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DOLPHIN RESEARCH ACTIVITIES: PROGRESS REPORT

OVERVIEW

In this document the two IATTC dolphin-related research activities currently under development are described, and a brief background on each topic is provided for context. In addition, the recent filling up of vacancies with the appointment of two scientists with academic background and professional experience regarding protected resources, including dolphins, will strengthen the capacity of the staff in this respect. It is anticipated that at the next meeting of the Scientific Advisory Committee in May 2023, the IATTC staff will be in a position to put forward a proposal for a dolphin research workplan, reflecting among others the experience learnt through field work, which for one of the projects has not yet been conducted but is expected to be completed by the end of this year.

DOLPHIN COW-CALF SEPARATION DURING CHASING AND BACKDOWN

With the drastic decrease in dolphin mortality due to entanglement in tuna purse-seine nets during the 1990s (e.g. AIDCP-43-02), more attention was paid to other possible sources of mortality. Some studies have shown that in the 1980s and 1990s there were cases of orphaned nursing calves due to maternal mortality (Perryman and Foster 1980; Au 1991). Based on analysis of biological samples collected by fisheries observers, it has also been suggested that mothers and calves may be separated during chases leading to purse-seine sets (Archer et al. 2001). However whether current fishing operations lead to permanent separation of cows and calves remains still an open scientific question.

To address it , in 2018 the IATTC staff, in collaboration with the Pacific Alliance for Sustainable Tuna (PAST) and the government of Mexico, put forward a proposal for a field study (AIDCP-37-03) to evaluate, through direct observation, whether dolphin mothers and calves are indeed separated during chase or backdown. The proposed study was to use high-resolution imagery collected aboard the helicopter of a purse-seine vessel to record any separation during the chase and a video camera mounted on a remote-controlled hexacopter to record any separation during and after backdown.

In the absence of a consensus for funding through the use of AIDCP resources, the proposed field study could not be implemented. In 2021 and 2022, PAST and IATTC discussed again about conducting the study, which would be funded independently by PAST. An agreement on the project (Project H.8.c in SAC-13-01) was reached, and PAST has already provided half of the amount specified in the budget, with the commitment to provide the second half within three months of the signature of the corresponding memorandum of understanding.

In the first phase of the project, IATTC will organize a workshop of experts to assist with the detailed design of the sampling protocol for the field study. This workshop is to be held in summer 2022. The field study will be held in later 2022, and results presented to the Scientific Advisory Committee in 2023.

DOLPHIN ABUNDANCE SURVEYS

IATTC evaluation of the status of dolphin populations has historically relied, at least in part, on estimates of absolute abundance from surveys conducted by the U.S. National Marine Fisheries Service (NMFS; e.g. Gerrodette et al. 2008). These estimates have been used to: a) evaluate current mortality relative to population size; and, b) update N_{min} and stock mortality limits (SMLs) (Special Report 14). In addition, the Antigua Convention, which entered into force in 2010, explicitly requires the IATTC to monitor the status of all species potentially impacted by tuna fisheries in the eastern Pacific Ocean. The 15-year hiatus in the NMFS surveys (the last survey was conducted in 2006) prompted recent research at IATTC on options for monitoring dolphin stock status.

Beginning in 2014, new work was conducted on developing indices of relative abundance for dolphins using AIDCP observer data (SAC-05-11d; Lennert-Cody et al. 2016), building on previous studies (e.g. Buckland and Anganuzzi 1988; Lennert-Cody et al. 2001). It was concluded that there are serious challenges to developing a reliable index from fisheries observer data.

Given this, the IATTC staff, with funding from the European Union and PAST, held a workshop in October 2016 to review options for estimation of dolphin abundance (Johnson *et al*. 2018). Based on this workshop, it was concluded (Johnson *et al*. 2018; Lennert-Cody *et al*. 2018) that for immediate management needs, ship-based surveys were the only reliable option to estimate abundance, despite their high cost. However, it was recommended that one of the top research priorities should be to include pilot studies on the use of high-resolution imagery as part of any future ship-based survey effort. This recommendation was motivated in part by recent research (Barlow 2015[1]), which suggested that not all dolphin schools on the survey trackline are detected during ship-based surveys, contrary to the assumption of the methodology used to estimate abundance. If confirmed with an appropriate field study, Barlow's results would imply that previous estimates of absolute abundance (e.g. Gerrodette et al. 2008) could be biased low.

