Summary Report on the Sea Cucumber Fishery – 2020/2021, 2021/2022 & 2023/2024 fishing season

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Contents

1. Introduction

For over a century, sea cucumbers were fished in the Seychelles in minimal quantities. Intense exploitation began in the late 1990s, driven by rising global demand and prices. This led to a shift from shallow-water collection to deeper areas using scuba gear, increasing catch volumes. By 1999, declines in economically targeted species prompted the Seychelles Fisheries Authority (SFA) to introduce management measures, including mandatory catch and effort logbook reporting. Over the past 20 years, additional measures have been implemented following the implementation of various fisheries dependent and fisheries independent stock assessments.

The current management regulations in place for the fishery (2022/2023 season) are as follows:

- A cap of 25 non-transferable fishing licenses and 4 processing licenses
- Open fishing season of 8-month duration
- Only 3 species are allowed to be exploited – Flower Teatfish (pentard, *Holothuria spp*.), Pricky redfish (sanpye, *Thelenota ananas*) and Golden Sandfish (Kokonm, *Holothuria lessoni*)
- Total Allowable catch, the quota for the 2022/2023 fishing season being 240,475 pieces for Flower Teatfish, 45,000 for Prickly Redfish and 100,000 for Golden Sandfish

The 2020/2021 fishing season started on September 15, 2020, and continued until June 15, 2021, totaling nine months, an extension from the usual eight months. This earlier start was due to requests from industry stakeholders at the pre-season MAC meeting. The 2021/2022 season ran from October 8, 2021, to June 7, 2022, maintaining the standard eight-month duration. The 2022/2023 season also lasted eight months, from October 15, 2022, to June 14, 2023. During the 2020/2021 and 2021/2022 seasons, the authorized species were Flower Teatfish (Pentard, *Holothuria spp*.), White Teatfish (Kokosye Blan, *Holothuria fuscogilva*), and Prickly Redfish (Sanpye, *Thelenota ananas*).

This summary report presents an overview of the catch and effort data for the Sea cucumber fishery during the 2020/2021, 2021/2022, and 2022/2023 seasons. It will outline the fluctuations in total catch, fishing effort, variations in Catch Per Unit Effort (CPUE), and percentage quota utilization, providing insights into the fishery's performance and trends over these periods.

2. Sampling methodology and data analysis

2.1 Sampling methodology

Data on the fishery is collected through the following sources:

i) Paper logbooks are provided to skippers during departure inspections. Skippers fill these logbooks at sea, recording catch and effort data after each dive. Catch is recorded in number of sea cucumber pieces.

ii) Port Control Officers collect landings data during inspections when the catch is being unloaded. Landings are documented in the total number of sea cucumber pieces and the total weight by species.

2.2 Catch, effort and catch per unit effort

For each species caught, the total catch in pieces was calculated seasonally using data collected form the logbooks. The effort was measured in terms of total number of trips, diver days, and diving

minutes. Diver day and diving minutes were calculated using the same method used in the 2012 and 2017 fisheries dependent stock assessments (MRAG, 2012, 2017).

Dive time was determined by multiplying recorded dive time by the number of divers. However, there were large variations in the recorded dive time, ranging from a few minutes to several hours.

To try to address the problem, the following rules were applied:

- **Dive time > 70 min** was treated as **total dive** time regardless of the number of divers
- **Dive time > 0** but number of divers was 0, dive time was treated as **total dive time.**
- **Total dive time = recorded dive time × number of divers.**
- Dive time less than 10 minutes were not included in the analysis.

Diver days was also calculated as per the equation (MRAG,2012):

$$E_i = d_i \frac{1}{n}$$

Where ***E*** is effort, ***d*** is the recorded number of divers and $\boldsymbol{n}$ is the total number of records on the same day for the same vessel. For example, if the dataset contains three records, each with four divers for a specific vessel and day, the effort for each record was estimated to be $\frac{4}{3}$ diver days. This method assumes equal effort for all records for a specific vessel on any given day.

From the two calculated effort, CPUE were then determined for each diving operation as per the below equation.

Dive time:

$$CPUE = \frac{Catch\ (pieces)}{Effort\ (dive\ time\ in\ min)}$$

Diver day:

$$CPUE = \frac{Catch\ \ (pieces)}{Effort\ (Diver\ day)}$$

The average CPUE was calculated by summing the CPUEs from all diving operations and then dividing by the total number of diving operations.

