Otago Participatory Science Platform 2021

Shark Spy

Community Monitoring of Taranaki Sharks

Image credit: Tran lawrence

Report prepared by

Rob Lewis, Sally Carson

For the purpose of partial fulfilment to Venture Taranaki Trust funding agreement to the New Zealand Marine Studies Centre, University of Otago in 2021.

Main contributing schools / groups:

Chaddy Charters, New Plymouth Sportfishing & Underwater Club, South Taranaki diving and underwater club, Mangorei School, Moturoa School, and Highlands Intermediate School.

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Introduction

There are multiple shark species that inhabit coastal ecosystems around New Zealand that lack crucial demographic data (e.g. abundances, seasonality, age structure, sex ratio; Ford et al., 2018). Sharks play an important role as apex or meso-predators by shaping coastal food webs via consumptive and non-consumptive effects (Heithaus, 2005; Estes et al., 2011; Heithaus et al., 2012). The Taranaki region has a rich marine diversity including multiple shark species. Previous research has indicated that several species of shark frequent the coastal waters around the region including but not limited to:

- Great white shark, *Carcharodon carcharias*
- Mako shark, *Isurus oxyrinchus*
- Bronze whaler, *Carcharhinus brachyurus*
- Basking shark, *Cetorhinus maximus*
- Small-tooth sand tiger shark, *Odontaspis ferox*
- Sevengill shark, *Notorynchus cepedianus*
- Smooth hammerhead shark, *Sphyrna zygaena*
- Porbeagle shark, *Lamna nasus*
- Blue shark, *Prionace gluaca*
- Thresher shark, *Alopias vulpines*
- School shark, *Galeorhinus galeus*
- Rig shark, *Mustelus lenticulatus*
- Spiney dogfish, *Squalus acanthias*
- Carpet shark, *Cephaloscyllium isabellum*

(Anderson et al., 1998; Roberts et al., 2008)

Unfortunately, the lack of demographic information on many of these species limits conservation, management, and policy initiatives. Sharks are however, a captivating and enigmatic group of marine animals which people are often enthusiastic to learn about. This presents an opportunity for the wider community to be involved in collecting data (connecting the community to science and the environment) while increasing our understanding of shark demographics. While historically sharks have not had a good reputation with humans the perception of sharks has been slowly changing in recent decades. While there is still a fear for safety, people have also fostered genuine respect for sharks along with a healthy interest in knowing more about them.

The same rich marine diversity that attracts sharks has also made the Taranaki region a hotspot for ocean activities including commercial and recreational fishing, spearfishing, kayaking, surfing, windsurfing, swimming, and diving. Previous consultation with water user community groups in the past has provided a range of observations, questions, and concerns about the New Zealand shark populations. Recreational fishers' have reported novel feeding behaviours and have concerns about the condition local shark populations are in. Speardivers, divers, swimmers, surfers, and free divers tended to want to avoid large sharks and were interested in their seasonality and distribution (i.e., when and where are they more likely of running into a shark?). Shark Spy sought to address the questions and concerns of the local community while increasing our scientific understanding of local shark demographics for conservation purposes.

Due to being subtidal, wide ranging, and sometimes relatively large studying sharks has its challenges. To collect information about seasonal distribution, relative abundances, and

demographic structure of shark populations requires searching for sharks at different times of the year. Baited underwater videos (BUVs) have become a popular option to collect this information in recent years owing to their cost-efficiency and ease of use. They are non-invasive and have been used effectively in monitoring sharks in the past (e.g. Marshall & Pierce, 2012; Santana-Garcon et al., 2014). BUV's can provide information about species diversity, seasonality, and abundance of sharks as well as their prey species when used as systematic surveys. Sightings can also be reported by any member of the community that happens to come across a shark to compliment this. Reporting opportunistic encounters of sharks by the wider community (divers, surfers, fishers, boat users etc.) provides incidental occurrence data which can identify seasonality and distribution.

Aims and Objectives:

The purpose of Shark Spy was to explore the abundance and demographics of shark, ray, skate, and chimera populations around the Taranaki region while involving local schools and community groups in the process of data collection, data analysis, and discussion of the results. The specific objectives were to:

- Gain understanding of the species composition, relative abundance, and demographic parameters of shark populations in the Taranaki region using underwater baited video and via incidental reporting of shark observations by the wider community.
- Record occurrence of shark and skate egg cases along the Taranaki Coastline.
- Provide discourse opportunities with community about local shark ecology and behaviour.