Following the conclusions of the 2016 workshop, in 2017 the IATTC staff contracted scientists at the University of St Andrews to develop survey design options for a new dolphin survey, including the use of drones to collect high-resolution imagery to evaluate, and if necessary mitigate, the bias issue raised by Barlow (2015). These survey design options were presented at the 37th Meeting of the Parties to the AIDCP (AIDCP-37-02) in August 2018. Also at that meeting, the IATTC staff, in collaboration with the government of Mexico and PAST, put forward a proposal to use the AIDCP budget surplus to fund a trial survey and a main survey, both with the use of drones (AIDCP-37-03). If the use of drones were to be successful, there are a number of advantages (Table S1), despite the higher cost. The funding was not approved. At the 39th Meeting of the Parties to the IATTC in July 2019, the IATTC staff again put forward a proposal to use the AIDCP budget surplus to fund a dolphin survey work (AIDCP-39-01; IATTC-94-04), which was again not approved.

[1] Work by Ranklin et al. (2020) support the results of Barlow (2015), but the species in the Ranklin et al. (2020) study did not include those dolphin species and stocks most involved with the purse-seine fishery.

Following this, PAST and the government of Mexico independently funded a trial dolphin survey, which took place in November 2019 (Oedekoven *et al*. 2021). In addition to evaluating the overall suitability of the research vessel and marine mammal observers for a dolphin survey, the trial survey had two goals related to the use of drone equipment: 1) test whether drones can be used to detect dolphin schools directly ahead of the survey vessel that might be missed by ship-based marine mammal observers, data essential for evaluating the potential of bias raised by Barlow (2015); and, 2) test whether drones can be used to collect data on dolphin school size and species composition, data essential for calibrating estimates made by the ship-based observers.

The results of the 2019 trial dolphin survey included:

- The Jorge Carranza (research vessel provided by the government of Mexico) was found to be a suitable survey vessel for the next dolphin survey upon which the team of experienced observers, in combination with the ship's command, were able to implement the NMFS survey protocol.
- The Jorge Carranza, with its custom-made drone platform, can also be used for conducting drone operations in Beaufort sea states up to 5.
- The performance of the drone equipment, camera systems and drone personnel, that were provided to the trial survey project, but were different than those initially proposed by University of St Andrews (AIDCP-37-02), was mixed.
    - The Seahawk drone can be used to conduct school size calibration flights, however, a better camera is needed for species identification of all individuals within the calibration schools.
    - Collection of the data needed to evaluate potential the bias identified by Barlow (2015) is possible using drones. However, the Seahawk drone is not a viable option for collecting such data during a main survey, and a different type of drone, such as those proposed in AIDCP-37-02, should be considered.
    - Cameras and video archiving/transmission capabilities that meet the specifications in the drone protocol are mandatory for a successful main survey; those provided for the trial survey did not fully meet the drone protocol (Oedekoven et al. 2021 Appendix 1).

Following the outcome of the trial survey, it was concluded that a second trial survey would be necessary to fully test the use of drones as proposed in AIDCP-37-02 (detailed recommendations for the second trial survey can be found in Oedekoven et al. 2021). This is an important step because the issue of bias raised by Barlow (2015) has serious implications for the interpretation of historical survey estimates, potentially requiring that the historical estimates be regarded as an index of relative abundance. Whether an updated index of relative dolphin abundance would serve the management needs of the IATTC would be a topic of discussion for the IATTC Scientific Advisory Committee (SAC).