2.3 Quota utilization

Quota utilization for the sea cucumber fishery was calculated for each vessel using the landings data, by comparing the recorded landings per species against the vessel's allocated quota for that species. The utilization rate for each vessel and species was determined using the formula:

$$Quota\ utilisation\ (\%) = \frac{Vessel\ landings\ per\ species}{Vessel\ quota\ per\ species}\ \text{x}\ 100$$

Additionally, an overall utilisation rate was calculated for each vessel by summing the landings across all species and comparing this total to the combined species quotas allocated to the vessel. This process was repeated for each fishing season, resulting in species-specific and overall quota utilisation rates per vessel

To summarise the data by fishing season, the minimum, maximum, and average quota utilisation rates were calculated across all vessels.

3. Results

3.1 Catch

The total catch of sea cucumbers across the three seasons showed a declining trend (Fig. 1). In the 2020/2021 season, the total catch was 313,511 pieces, with Flower Teatfish contributing the largest portion at 225,489 pieces, followed by White Teatfish (49,295) and Prickly Redfish (38,727). The 2021/2022 season saw a reduction in total catch to 289,505 pieces, primarily driven by decreases in Flower Teatfish (209,618) and Prickly Redfish (30,140), while White Teatfish remained relatively stable at 49,908 pieces. By the 2022/2023 season, the total catch further declined to 230,248 individuals. Catches of Flower Teatfish and Prickly Redfish continued to decrease to 194,390 and 26,925 pieces, respectively, while the catch of the of the newly introduced species, Golden Sandfish was 8,933 pieces.

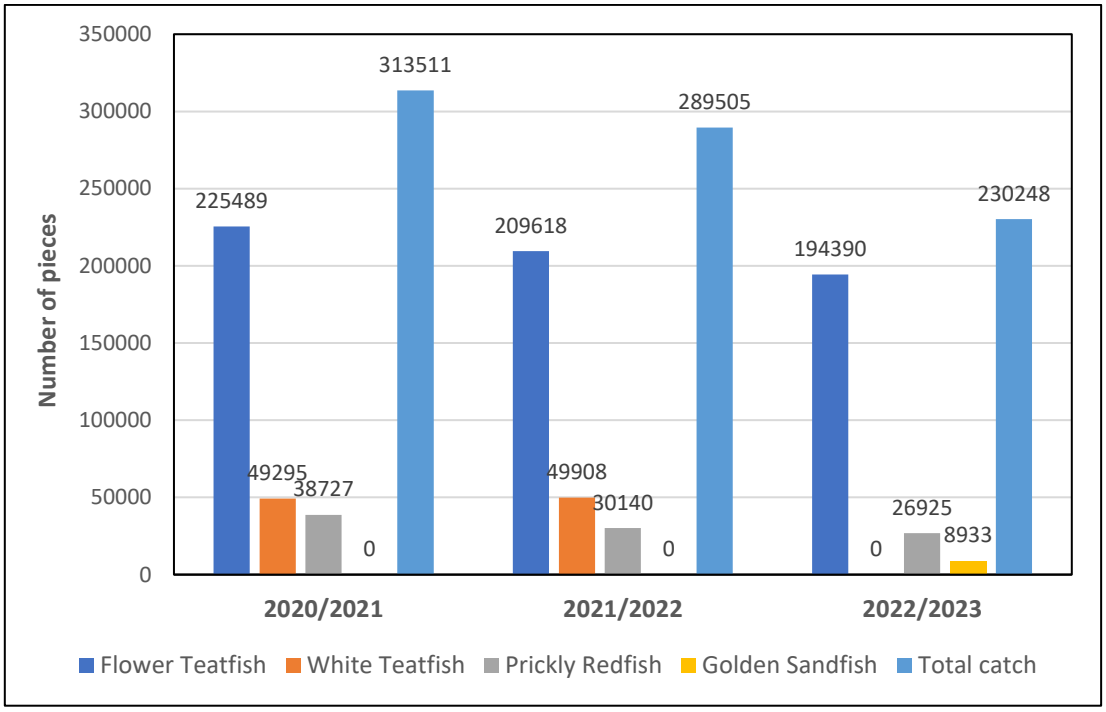

Figure 1. Catches of sea cucumber by species for the 2020/2021, 2021/2022 and 2022/2023 fishing season.

