Body size measurements of megafauna species at 6 sites after the 2020 COVID lockdown in the Galapagos Islands from 2020-2021 (Galapagos diver disturbance project)

Website: https://www.bco-dmo.org/dataset/913952
Version: 1
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Project

» RAPID: Illuminating the effects of a COVID-19 elimination of diver disturbance on reef fish behavior, distribution and ecosystem functioning in the Galapagos Marine Reserve (Galapagos diver disturbance)

Contributors	Affiliation	Role
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Abstract

The effect of changing levels of scuba diver disturbance, from a low during the 2020 COVID 19 lockdown to normal levels nearly a year later (July - August 2021) on the body sizes of 6 species of marine megafauna (sharks, sea lions and rays) was sampled to test the hypothesis the megafauna community would differ between the lockdown and post-lock down period 1 year later. These data are from the period after the COVID 19 lockdown in July-August 2021. The presence and size of the megafauna was recorded by extended duration video cameras that recorded from a fixed position at 12-15 m depth at each of the 6 sites. These were GoPro7 cameras in an aluminum housing with a battery pack to enable 6-8 hrs of continuous video recording. All megafauna species seen within 5 meters distance from the camera were identified to species. Total body lengths of megafauna were estimated within 5 cm increments by comparing them to known size indicators in the videos. These data were collected by Drs Robert Lamb, Jon Witman and Franz Smith. Rebecca Ward-Diorio worked up the data from the GoPro files. The GoPro file names are provided for reference. Day trips to support scuba based research on board the MV Valeska, a 14 m long fiberglass boat. Various trips between October 1, 2020 to August 31, 2021, with Jon Witman as Chief Scientist

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Coverage

Spatial Extent: **N**:-0.236963 **E**:90.68595 **S**:-1.32879 **W**:90.14065
Temporal Extent: 2020-10-10 - 2021-08-31

Methods & Sampling

The marine megafauna were readily identified as either Galapagos sharks, White tip reef sharks, Black tip sharks, Scalloped hammerhead sharks, Galapagos Sea Lions or Giant manta rays from the GoPro 7 videos. As the extended duration video cameras were set up at 12-15 m depth, a diver stretched a meters tape

perpendicular to the front of the camera and signaled the distances at meter intervals from 1 to 5 meters. This defined a sampling area to count and measure any of the 6 species passing through the video recorded space. Total body lengths of megafauna were estimated within 5 cm increments by comparing them to known size indicators in the videos. These data were collected by Drs Robert Lamb, Jon Witman and Franz Smith. Rebecca Ward-Diorio worked up the data from the GoPro files. The GoPro file names are provided for reference.

Data Processing Description

No sophisticated methods of data processing, just counting and measuring from collected video footage.

BCO-DMO Processing Description

Removed units from column names

Removed spaces from column names and replaced them with underscores ("_")

Added columns to the dataset that include latitude and longitude for each site

Removed unit abbreviations from Total_body_length column values

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Parameters

Parameter	Description	Units
Site	Site in the Galapagos where video footage was collected for the study.	unitless
Site_Latitude	Latitude of Site.	decimal degrees
Site_Longitude	Longitude of Site in decimal degrees. A negative value indicates a Western coordinate.	decimal degrees
Date	Latitude of Site in decimal degrees. A negative value indicates a Southern coordinate.	unitless
GoPro_Video_File_name	File name of collected video footage.	unitless
Species_Code	CAGA: Carcharhinus galapagensis (Galapagos shark); TROB: Triaenodon obesus (White tip reef shark); CALI: Carcharhinus limbatus (Black tip shark); SPLE: Sphyrna lewini (Scalloped hammerhead shark); ZACA: Zalophus wollebaeki (Galapagos sea lion); TAME: Mobula birostris (Giant manta ray)	unitless
Total_body_length	Total body length estimate of megafauna	cm

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Instruments

Dataset-specific Instrument Name	Extended duration video camera manufactured by Marine Imaging Technologies (MITECH)
Generic Instrument Name	Camera
Dataset-specific Description	These "action camera housings" (https://marineimagingtech.com/cameras-housings/housings/) were fabricated for this NSF project. Their features included a flat port, a chassis to mount a GoPro 7 camera and connections to a NiCad battery pack. One of these camera housings was mounted on a\n 80 cm tall stainless steel tripod placed in the rock bottom. Two systems were deployed at a time with one camera per site. The cameras recorded continuous video of the reef fish and megafauna for 6-8 hours per deployment.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Website: https://www.nsf.gov/awardsearch/showAward?AWD_ID=2035354&HistoricalAwards=false

Coverage: Galapagos Islands, Eastern Tropical Pacific

Large-scale changes in the magnitude of human influence on the biosphere have occurred due to travel restrictions and quarantines to contain the COVID-19 pandemic. The reduction in the number of visits to natural areas is providing an unprecedented opportunity to study the effects of people on wildlife and ecosystems. Previous studies indicate that humans can impact the entire ecosystem by frightening animals and altering their behaviors. The COVID-19 quarantine has created a "natural experiment" in the ocean at scuba-diving destinations worldwide by suspending dive tourism and temporarily eliminating the effects of diver-induced fear in reef fish communities. In the Galapagos Islands, the number of scuba divers dropped from 18,000 divers a year to zero in March 2020 when the government of Ecuador halted dive tourism. This study is measuring the changes reef fish behavior, populations and ecological interactions between species to gain an understanding of how dive activity affects the functioning of this marine ecosystem. The effects of changes in diver disturbance are being determined by comparing reef fish communities during and after the quarantine to those from a long-term pre-COVID-19 baseline study. Broader impacts include training opportunities for undergraduate students through participation in field research and senior thesis projects. Public outreach is focused on presentations to the general public and high school students in the US and in the Galapagos. A YouTube video on the ecological effects of diving activity in the Galapagos Marine Reserve is being produced and made publicly available. Insights from this project is increasing awareness of how humans impact subtidal marine ecosystems, which is aiding marine conservation efforts of marine protected areas in the Galapagos and elsewhere.

The intellectual contribution of the research lies in its ability to test hypotheses about the role of humans in influencing consumptive and non-consumptive interactions in shaping the structure, complexity and functioning of marine ecosystems. While it is known that reef fish react to humans as potential predators, less is known about how the fear of predation, a major type of non-consumptive interaction, affects subtidal marine communities, particularly on large spatial scales relevant to conservation. An integrated, observational-experimental research program is addressing this knowledge gap in the Galapagos Marine Reserve by comparing current conditions with existing pre-COVID-19 data. Four hypotheses or predictions related to pandemic spillover effects are being tested: 1) diver disturbance results in behavioral shifts in reef fishes; 2) divers decrease the abundance and diversity of reef fishes and this effect is currently reduced; 3) emergence

or increased abundance of previously wary herbivorous and /or predatory fish results in greater consumption of benthic organisms during and immediately after the COVID-19 period; and 4) decreased diver disturbance associated with the pandemic changes the complexity of behavioral networks (aggressive and positive interactions) among reef fish, sharks and sea lions. The hypotheses are being tested at 14 sites over the course of three research trips using underwater observations and experiments involving fish counts, video camera deployments to record fish behaviors, feeding rates, interactions between species and underwater boat noise from dive tour boats. This project has implications for understanding how fish communities in the Galapagos Marine Reserve ecosystem will respond to future perturbations, while also providing unique insight into the ecological ramifications of a human pandemic.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2035354