Since the 2019 trial dolphin survey, the IATTC staff has worked with PAST and the government of Mexico to arrange for and fund a second trial survey. Discussions are ongoing, although the staff is hopeful that a second trial survey can be conducted in summer or fall of 2023 (see Project H.8.b in SAC-13-01).

REFERENCES

Archer, F., Gerrodette, T., Dizon, A., Abella, K., and Southern, Š. 2001. Unobserved kill of nursing dolphin calves in a tuna purse-seine fishery. Mar. Mam. Sci. 17, 540–554. doi: 10.1111/j.1748-7692.2001.tb01003.x

Au, D. W. K. 1991. Polyspecific nature of tuna schools: sharks, dolphin, and seabird associates. Fish. Bull. 89, 343–354. doi: 10.1038/354343a0

Barlow, J. 2015. Inferring trackline detection probabilities, g(0), for cetaceans from apparent densities in different survey conditions. Marine Mammal Science 31: 923–43.

Buckland, S.T. and Anganuzzi, A.A. 1988. Estimated trends in abundance of dolphins associated with tuna in the eastern tropical Pacific. Report of the International Whaling Commission 38: 411-437.

Gerrodette et al. 2008. Estimates of 2006 dolphin abundance in the eastern tropical Pacific, with revised estimates from 1986-2003. NOAA-TM-NMFS-SWFSC-422.

Lennert-Cody, C. E., Buckland, S.T. and Marques, F.C. 2001. Trends in dolphin abundance estimated from fisheries data: A cautionary note. Journal of Cetacean Research and Management 3:305–19.

Lennert-Cody, C.E., Maunder, M.N., Fiedler, P.C., Minami, M., Gerrodette, T., Rusin, J., Minte-Vera, C.V., Scott, M. and Buckland, S.T. 2016. Purse-seine vessels as platforms for monitoring the population status of dolphin species in the eastern tropical Pacific Ocean: the use of fishing vessels as scientific platforms. Fish. Res. 178, 101–13.

Lennert-Cody, C.E., Buckland, S.T., Gerrodette, T., Webb, A., Barlow, J., Fretwell, P.T., Maunder, M.N., Kitakado, T., Moore, J.E., Scott, M.D., Skaug, H.J. 2018. Review of potential line-transect methodologies for estimating abundance of dolphin stocks in the Eastern Tropical Pacific. Journal of Cetacean Research and Management, 19:9-21.

Perryman, W. L., and Foster, T. C. 1980. Preliminary Report on Predation by Small Whales, Mainly the False KillerWhale Pseudorca crassidens, on dolphins (Stenella spp. and Delphinus delphis) in the Eastern Tropical Pacific. Southwest Fisheries Center Administrative Report LJ-80-05. La Jolla, CA: National Marine Fisheries Service.

Ranklin, S., Oedekoven, C., Archer, F. 2020. Mark recapture distance sampling: using acoustics to estimate the fraction of dolphins missed by observers during shipboard line-transect surveys. Environmental and Ecological Studies. https://doi.org/10.1007/s10651-020-00443-7

TABLE 1. Comparison of survey options, based on Design 3 (option 1) of AIDCP-37-02: survey for the northeastern offshore spotted dolphin and the eastern spinner dolphin; one survey vessel.

Survey with the use of drones		Survey without the use of drones	
Advantages	Disadvantages	Advantages	Disadvantages
Evaluate potential g(0) bias	Only 2 of 10 previous stocks	Costs less	Only 2 of 10 previous stocks
Obtain absolute abundance	Will not address bias due to movement in/out of survey area	Easier to implement	Will not address bias due to movement in/out of survey area
Not vulnerable to comparability issues	Costs more	Less risk equipment will not perform as expected	Implements potentially flawed survey protocol
Population size relative to mortality	More difficult to implement		Will not provide absolute abundance
Update N_{min} and SMLs	Equipment may not perform as expected		Only extends historical relative abundance trend by one point
Adjust historical estimates for bias of Barlow (2015)			Vulnerable to comparability issues
			Estimate of N_{min} for SMLs unreliable