3.2 Effort

The fishing effort for the sea cucumber fishery, as indicated by the number of trips, total dive minutes, and diver days, exhibited a declining trend over the three seasons (Table 1). In the 2020/2021 season, a total of 153 trips were made, accumulating 1,404,692 dive minutes, with an average of 96.15 minutes per dive. This season also recorded 7,695 total diver days, with an average of 0.52 diver days per trip. The 2021/2022 season saw a reduction in effort with 141 trips, though total dive minutes slightly increased to 1,481,697, resulting in an increased average dive time of 96.77 minutes. However, total diver days decreased to 6,955, with a lower average of 0.44 diver days per trip. By the 2022/2023 season, the number of trips further decreased to 127, and total dive minutes dropped significantly to 1,100,343, despite an increase in average dive time to 101.15 minutes per dive. Total diver days also declined to 5,813, but the average diver days per trip increased to 0.53.

Table 1: Fishing effort for the 2020/2021, 2021/2022 and 2022/2023 fishing season

Season	No. of trips	Total dive mins	Avg. dive mins	Total diver days	Avg. diver days
2020/2021	153	1404692	96.15	7695	0.52
2021/2022	141	1481697	96.77	6955	0.44
2022/2023	127	1100343	101.15	5813	0.53

3.3 Cath per unit effort

The CPUE, measured as the average number of pieces per diver day, showed a slight decline across the three fishing seasons (Fig. 2). In the 2020/2021 season, the overall CPUE was 53 pieces per diver day, with Flower Teatfish contributing the highest at 40 pieces, followed by White Teatfish (8 pieces), and Prickly Redfish (6 pieces). By the 2021/2022 season, the overall CPUE had decreased to 50 pieces per diver day, with slight reductions observed in Flower Teatfish (37 pieces) and Prickly Redfish (5 pieces), while White Teatfish slightly increased to 9 pieces per diver day.

In the 2022/2023 season, following the ban on White Teatfish, the overall CPUE further decreased to 48 pieces per diver day. Notably, Flower Teatfish CPUE increased to 42 pieces, and Prickly Redfish CPUE increased to 17 pieces. Additionally, Golden Sandfish, which was introduced in the 2022/2023 season, recorded a CPUE of 63 pieces per diver day.

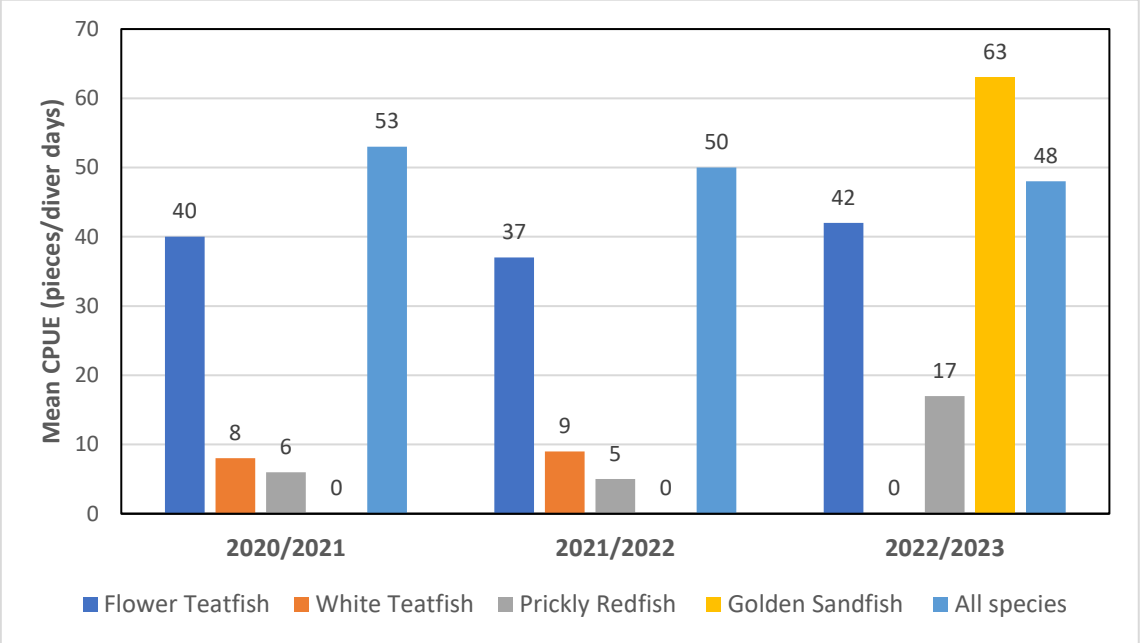

Figure 2. Mean CPUE in pieces per diver days by species and for all species combined for the 2020/2021, 2021/2022 and 2022/2023 fishing season.