About this project

This project was a collaboration between the University of Otago's New Zealand Marine Studies Centre and Department of Marine Science, Taranaki schools, Taranaki interest groups (fishing groups, boating groups, divers, spear divers, etc.) and the wider Taranaki community. The BUV footage was collected and analysed with classes of students from two primary schools and an intermediate school. Incidental sightings came from a range of people from the wider community. Egg case surveys were carried out with students from Highlands intermediate school.

This project was funding through the Taranaki Participatory Science Platform (MBIE Curious Minds).

Methods

Shark Spy employed three methods of data collection which included systematic surveys using BUVs, reporting of incidental sightings by the public, and reporting chondrichthyan egg case sightings using beach clean-up days/incidental reports.

Baited underwater video (BUV)

Study site

The area of sampling for Shark Spy included the Sugar Loaf Islands and the adjacent coastal areas as far north as Waitara Beach. The maximum depth of the sample areas was 30m, and substrate varied depending on location. Sample site locations are displayed in figure 1.

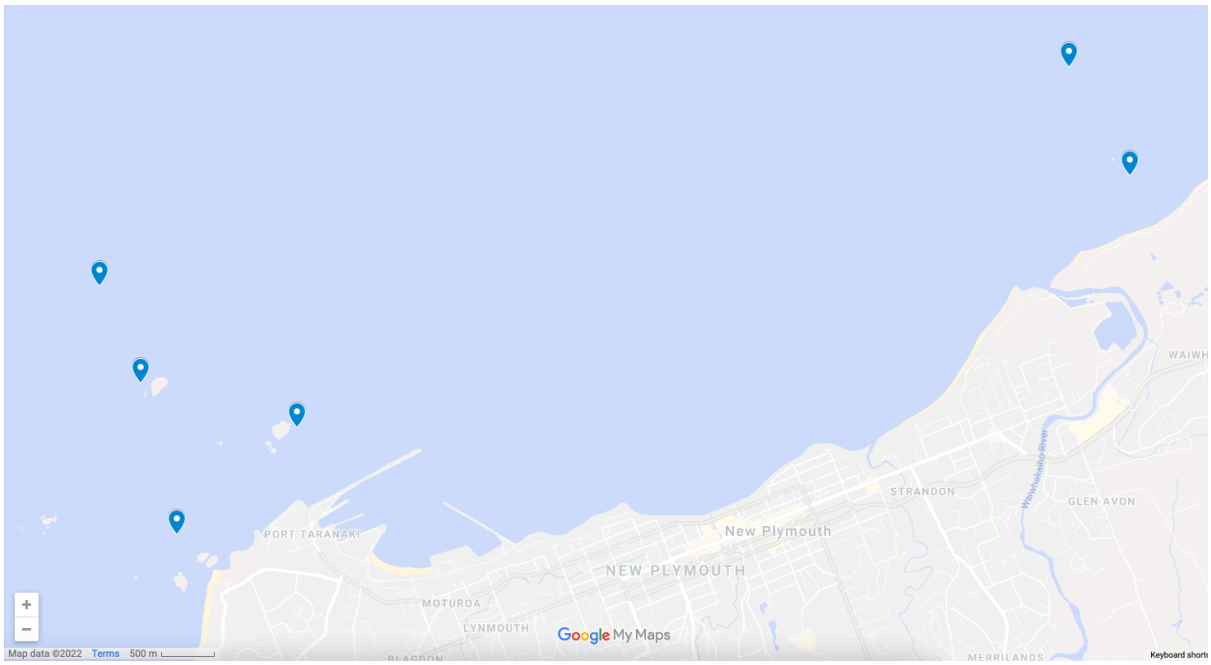

Figure 1. Map of all sampled locations using BUVs in 2021.

Video images were obtained using a downward-facing baited underwater video (BUV) system equipped with a single waterproof SJcam SJ5000X mounted in a protective cap which could be deployed to depths of up to 30m. Below the camera there was a bar 1m in length with a bait box fixed in the centre. To bring sharks to the camera the bait box was filled with 500g of broken up pilchard and sardine.

