Coordinated feeding by Atlantic spotted dolphins (Stenella frontalis) in the Gulf of Mexico

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Summary
In 1986, Atlantic spotted dolphins (Stenella frontalis) in the Gulf of Mexico were observed and filmed while feeding in a coordinated manner on a school of chub mackerel. Dolphins herded the fish onto shallow waters against the shore while feeding. Observers present in the area reported coordinated feeding activities for at least one hour. Dolphins approached the feeding area from various directions, swimming rapidly and pursuing the school of fish. Observations were made from 1/2-inch video footage, which was taken from the bridge of the National Oceanic and Atmospheric Administration vessel CHAPM-6X.

Introduction
Dolphins can display a high degree of coordination among individuals while engaged in feeding maneuvers. Dolphins can be trapped against shorelines, driven and trapped between dolphin groups, encircled in shallow and open waters, or chased into shallow water. Dolphins (Tursiops truncatus) (Würsig, 1986) review by Shaefer, 1990), common dolphins (Delphinus delphis) (Gallos, 1991, dusky dolphins (Lagenorhynchus obscurus) (Würsig & Würsig, 1986), and killer whales (Orcinus urinula) (Simkiss & Ugarte, 1993).

Observations
On 30 March 1986, at 1400 hr, a group of at least one hundred Atlantic spotted dolphins was observed (by request of the U.S. National Marine Fisheries Service) feeding in a coordinated manner in the Gulf of Mexico (21°51.83' N, 95°57.85' W) in 40 m deep water. Calm, sunny weather, with a Beaufort Sea State of 0, facilitated detailed observations of the event. Video footage, on 1/2 inch VHS format, was taken from the bridge of the National Oceanic and Atmospheric Administration vessel CHAPM-6X. Dolphins approached the feeding area from various directions, swimming rapidly and pursing the school of fish (J. Watson, National Marine Fisheries Service, Pascagoula, MS, pers. comm. 1991). Birds can be seen in the upper part of the video, and were identified as either sooty (Sula nebou) or bridled (Sterna anaetheta) terns (D. Peak, University of Texas—Medical Branch, pers. comm. 1993). It is not clear from the video whether the terns were present during the entire feeding event. The school of fish appeared to be spatially distributed in the area (radius of the area) separation distance among schools, and quantity of prey are unknown. The group of dolphins was split into smaller sub-groups (sub-group sizes were not provided), and harboring fish schools into tight balls. Only one dolphin sub-group was documented, since it was not possible to film all the isolated sub-}

Accounts of dolphins feeding in open waters in a coordinated manner are not as common or as nearshore, probably because fewer offshore behavioral observations have been made. Springer (1957) and Siebenaler & Caldwell (1986) mentioned coordinated feeding by spotted dolphins (Stenella frontalis) on pelagic (Lagodon rhomboides) in the Gulf of Mexico, but no specific behavior was noted. We present a description of a coordinated feeding event by Atlantic spotted dolphins in the Gulf of Mexico.
of the fish school. The bubbles appeared to have two functions: (1) to displace individual fish near the surface from their anti-predator schooling mode, and (2) the undertow of the bubble snuck sub-surface fish under, in essence, having a collapsing effect, that resulted in condensing and containing the fish school, possibly to maintain the spatial integrity of the fish school. Use of such "bubble-bursts" is exemplified by the observation of a single dolphin "bubble-bursting", while a comparative fed on a fish isolated by the bubble.

While the majority of the dolphins in the focal sub-group worked to keep the fish together in a ball and near the water surface, individuals would take turns catching fish. It was not possible to determine if fish were taken in all passes through the fish school. The containment was very fluid and gave no detectable order of individual movement. Some dolphins passed through the edge of the aggregation, rolling on their sides in an arc towards the fish. Using the lighter underside of the body as a "flash" effect to scare the fish (Würsig et al., 1990) and physical fin slapping kept the fish tightly together. A slight variation on this behavior consisted of dolphins gliding through the fringes of the fish school, and then becoming more active outside of the fish ball, with some splashing as the animals arced back towards the school. Other dolphins appeared to wait just below the surface, forming an underwater barrier and not passing through the fish school. When the school of fish started to split apart or moved in a different direction, some dolphins tail slapped or made small lunges that created splashes, which appeared to serve as a method to maintain the perimeter of the fish school.

Based on the degree of individual spotting (Perrin, 1969), the focal dolphin sub-group appeared to include animals of various ages, with juveniles and adults working together. It was not possible to determine whether some dolphins fed more frequently than others. Dolphins were frequently observed waiting their turn to make feeding passes, while probably working to not let the fish ball move downward. A few distinctly pigmented or marked individuals were observed, but it was not possible to follow their movements for more than several seconds. Based on relative body size, the group of dolphins that appeared adult individual was observed touting one fish at a time to the outskirts of the main activity. Each time, relatively young animals then swam to these fish and presumably ate them. This happened on three occasions: it is not known whether the adult and young animal were the same individuals each time.

The research vessel resumed course after approximately one hour, but the feeding behavior continued, with new dolphins arriving in the area (J. Watson, pers. comm., 1991).

Discussion
This event documents Atlantic spotted dolphins making coordinated foraging movements resulting in sightly herded fish balls. Prey containment was accomplished by the dolphins encircling and diving vertically into the fish ball to confine prey to the water surface. Arcing, splashing, tail slapping, and "bubble-bursting" appeared to be part of a multi-faceted containment of fish.

Schooling by prey fishes may increase the ability of individual fish to sur vive predation (Noll & Cullen, 1974), while predators more efficiently capture schooling prey by schooling themselves (Major, 1979; Schmitt & Strand, 1982). Group foraging may occur either because group benefits are possible than during solitary foraging, or because animals are constrained to group living for reasons other than finding food and thus must pursue prey together (Pecker & Rutman, 1988). For cetaceans, coordination with other animals while feeding on a prey school is believed to increase the feeding success of an individual (Würsig et al., 1985; D'Vincent et al., 1985). Further study documenting individual dolphin movements and behaviors during coordinated feeding bouts is needed.

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