The CPUE, expressed as the average number of pieces per dive minute, showed varying trends across species and seasons (Fig 3). In the 2020/2021 season, the overall CPUE across all species was 0.25 pieces per dive minute. Flower Teatfish had a CPUE of 0.19, White Teatfish 0.083, and Prickly Redfish 0.027. The following season, 2021/2022, recorded a decline in CPUE for all species, with the overall CPUE decreasing to 0.21. Flower Teatfish dropped to 0.16, White Teatfish to 0.037, and Prickly Redfish to 0.021.

In the 2022/2023 season, the overall CPUE slightly increased to 0.23 pieces per dive minute. Flower Teatfish showed an improvement to 0.21, while Prickly Redfish rose to 0.078. The CPUE for Golden Sandfish was 0.25.

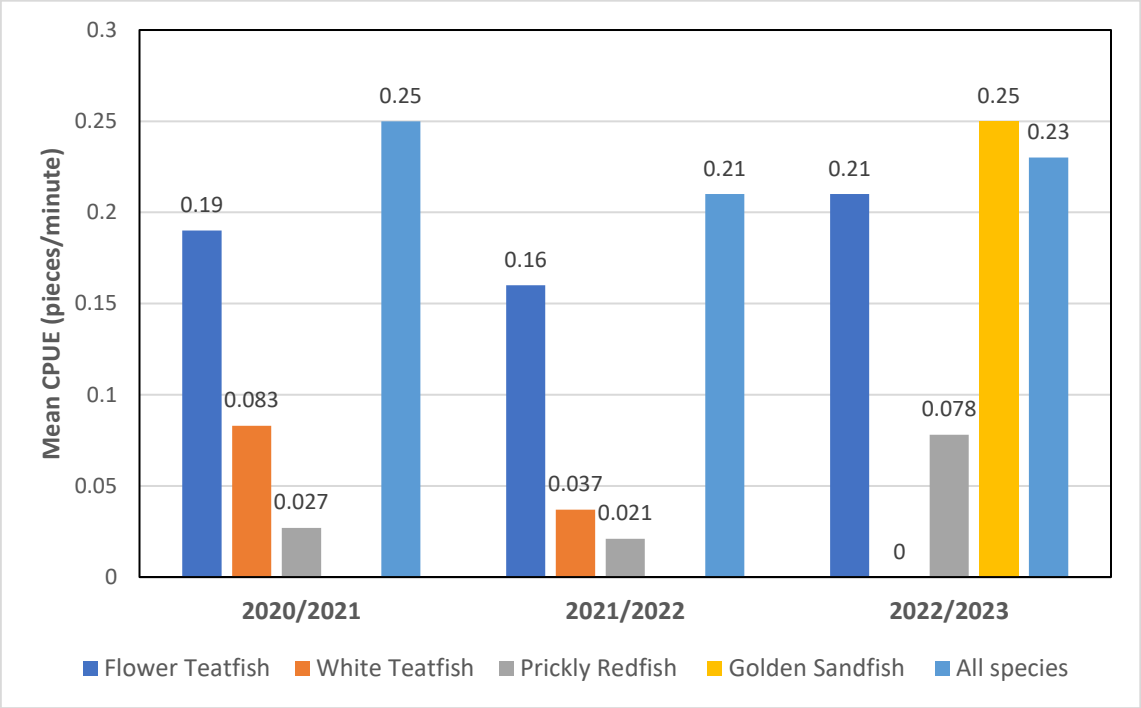

Figure 3. Mean CPUE in pieces per minute by species and for all species combined for the 2020/2021, 2021/2022 and 2022/2023 fishing season.

3.4 Quota utilization

The quota utilization for the sea cucumber fishery, measured across different species and seasons, demonstrated notable variations (Fig. 4, Table 2). For Flower Teatfish, the average quota utilization remained relatively stable across the four seasons, ranging from 83% (2023/2024) to 93% (2022/2023). White Teatfish showed consistently high average utilization at 95% in 2020/2021 and 89% in 2021/2022. Prickly Redfish displayed more variability, with average utilization declining from 103% in 2020/2021 to 55% in 2023/2024. Golden Sandfish had a lower average utilization of 12% in 2022/2023, which further declined to 5% in 2023/2024.