Deployments were conducted in two sampling seasons split into summer (January 2021) and spring (November 2021). All trips were conducted between 9am and 2pm in Beaufort sea-state <6 and swell height <3m. Before deployment of the BUV the camera was turned on and recording initiated. The BUVs were deployed from the side of the vessel and lowered to rest on the seafloor (the camera sits approx. 1m from the seafloor). Recording lasted for an hour before the camera would shut down. The BUV's were then recollected. The video data was downloaded, and the first 30 mins separated for the purpose of analysis following the same protocols as what the department of conservation have outlined for their BUV research (see Haggitt et al., 2014).

Data analysis

Videos were analysed in the classroom by students ranging from years 6-12. Only the first 30 minutes of each video was used for analysis to ensure that the species sampled were present in the area to start with, rather than being attracted from larger distances as the bait plume extends. Any sharks that were captured by the camera were identified to species level, sexed if possible, and potential prey species were identified. 'Max N' (maximum number) counts are a straightforward method of estimating relative abundances of the species seen on the footage and is a standardized method in the literature (Willis & Babcock, 2000). The students were asked to produce a species list of all the animals seen in a video as well as a count of the maximum observable number of a single species in a single frame. The data was then compiled, and a biodiversity index calculated using species richness, relative abundance, and seasonality information via the Shannon-Weiner index.

Incidental sightings of sharks

Members of the public and water user groups such as divers, fishers, boat users, were encouraged to get involved and register shark sightings to Shark Spy. Sightings were asked to include a photo for ID, a location, and a date. In order to store these sightings as well as make them available to the communities that helped to collect them it was decided to use iNaturalist as a platform. iNaturalist is a global image sharing network seeking sightings of all animal and plant species. It is well established and allows for the data from projects to be downloaded for free by anyone. Members of the community could send sightings to Shark Spy, or upload their sightings directly to iNaturalist via the website (https://www.inaturalist.org/projects/shark-spy) or a mobile app.

Beach surveys for egg cases

Some species of sharks, skates and chimera lay eggs, which often wash up on beaches. Recording the sightings of these egg cases provides insight about the seasonality and occurrence of egg laying chondrichthyan species. Different species have unique designs in egg cases so any that were found can identified to species. A separate iNaturalist Project (https://www.inaturalist.org/projects/shark-spy-egg-cases) was created to catalogue community finding of these egg cases alongside live shark sightings. Systematic surveys in a 100m section along the high tide zone were conducted at five different locations along the New Plymouth coastline (figure 2) alongside beach litter surveys conducted by the Sustainable Coastlines project citizen science project.

