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# OBSERVATIONS OF AN INTERACTION BETWEEN SPERM WHALES AND SHORT-FINNED PILOT WHALES IN THE GULF OF MEXICO

On 24 August 1994 an unusual interaction between short-finned pilot whales (*Globicephala macrorhynchus*) and sperm whales (*Physeter macrocephalus*) was observed during a study of acoustic and surface behavior of sperm whales in the north central Gulf of Mexico (28°43.20′N, 88°44.13′W). We report here the defense reaction of sperm whales to the presence of pilot whales and give an indication of the generality and rate of interactions such as this from studies of tracked sperm whales in the South Pacific. While the true nature of the interaction is difficult to interpret, this account provides suggestive evidence that short-finned pilot whales may show aggression toward, or at least threaten, sperm whales. Pilot whales are not generally known to prey on other marine mammals; however, records from the eastern tropical Pacific suggest that this species does chase, attack, and may occasionally eat dolphins during fishery operations (Perryman and Foster 1980). In captivity, pilot whales have been noted to show aggression toward humans (Norris 1967) and to have eaten still-born or young dolphins (Brown *et al.* 1966, secondary reference *in* Perryman and Foster 1980). A male pilot whale off Hawaii bit into the thigh of a woman and took her at least 12 m below the surface in possibly aggressive or play-related behavior (Shane *et al.* 1993).

The following report describes the general behavior state and salient behavioral events recorded during the 150-min interspecific interaction. Real-time field notes, 35-mm photographs, and video tape with running spoken commentary taken on board the 32-m R/V *Pelican* were used as the basis for this description. Pilot whales were tentatively identified to species based upon recognized geographic distribution patterns, and the term "adult" sperm whale refers to presumed adult females and immatures as the presence of a mature male was not observed.

At 1410 (28°39.20′N, 88°41.91′W) a large school of approximately 30 short-finned pilot whales was sighted with 25 × 150 binoculars. Individuals were dispersed in numerous subgroups and spread over a 2–5-km area, with some animals approaching the research vessel within 200 m and paralleling its course directly abeam. Low, directional leaping and rapid surfacing was noted at this time, and two of the authors (BW, DW) commented that the apparent size of these pilot whales exceeded what they had observed in other geographic locations.

At 1446 (28°43.20′N, 88°44.13′W) a subgroup of sperm whales was sighted near the horizon just prior to their fluke-up dives. Eighteen minutes later, at 1504, a mixed aggregation of sperm whales (referred to as "group 1") and pilot whales was sighted. The observation of several large pilot whales tail lunging and tail slapping at the head of an adult sperm whale suggested that

this might be an agonistic encounter. As the research vessel approached, the composition of the aggregation was noted to consist of a sperm whale mother/calf pair surrounded by 8–10 pilot whales. The pilot whales appeared excited, as evidenced by rapid swimming and surfacings, fluke-up dives, and variable movements along the flanks, heads, and flukes of the sperm whales. The behavior of the mother/calf pair appeared distressed, as suggested by high head rises, frequent respirations, fluke swiping, and erratic changes in body orientation and posturing.

Also in view at this time, and at an approximate distance of 500 m, was a subgroup of six adult sperm whales and one calf (referred to as "group 2") and approximately 20 pilot whales. At 1532, after 28 min of observation on group 1, the research vessel motored to within 300 m of group 2, attempting to stay near the whales but not approaching them directly. The remaining 122 min of behavioral observation was done at a distance no greater then 300 m and at zero or minimal vessel power.

At 1600, group 1 and attendant pilot whales joined group 2, increasing the overall sperm whale group size to seven adults and two calves. At least three additional lone adult sperm whales, also escorted by pilot whales, approached group 2 at rapid swim speeds and eventually joined the interaction (one as late as 1705), resulting in a total of 10 adults, two calves, and 30–45 pilot whales. The increase in the number of sperm whales appeared to be correlated with a decrease in pilot whale activity, and the presence of calves may explain why these sperm whales did not attempt to flee by vertical descent.

The sperm whales remained close to each other, often huddled together and touching, throughout the observation. This huddling behavior included the creation of numerous marguerite formations (Nishiwaki 1962) over the duration of the interaction. The marguerite formation was assembled horizontally at the water surface with heads in and flukes out, and at times vertically, providing a three dimensional marguerite in which whales were pitch-poling with heads at the surface and flukes suspended below. In most cases one or both of the young calves were directly in the center of these formations. The marguerite was not always a complete circle and seemed to wax and wane with increases and decreases in overall pilot whale activity.

