

WHAT ARE THE DOLPHINS' PAYOFFS WHEN COOPERATING WITH FISHERMEN?

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GRANT REPORT

Why would self-serving individuals spend energy and risk themselves to benefit others? Multidisciplinary research has given rise to a solid theoretical foundation proposing complementary routes to the evolution of cooperation, and kinship has long been thought as a central mechanism for yielding inclusive fitness for cooperators. However, cooperative behavior among individuals of different species suggest that this may not be universally true. Cooperative behaviors that transcend species boundaries provide a unique opportunity for testing how cooperation arise from direct fitness benefits alone. In my research, I aim to quantitatively evaluate the direct benefits accrued from foraging interactions between wild bottlenose dolphins (*Tursiops truncatus*) and artisanal, net-casting fishermen in Brazil. This foraging interaction is an intriguing example of joint effort between two top predators to access a common resource—fish schools. However, all we know so far about this interaction comes from the viewpoint of fishermen. Above the water, dolphins seem to herd fish schools towards fishermen who stand in lines in shallow waters and wait for a specific behavioral cue they interpret as the right moment for casting their nets. Foraging with dolphins is beneficial for fishermen—they catch fish more often. However, we do not know what happens on the dolphins' side. The limited visibility of the waters where the interaction takes place makes fish not trackable for humans. Fishermen suggest that dolphins harvest similar benefits; researchers hypothesize dolphins benefit from catching more easily the disoriented fish that break off the school when the casting nets hit the water. However, no direct evidence for this hitherto exists. Quantifying the costs and benefits *in situ* is challenging, but key to understand how this unique human-animal interaction emerged and remained restricted to part of a small dolphin populations in southern Brazil. To tackle this challenge, I led a research project—partially funded by a Society for Marine Mammalogy Grants in Aid of Research—to collect detailed data on dolphin and fisherman behavior, using a multi-platform data sampling. I spent a total of 144 hours recording interactions during 18 consecutive days in May and June 2018. I have registered 1270 net casting events, in which more than 3,500 fish were caught. I have capture most of all these interactions in a total of 52 hours of footage from a drone, 105 hours of underwater footage using a high-definition sonar camera, 110 hours of acoustic recordings of dolphins' foraging behavior, and more than 4000 photographs of dolphin dorsal fins for individual identification. So far, I have analyzed the observation data collected in the field. My preliminary analyses indicate that catching fish in Laguna is not an easy task—for dolphins or humans. Fishermen return with empty nets after most of casting attempts; however, when they follow the dolphins' behavioral cues, their catch success increase considerably, in line with previous studies. A key advance of my preliminary data is giving the first palpable evidence that dolphins may reap similar benefits than fishermen do—the acoustic data points out that after the nets are casted dolphins engage in active acoustic foraging activity, suggesting that they benefit from preying on trapped fish. The next steps are extracting and combining data from the overhead, above and underwater footage and recordings to describe the interaction with unprecedented detail, quantify the foraging benefits for both parties, evaluate the influences of one party on the other's foraging, and assess the fragility of this system to potential upcoming perturbations. Processing the raw photo and videos is very time-consuming and I have been applying for postdoc fellowships to fully dedicate to this project and use the state-of-the-art methodology to analyze these data. The outcomes of research will fuel the debate on the evolution of cooperative behavior, a central question in Evolutionary Ecology—and I expect to publish these results in early 2019. Determining the ecological drivers of such a rare phenomenon is the foundation for a deeper investigation of how this cooperative behavior has been transmitted over generations and is maintained only within a subset of the dolphin and the fishermen populations. On the fishermen's side, foraging with dolphins is socially transmitted, primarily from fathers to sons, and is part of their local cultural repertoire. Similar processes may take place on the dolphin's side— foraging techniques may be transmitted among dolphins via learning, which would make these interactions part of the dolphins' cultural repertoire. Cooperation and culture in charismatic fauna attract the attention of broad audiences, opening the dialogue on the conservation of this interaction that is not only culturally, but economically important for fishermen communities. I recognize and thank the support of the Society for Marine Mammalogy in making possible the investigation of such fascinating natural phenomenon.