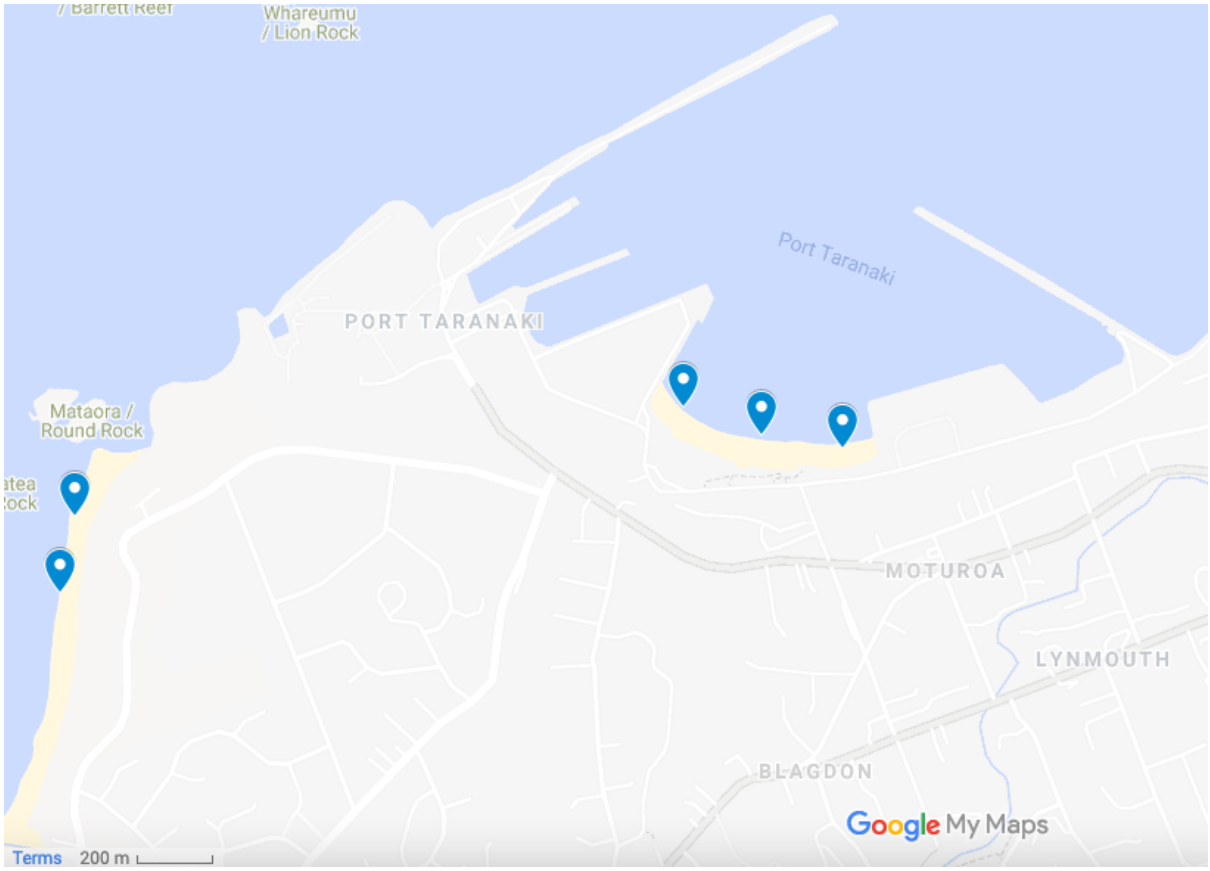

Figure 2. Map of all sampled locations where egg case surveys were conducted.

Data Analysis

Data on species, location, and seasonality was exported from iNaturalist for the purpose of analysis. As there are limited sightings only exploratory data analysis was conducted.

Results

Dedicated surveys

In total the dedicated surveys resulted in three hours of analysed footage (6 samples of 30 minutes each). Only a single instance of a shark being found on the BUV's was recorded, that being a sevengill shark located off the Waiwhakaiho Rivermouth in the November sampling season.

Incidental sightings

In total the Taranaki region has 76 sightings of sharks listed since 2013 when the first sightings were added. Twenty-seven of those sightings have been added since January 1st, 2021 (the start of the Shark Spy project in Taranaki, Table 1). Of those 15 sightings were reported to Shark Spy by community members.

Table 1. Species, number, and the month of reported sightings of sharks from around the Taranaki region in 2021.

Species name	Common name	Number	Month/s
Cephaloscyllium isabellum	Carpet shark	6	January
Notorynchus cepedianus	Broadnose sevengill shark	5	August, November, January
Isurus oxyrinchus	Mako shark	3	January
Galeorhinus galeus	School shark	2	December, January
Carcharhinus brachyurus	Bronze whaler shark	2	November
Alopias vulpinus	Thresher shark	1	December
Prionace glauca	Blue shark	1	November
Squalus acanthias	Spiny dogfish	1	December

The majority of reported sightings were clustered in the warmer months of the year (Nov, Dec, Jan, Feb). Carpet sharks and broadnose sevengills were the most commonly reported species with mako sharks being the second most reported species. All reported sightings were between the months of August 2021 – January 2022 (spring to summer months).