During marguerite formations and periods of tight huddling, the following behavioral events were observed for sperm whales: (1) *open mouth behavior*—mouth agape exposing the teeth and associated white mouth and lips; (2) *inverted surface posturing*—inverted ventrum-up body position at the surface of the water exposing underside of lower jaw; (3) *lateral fluke swishes*—a portion of a fluke blade above the water surface and rapidly thrust in a lateral or sideways orientation; (4) *peduncle arching*—caudal peduncle arched above the surface of the water (particularly frequent in calves); (5) *underwater bubble clouds*—underwater exhalation of air; (6) *tail slapping*—repeated horizontal fluke slaps on surface of water; (7) *spy hopping*—lifting of head above surface of water; and (8) *inverted underwater posturing*—inverted body position directly below a calf at the surface situated between two adults.

The pilot whales remained near and among the sperm whales for a majority of the observation period. Many fluke-up dives and caudal arches were noted and some rapid "surge" swimming (in which a burst of white water was created at the surface by the forward movement of a pilot whale) was observed. The pilot whales appeared to take particular interest in attempts to penetrate the marguerite formation of the sperm whales. In one particular instance two pilot whales swam toward an adult sperm whale, inverted themselves just prior to interspecific body contact and slid over the sperm whale's dorsum and back and directly into the center of the marguerite. The pilot whales did not seem to act in any particularly coordinated fashion except for a "stand-off" in which approximately 25 pilot whales clustered behind the flukes of the sperm whales which were in a staggered line-abreast formation. At other times groups of both species formed lines facing each other at a distance of less than one sperm whale body length.

At 1715 (28°43.75'N, 88°45.35'W) five rough-toothed dolphins (*Steno bredanensis*) approached the research vessel, at first swimming among the pilot whales and sperm whales, and eventually remaining directly below the bow of the vessel. At 1734 all of the pilot whales had departed and most of the sperm whales had sounded. Several sperm whales remained rafting or pitch-poling vertically in the water. Large circular scars characteristic of squid suckers were observed on the lower jaws and heads of these animals. At 1820 all sperm whales had departed. Remains of two partially digested and apparently regurgitated squid were seen floating in the water at this time and one was collected.

Vocalizations of both species were gathered using sonobuoys deployed within 1 km of the interaction and recorded on a Racal V-Store tape recorder. Sound recordings were made at 3.75 in/sec with an associated bandwidth of DC-12.5 kHz. The sperm whales maintained a stereotypical steady vocal pulsing throughout the interaction, while pilot whale vocalizations were mostly infrequent whistles, with occasional burst pulse 'tonal' signals. While there were no direct correlations between vocalizations and behavior, the sperm whales produced a number of four-, six-, and seven-pulse codas at the start and end of the interaction. No rough-toothed dolphin vocalizations were heard until at least 10 min after they had joined the interaction. Once the pilot whales departed the area, and after a series of codas, the sperm whales slowly became silent.

Our interpretation of this interspecific interaction as agonistic is based upon the defense behavior displayed by the sperm whales. Accounts of how this species reacts to whalers, killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), and sharks closely parallel the behaviors observed here.

Nishiwaki (1962) described the marguerite formation after observing all members of a sperm whale group circle a harpooned affiliate in a heads-in and flukes-out arrangement resembling the petals of a marguerite flower. Berzin (1971) reported a similar account from far eastern whalers in the northern Pacific in which a group of hunted sperm whales maintained a large circle of adults surrounding young animals. Best *et al.* (1984) described an apparent

calving episode in which a tightly bunched group of sperm whales, with all calves in the center, were thrashing their flukes. These authors then state that outside of the "circle" (it is difficult to assess if this was indeed an actual marguerite) were numerous killer whales and dozens of sharks. Palacios and Mate (1996) observed the marguerite formation during an attack by false killer whales on sperm whales near the Galápagos Islands.

