanied by *Tursiops* sp.), upon detecting the *O. orca*, made an extreme course change and travelled away at high speed (Zaeschmar, unpub. data).

The tactics employed by both the predator and the prey in events such as those described here are complex, and it can be difficult to definitively disassociate predation pressures from other ecological aspects; therefore, a single event such as this is not suitable for drawing conclusions. However, it has been proposed that one of the driving forces behind group living is predation (Morse, 1977; Norris & Dohl, 1980; Inman & Krebs, 1987). It is recognised that cetaceans under attack use anti-predator tactics which are species and circumstance dependent, including "flight" or "fight" strategies (Connor, 1996; Heithaus, 2001; Ford et al., 2005; Srinivasan, 2009). Typical responses when adopting the "flight" strategy are coalescence, high-speed directional flight (as a group and dispersing from the group), and movement into shallow waters for refuge (Jefferson et al., 1991; Connor, 1996; Ford & Ellis, 1999; Visser, 1999a).

Coalescence is a common response to stress or danger in many species of cetaceans (Jefferson et al., 1991) and was observed during the events reported here. However, Jefferson et al. (1991) also suggest that this may sometimes result more from herding by *O. orca* than from defensive manoeuvres by the prey. As the *O. orca* were seen to swim parallel to the mixed-species group after they had formed a tight group, this formation may have resulted from both defence and herding.

O. orca is the fastest of the odontocetes measured and can sprint at 12.5 m/s^{-1} (Williams, 2008) and possibly up to speeds of 15.4 m/s^{-1} (Lang, 1966). Top swimming speeds of *P. crassidens* are unknown; however, animals have been recorded at 7.46 m/s^{-1} (Fish, 1998) and 8.0 m/s^{-1} (Rohr et al., 2002).

The presence of calves/juveniles may have influenced the behaviour of not only the predator but also the prey. The *P. crassidens* may not have been able to flee at full speed. Given that *O. orca* are the fastest of the odontocetes, it is unlikely that young *P. crassidens* could maintain the speed required to evade an attack. The *O. orca* may have been employing a similar strategy they are known to use on tuna—an endurance-exhaustion technique (Guinet et al., 2007). Additionally, given that *P. crassidens* are typically a pelagic species, their response by travelling close to the shore after the attack may be a strategy to avoid further predation—a tactic that is known to be used by grey whales (*Eschrichtius robustus*) travelling with calves (Baldridge, 1972).

Although only two of the rammings involved calves, it is possible that calves were the primary targets of the *O. orca*. Given the number of calves

Figure 2. Two oval shaped and crater-like fresh wounds on the dorso-thorax and two healed dark oval scars on the saddle patch of one of the *O. orca* (NZOP-007) involved in the *P. crassidens* attack; these wounds and scars are likely from cookie-cutter shark (*Isistius* sp.) bites. Photo © Robert Bradley/Magic Memories

observed in the group of *P. crassidens*, we speculate that the attacked cluster of individuals (which separated from the original group) may have been a nursery group. After the attack, in which at least one calf was killed, the mixed-species group still contained at least four calves. Similar nursery group structure has been observed in other delphinid species in New Zealand waters (Würsig et al., 2007; Stockin et al., 2008).

P. crassidens are considered to be extremely social and affiliative, typically travelling in groups of 20 to 100 individuals (Baird, 2008) and forming strong bonds (as documented by mass strandings) (Caldwell et al., 1970; Phillips, 1988; Stacey et al., 1994). As observed in other odontocete species, maternal care in *P. crassidens* is prolonged and intense, with a high investment by the mother (Haenel, 1986; Mann & Smuts, 1998; Ferreira, 2008). Two *P. crassidens* turned and approached the *O. orca* while the *O. orca* held a live *P. crassidens* calf in their mouths. This may be indicative of a mother or another individual attempting to help the calf. Whether this behaviour was altruistic, epimeletic, or nurturant is open to interpretation, but assisting distressed conspecifics has been recorded for a wide range of cetacean species since the early days of cetology (Caldwell & Caldwell, 1966; Lodi, 1992). Alternatively, this may have been a case of predator investigation (Connor, 2000) by a related or nonrelated *P. crassidens*.

The apparent voluntary leaping observed during the third attack (Figure 1) may have been an attempt by the *P. crassidens* to avoid an underwater attack, or the *P. crassidens* may already have been rammed underwater. The speed with which the *O. orca* propelled itself out of the water, following this *P. crassidens*, allowed it to make a substantial physical impact into the side of the *P. crassidens*. Figure 1b shows the distortion of the body of the *P. crassidens*, which, despite anecdotal reports of this impact "snapping her back",[1] could not be verified and, given that one of the authors (TM) observed this *P. crassidens* swim off to join the mixed-species group, it seems unlikely that its back was broken. It cannot be ruled out that other physical damage (which may or may not ultimately have been fatal) occurred.

It was not possible to ascertain if the attacks were made on the same or different *P. crassidens*, except for the instances where there were gross body size differences (i.e., between adult and calf). Additionally, it is possible that further attacks on the same (or different) individuals were made underwater and thereby were not observed. One tactic of the predator may have been to repeatedly attack the same individual in an attempt to weaken it. Predation on younger (smaller) individuals may involve a lower energetic cost and/or less risk to the predator than predation on older (larger) animals.

