Using fishing, biological and genetic data for effective co-management of the sea cucumber fishery in the Seychelles

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Background

Since the 1990s, most sea cucumber stocks have been over-exploited worldwide and in sharp decline. In the southwest Indian Ocean region, particularly in the Seychelles, the sustainability of the sea cucumber fishery is a major national issue, with catch monitoring statistics showing significant resource depletion since 2010. Specifically, three species make up the bulk of the catches, prized for their high commercial value. These include the pentard, the white teatfish and the prickly redfish.

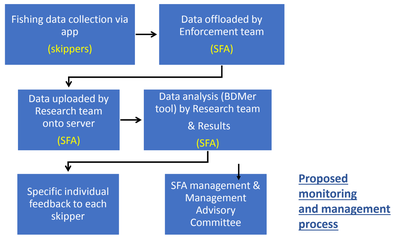
The overall objective of the SEACUSEY project is to ensure the sustainability of the economic sector related to sea cucumber resources in the Seychelles through adaptive co-management. Its specific role is to define and implement operational management measures that are adapted to the diversity, genetic structure, abundance, distribution and evolution of stocks of the three main commercial species.

In order to achieve these objectives, the SEACUSEY project was prepared and carried out in association with the three key actors of the sector in the Seychelles (SFA, SCHA and AMSSI) and French research partners (IRD and University of La Réunion island).

Five specific activities were carried out under the project. These include (1) An experimental fishing survey, (2) Dive profiling, (3) Fishing data collection via an app, (4) Development of the BDMer tool, and (5) Biological & genetic studies.

Anticipated outcome of the project

It is hoped that through the SEACUSEY project, that the tools developed and results found will be used to effectively improve the management and efficacy of the sea cucumber fishery well into the future.



Proposed monitoring and management process

Methods

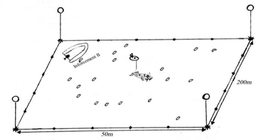
1. An experimental fishing survey, in accordance with real fishing conditions was developed in order to assess empirically how catch per minute (CPUE) varied according to varying sea cucumber densities in different fishing areas. More details on this activity can be seen on Poster 1.

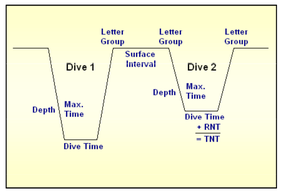
2. Dive Profiling was carried out to determine the effective fishing effort (CPUE) based on the amount of time divers spend actually searching for sea cucumbers. Current CPUE estimates are based on 'total dive time' that is recorded in the current log books. However, this estimate fails to take into consideration the actual time spent fishing, as safety stops and rest times are not recorded separately. Six fishers from three vessels (Galate, Great White and Escapade) were given pressure recorders that accurately mapped each dive trajectory, allowing us to build a model to better estimate the actual fishing time.

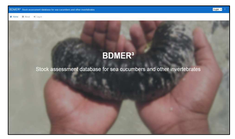
3. Fishing data collection via an app has been developed using the software ODK Collect. A trial of the app was successfully carried out between January and May 2018 by some collaborative skippers.

4. Development of the BDMer tool was done by the IRD, in order to ensure a fast and secure transfer of fishing data that is collected via the app. The server has been installed at the SFA, and will act as a collaborative tool between the IRD, SFA and the local sea cucumber sector.

5. Biological and genetic studies were carried out, aimed at improving our knowledge of the target species. Sampling campaigns were carried out by the SFA team, onboard R/V L'Amitié, as well as enlisting the help from certain skippers. Biological samples were processed at the SFA, whilst the DNA samples were sent to the University of La Réunion, and the IRD for analysis.







Results & Discussion

1. The experimental fishing survey revealed that visibility significantly influenced the CPUE (Fig. 1). Therefore, under the new E-Logbook, visibility is a variable that is recorded.

2. Dive Profiles of >600 dives were collected between February and June 2018. Data included diver depth & time every 10 seconds. Results showed that the divers fished at 35 m on average (Fig. 2). Total dive time averaged 34 minutes per dive, 21 minutes of which (66%) were spent on looking for sea cucumbers (Fig. 2). Catch per minute can be estimated if the skippers accurately record the average depth, total time, and the exact number of fishers for each dive (Fig. 3).

3. Fishing data collection via the app proved to be efficient, more accurate and less time consuming compared to the current logbook system. The project purchased smart phones that will be distributed to the skippers for the purpose of data recording using the E-logbook. The phones remain property of the SFA, and will be collected after each fishing trip to offload the data. It is anticipated that this app will replace the current system in the near future.

4. Development of the BDMer tool has been established at the SFA, and is ready to receive and process data under the new data collection system. It is aimed that individual results will be communicated to each skipper for their own information.

5. Biological sampling of 93 samples of Pentard revealed that this species reaches sexual maturity at about 31 cm length. DNA analysis from hundreds of samples revealed that there is a single stock per species (pentard & white teatfish) throughout the Seychelles. However, weak genetic difference was observed across samples of white teatfish, possibly due to the low abundance of that species in the Seychelles.

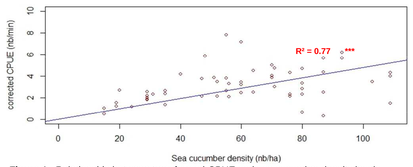


Figure 1. Relationship between transformed-CPUE and sea cucumber density levels

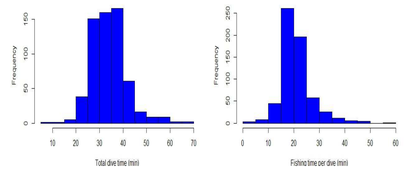


Figure 2. Histograms showing the total dive time and fishing time for each dive

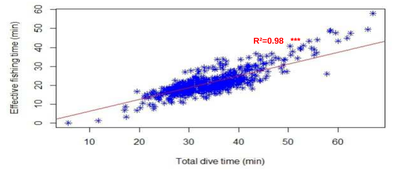


Figure 3. Linear model showing the strong relationship between total dive time and the effective fishing time

Poster produced by Ameer Ebrahim, Project Officer for the SEACUSEY project Contact: ameer.ebrahim@griffithuni.edu.au