Indications of the generality and rate of occurrence of instances such as that observed in the Gulf of Mexico can be obtained from observations during tracking of sperm whales in the South Pacific between 1985 and 1993 (see Smith and Whitehead 1993, Dufault and Whitehead 1995, for some details of the research). During 165 twenty-four-hour days of tracking sperm whales from 10–12 m auxiliary sailing vessels (principally off the Galápagos Islands and mainland Ecuador), there were 18 instances in which sperm whales and short-finned pilot whales were visible at the same time. In five of these cases, apparent harassment of the sperm whales by 12–50 pilot whales was observed, and in two of them [both off mainland Ecuador, and, as determined by individual identification studies (Arnbom 1987), containing different groups of sperm whales] the sperm whales were observed to adopt the marguerite formation. In neither observation of the marguerite formation were first-year sperm whale calves present. In four of the five harassment cases, including both times the marguerite was observed, the pilot whales were accompanied by 12–50 bottlenose dolphins (*Tursiops truncatus*); however, it seemed to be the pilot whales that were most affecting the behavior of the sperm whales. Harassment incidents lasted between 10 and 60 min, and behavior of both species was generally similar to that observed in the Gulf of Mexico, although observations were less complete and detailed. The two observations of the marguerite formation during apparent pilot whale harassment were the only clear observations of this behavior during the South Pacific studies.

L. Ballance (personal communication) observed a group of eight sperm whales, including one calf, form a marguerite as a possible response to killer whales in the eastern tropical Pacific. Interpretation of this account is complicated, however, by the presence of a mixed aggregation of pilot whales and bottlenose dolphins swimming around the sperm whales in an excited manner. Ballance suggests that these smaller delphinids may have been seeking refuge from the killer whales by associating with the sperm whales. However, it may also be true that the sperm whales formed the marguerite in response to the pilot whales (and possibly the bottlenose dolphins).

In contrast to all of the above accounts, Arnbom *et al.* (1987) reported the reaction of sperm whales to an attack by killer whales. These sperm whales did not create a defense marguerite, but rather faced their aggressors in more of an offensive manner. However, similar to the acoustic behavior of sperm whales reported here, Arnbom *et al.* (1987) also found that the sperm whales eventually became silent after the encounter.

Reports of sperm whales forming the marguerite are relatively uncommon in the literature. Most existing accounts suggest that the marguerite is a defense response to some perceived threat to injured or particularly vulnerable

individuals (calves), similar to what is commonly reported for terrestrial animals. While the defense reaction of sperm whales reported here and by others (Nishiwaki 1962; Berzin 1971; Best *et al.* 1984; Palacios and Mate 1996; L. Ballance, personal communication) varies from that of Arnbom *et al.* (1987), differences may simply reflect divergent strategies activated by perceived risk and potential vulnerability at both the individual and group level.

Attack responses of sperm whales toward whaleboats are well documented and include inverted body posturing, lateral fluke swipes, head rises, and inverted open mouth behaviors (Norris 1967, Caldwell *et al.* 1978). Many of these discrete behavioral events, reported for whales in obvious distress, were also prevalent throughout the interaction reported here.

The sperm whale defense responses described in this note suggest that these animals were reacting to a perceived threat. No actual combat or overt fighting was observed, and no evidence of injury to either species was noted. Therefore, we hypothesize that the pilot whales were testing the vulnerability of these sperm whales to assess the potential for separating particularly weak or young individuals from the group. The pilot whales were cautious in their threats (as are most terrestrial mammals) because of the potential for injury. Thus, no obvious attacks were attempted by the pilot whales, most likely as a result of a perceived lack of general sperm whale vulnerability. It is also possible that the pilot whales were engaged in play or practice of predation, with no real intent to harm or kill the sperm whales. The presence of apparent blackfish tooth rakes on the dorsal fins and flukes of sperm whales from both the Gulf of Mexico and South Pacific suggests that this type of non-lethal predation may be occurring. Killer whales are known to teach cooperative hunting strategies to their young (Lopez and Lopez 1985), but we have no evidence for this point in the present case. A final alternative explanation may be that of competitive exclusion occurring between two squid-eating species.

In combination with the few accounts of pilot whales aggressing towards other marine mammals, and evidence that several blackfish species including false killer whales and pygmy killer whales (*Feresa attenuata*) may attack and eat other cetaceans (Perryman and Foster 1980, Hoyt 1981, Palacios and Mate 1996), it is not unreasonable to speculate that this interaction was aggressive in nature.

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