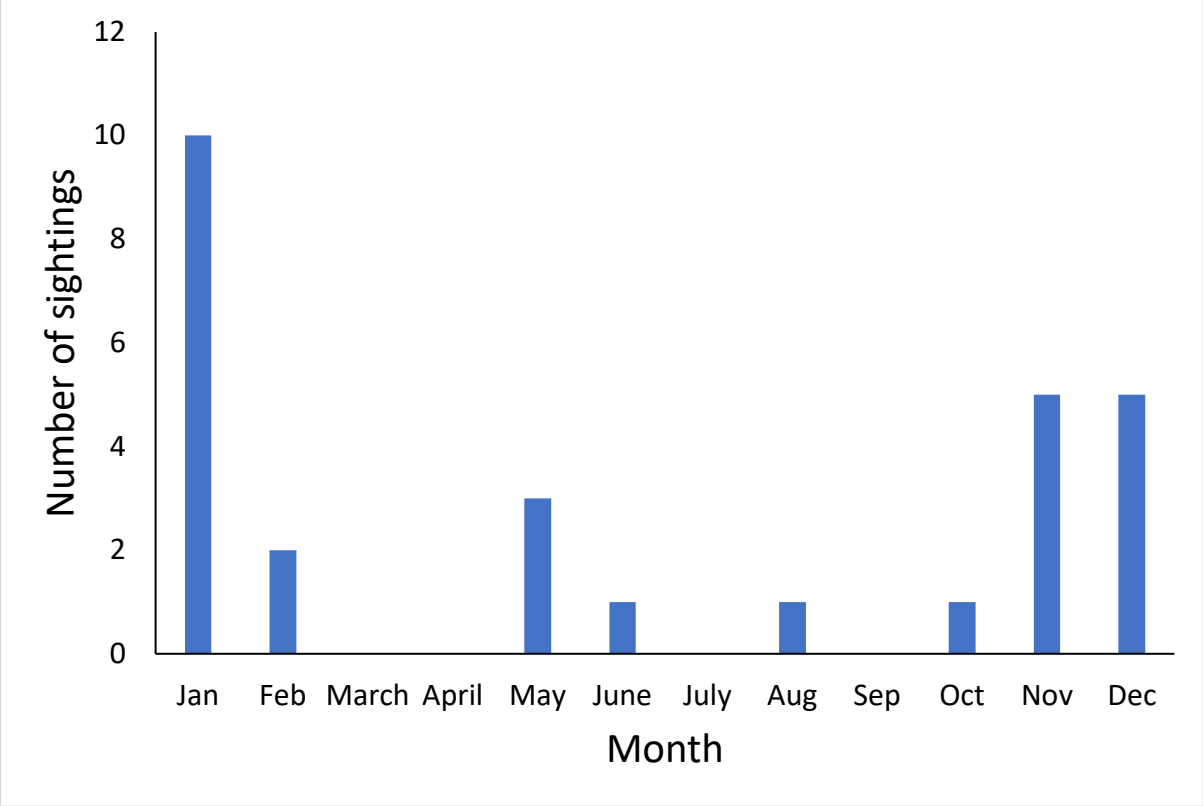

Figure 2. Number of shark sightings reported per month on iNaturalist in 2021/Jan 2022 from the Taranaki region.

There were no egg case sightings during the egg case beach surveys, and since 2013 only a single carpet shark egg case has been reported for the region in 2018.

Discussion

The objective of Shark Spy was to explore the abundance and demographics of chondrichthyan (sharks, rays, skates, and chimera) populations local to the Taranaki region.

In contrast to dedicated BUV surveys in the Otago region in previous years, sighting sharks via the BUV's appeared to be less successful. In all deployments there was however a strong response to the bait from other species such as scarlet wrasse (*Pseudolabrus miles*), terakihi (*Nemadactylus macropterus*), red rock crabs (*Guinusia chabrus*), and common octopus (*Macroctopus maorum*) which indicates that the bait was effective and lends reliability that had sharks been present that there is a good chance they would have been recorded. Reported sightings by the community, on the other hand, were able to highlight the variety of shark species encountered in the Taranaki region, all of which hold information on location and season that would otherwise not be recorded.

As the number of sightings is still low overall as well as per species, no major statements can be made for the Taranaki's shark biodiversity. So far it appears that encounters with sharks along the Taranaki coastline is dependent on season with summer months containing many of the sightings. This could, however, be a by-product of more people making use of the

ocean for recreational purposes during these months. The variety of different shark species being reported is a positive sign for coastal health, although larger numbers of sightings would lend this statement more confidence.

In conclusion, Shark Spy in 2021 has created the foundations of what could become a long-term data set monitoring chondrichthyan species in the Taranaki region and has added to the national database for shark demographic information. Due to there being only one year worth of data there is not enough information to confidently start making statements about the seasonality, richness, and relative abundances of sharks and their relatives in Taranaki waters, however, the data so far is very positive and with continued collection will provide additional data for conservation and management decisions concerning of these important marine animals.

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