

A DOLPHIN-HUMAN FISHING COOPERATIVE  
IN BRAZIL

KAREN PRYOR, JON LINDBERGH, SCOTT LINDBERGH,  
AND RAQUEL MILANO

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Fishermen and townspeople report that the fishing takes place all day every day except during bad weather, and all year except in the winter months of July and August. Town records state that the cooperative fishing began in 1847. Some fishermen report that their fathers and grandfathers fished before them, sometimes with the same individual dolphins. Currently at least three generations of dolphins are involved (as evidenced by a female, "Chinelle," with at least two known adult offspring, one with a calf, active in the fishery).

The primary prey fish is the mullet, *Mugil cephalus*: juveniles are caught in November through March, as we observed in February, and breeding adults in April (as we observed) and May and June. Fishing with dolphins largely ceases in July and August; in September and October other species are reported to be exploited, including the Brazilian croaker, *Micropogonias furnieri*, and the black drum, *Pogonias chromis*. While some people fish with the dolphins for sport, for most participants this is a commercial rather than a subsistence fishery. The catch is sold in nearby metropolitan markets. The dolphin-associated fishery is said to be the primary source of income for about one hundred families.

On both visits we observed and photographed the fishing from shore and by boat, either travelling in the lagoon or anchored among the fishermen or among the dolphins. The fishing is highly ritualized, and appears to involve learned behavior in both men and dolphins. The fishermen, each with a circular nylon throw-net rimmed with weights, position themselves in a single line, a net's diameter apart, standing in approximately 1 m of water parallel to the shore. One or two dolphins station themselves several meters outside the line of men, facing seaward, floating or moving slowly at the surface. From time to time a dolphin submerges, usually moving seaward; the men then brace themselves. The dolphin reappears, usually in a few seconds, travelling toward the line of men. It comes to an abrupt halt and dives just out of net range, 5-7 m from the line, thus making a surging roll at the surface, a movement markedly different from normal respiratory surfacings. Men who are in front of the dolphin as it rolls then cast their nets. Fish are caught under the nets and become entangled in the meshes. Successful fishermen return to the beach to harvest their catch, and others replace them in the line.

The water is extremely turbid; visibility is less than 1 m. The men cannot see the fish, and must depend on the dolphin's behavior to know when to cast the nets. They state that the dolphins detect fish, round them up, and deliver them to the line; the fishing depends on this behavior. Occasionally we observed and photographed mullet jumping just ahead of a dolphin returning to the line; but even when we could not see the fish until they were netted, the dolphins certainly appeared to us to be detecting and herding fish. We never saw a dolphin perform the roll toward the line without exhibiting the submerge-depart-and-return behavior sequence first. The men rarely cast without a dolphin's cue (refolding the net takes time, and one might thereby miss a better opportunity); and nets were not cast behind a dolphin, or in its general vicinity, or in front of dolphins that had not signalled, but only in front of dolphins performing the correct behavioral sequence indicating the arrival of fish.

The cue is quite informative: the timing of the dolphin's roll indicates that fish are present; the direction of the dolphin's movement indicates the location of the fish, and the vigor of the movement appears to indicate whether the school is large or small: the dolphin may show the head, back and dorsal fin, or just the head or blowhole. A spectator can quickly learn to predict whether one fishermen or several will respond to a particular signal.

The dolphins apparently take advantage of the confusion which the falling nets cause among the fish schools to catch fish for themselves. Episodes which

are successful for the fishermen are often followed by bouts of dolphin feeding behavior, including rapid changes of direction underwater, waving the flukes in the air, and heads in the air with fish in the jaws. We have seen individual dolphins working at the line for a single pass or for two hours or more, before moving away, often to be replaced by newcomers.

The method is efficient. In one half-hour period in April we observed a single dolphin bringing fish to the line of fishermen six times. In four of these episodes one or more fishermen caught fish, typically 10 or more adult mullet weighing up to an estimated 2 kg each. On February 17 we observed one man, working from a small boat with a single dolphin, who took over 100 kg of juvenile mullet in approximately two hours. The system is probably efficient for the dolphins as well. Based on captive studies, 10–12 kg of mullet would be an ample daily ration for an average-sized adult bottlenose dolphin (Defran and Pryor 1980). Bel'kovich reported dolphins in the Black Sea hunting mullet in groups, using a variety of cooperative strategies; search time could be long, and individual pursuit was often unsuccessful (Bel'kovich *et al.*, in press). Others have described strenuous pursuit of mullet in shallow waters by individual dolphins (Hamilton and Nishimoto 1977, Shane 1987). The Laguna fishing method provides a reliable, easily located resource, and allows successful fish capture by individuals, including females with calves, with minimal effort.

The fishing appears to be initiated and controlled by the dolphins, not by the men. On four occasions we have seen a dolphin leave the line of men and move to another section of the beach; immediately some or all of the men ran through the water to reform a line in the new site selected by the dolphin. In other parts of the lagoon on several occasions we have seen one or more men waiting on shore in the hope of a dolphin's arrival. Fishing does not begin until a dolphin initiates it.

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The local population of bottlenose dolphins is estimated by experienced fishermen at about 200. Of these an estimated 25–30, referred to as "good" dolphins, are said to be participants in the cooperative fishery. On 17 February from a boat in the inlet we saw six separate groups (varying in size from 1–3 dolphins and 4–40 men) engaged in cooperative fishing in different locations simultaneously. We were able to see a maximum of 10 adult dolphins working at the same time. Including juveniles and calves at least 10 more dolphins, which may or may not have been associated, were also present in the inlet.

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Dolphins which do not work with the fishermen are called "bad" dolphins (*ruim* in Portuguese). The *ruim* may occasionally interfere with the fishing, typically by dispersing fish and by damaging nets and netted fish. "Good" dolphins are said to defend their resource by displaying aggression toward the *ruim*; we did not witness any encounters between the two (we have seen several groups of 2-7 dolphins, identified by the fishermen as *ruim*, offshore and in central parts of the lagoon). The fishermen consider that the "good" dolphins are largely resident in the lagoon. Some believe that there are at least two separate populations of *ruim*, one in the lagoon and one coastal or off-shore. Confirmation of the distribution and range of these groups awaits future investigation.

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Several historical accounts exist of dolphin-human interaction in the catching of mullet (Pliny the Elder, A.D. 23-79, Longman 1926, Busnel 1973, Ascherson 1982). Ranging from the Mediterranean to North Africa to Australia, these accounts are strikingly similar. Men on shore observe mullet travelling along the coast, too far out to reach from land. Then, if bottlenose dolphins happen to be passing simultaneously, the men shout, whistle, or slap the water to attract the dolphins. If the dolphins then move inshore, the mullet are trapped against the beach, and a great melee follows, with men scooping or spearing mullet in the shallows and fish and dolphins leaping in every direction.

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KAREN PRYOR, JON LINDBERGH, 44811 S.E. 166 St., North Bend, WA 98045;  
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D.F. Brazil. Received February 23, 1989. Accepted June 28, 1989.



*A curious sight: a long line of throw-net fishermen, standing hip deep in the water, wait for a dolphin to drive fish into net range.*



# CHAPTER TWENTY

## A Dolphin-Human Fishing Cooperative in Brazil

**by Karen Pryor, Jon Lindbergh, Scott Lindbergh,  
and Raquel Milano<sup>1</sup>**

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