It is likely that at least two *O. orca* attacked individual *P. crassidens* in the group simultaneously (i.e., an adult and a calf *P. crassidens*). Given the body position of the *P. crassidens* calf (Figure 1a) and the similar rotational pivot it takes to the adult in the sequence, it is possible that this calf was knocked from the water by a second *O. orca*, which was not seen to surface beneath the calf. Video establishes a time-line which also indicates this.

Several studies of *O. orca* predation on marine mammals note that females and subadults were active participants throughout the attacks, but mature males had little or no involvement (Arnbom et al., 1987; Silber et al., 1990; Jefferson et al., 1991). Here the attacks were conducted by individual(s) of adult female/subadult male size, with the adult male only participating during the prey-sharing phase. Although Berta et al. (2006) define *O. orca* as having the optimum shape in terms of "fineness ratio" (p. 224) and streamlining, Ford et al. (2005) have suggested that the larger body size and appendages of adult males are likely to have a negative impact on their speed and manoeuvrability compared to the smaller females (and we additionally recognize that such constraints should not affect subadult males).

If fleeing is not a viable option to avoid predation from *O. orca*, adult *P. crassidens* may be physically capable of defending themselves, particularly if they remain in a group. Cetaceans that tend to resist attacks may be more likely to survive attacks than those with more submissive physical reactions (Steiger et al., 2008), certainly when compared to species which are less able to fight back (e.g., *Balaenoptera acutorostrata* [Minke whales]: Ford et al., 2005; Ford & Reeves, 2008).

P. crassidens may resist attacks by predators as they themselves have been recorded harassing cetaceans, including species much larger than themselves—for example, sperm whales (*Physeter macrocephalus*) (Palacios & Mate, 1996) and humpback whales (*Megaptera novaeangliae*) (Weller, 2002). Immediately following the events reported here, one of the *O. orca* (NZOP-003) was photographed with fresh tooth-rake marks on its caudal peduncle. It is not possible to ascertain if they were conspecific rake marks or if they had been inflicted by a *P. crassidens* during the attacks. Given the robust dentition of *P. crassidens* (Stacey et al., 1994), there could be substantial risk for a predator attacking this species.

The three *O. orca* matched to the *NZOIC* had previously only been seen once (August 2008). They were part of a group of seven *O. orca* which

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[1] Telegraph News, UK, *Killer whale attacks dolphin in front of tourists* (telegraphic.co.uk, 28 May 2010)

attacked and killed three bottlenose dolphins (coastal ecotype) in almost the exact same location as the *P. crassidens* attacks reported here in the Bay of Islands (Zaeschmar, Halliday, & Visser, unpub. data). The number of fresh and healed cookie cutter shark bite marks on these *O. orca* is of note (e.g., see Figure 2). The *O. orca* which frequent New Zealand waters do not typically have prolific cookie cutter shark bite wounds. Visser (1999c) reported a group of *O. orca* near the Bay of Islands, which had fresh and healed cookie cutter shark bite wounds, but these were apparently from a different population of *O. orca* to the New Zealand population. Cookie-cutter sharks tend to show a distribution with a preference for deep tropical to temperate waters (Bass et al., 1976; Compagno, 1984; Jahn & Haedrich, 1988; Cox & Francis, 1997). The extensive number of bites on the individuals reported here may be indicative that this particular group of *O. orca* has a home range which is centred further offshore and perhaps in warmer waters.

Three *P. crassidens* from the mixed-species group have been matched to a photographic catalogue (Zaeschmar, unpub. data). All three were first photographed in 2007 in the Bay of Islands and were re-photographed on the day of the events reported here—both before and after the attacks (Zaeschmar, unpub. data). No matches were made for the *Tursiops* sp. from the mixed-species group (Zaeschmar, unpub. data).

It is not clear if the presence of the vessels had any role to play in the events described here; however, it is known that boat noise can mask *O. orca* calls (Nowacek et al., 2007). Off Kaikoura (42° 25' S, 173° 41' E), New Zealand, *O. orca* occasionally approach dusky dolphin (*Lagenorhynchus obscurus*) groups in the stern wake of vessels, perhaps using the engine noise (and/or possibly cavitation from the propeller) to mask their presence (Visser, unpub. data). The Voluntary Code of Conduct used in the Bay of Islands by the dolphin watching vessels includes shutting down engines whenever *O. orca* are encountered in the vicinity of other cetaceans in the hope of mitigating any impact the boats may have.

Predator-prey interactions involving cetaceans tend to be difficult to observe and are thus poorly understood. Hence, observations on the effectiveness of the predatory tactics of *O. orca* and of the anti-predator responses of their cetacean prey, such as those reported here, could be helpful as a means to interpret the subtlety of such complex interactions. From a biodiversity or conservation perspective, a better understanding of the dynamics of these predator-prey interactions would help increase our knowledge of both the predator and the prey, thereby allowing us to make better management decisions.

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