Overall, the average quota utilization for all species combined showed a declining trend, starting at 89% in 2020/2021, decreasing slightly to 85% in 2021/2022, and dropping further to 70% and 60% by 2022/2023 and 2023/2024 respectively.

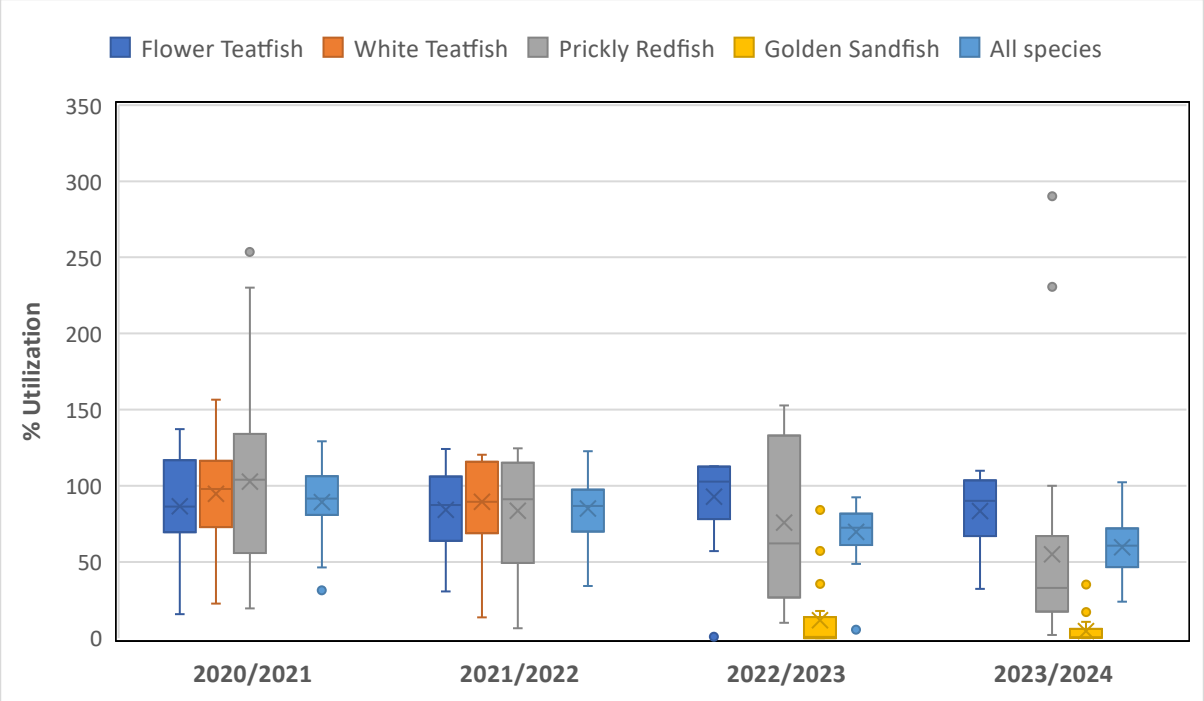

Figure 4. Boxplot showing variations in quota utilization (in percentage) amongst fishing vessels by species and for all species combined for the 2020/2021, 2021/2022, 2022/2023 and 2023/2024 fishing season. Average percentage quota utilization is indicated by the X.

Table 2. Summary statistics for the percentage quota utilization amongst fishing vessels by species and for all species combined for the 2020/2021, 2021/2022, 2022/2023 and 2023/2024 fishing season.

	Flower Teatfish			White Teatfish			Prickly Redfish			Golden Sandfish			All species		
Season	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**
2020/2021	16	86	137	23	95	156	19	103	254				31	89	129
2021/2022	31	84	124	14	89	120	6	84	125				34	85	123
2022/2023	1	93	113				10	76	153	0	12	84	6	70	92
2023/2024	32	83	110				2	55	290	0	5	35	24	60	102

4. Key findings

Below is a summary of the key findings from this report:

- The total sea cucumber catch has shown a consistent decline over the last three fishing seasons, with the catch dropping from 313,511 pieces in 2020/2021 to 230,248 pieces in 2022/2023.
- There has been a noticeable reduction in fishing effort, as reflected by fewer trips, decreased total dive minutes, and reduced diver days across the three seasons, despite a slight increase in average dive time per trip.
- The CPUE, measured by both diver day and dive minute, has seen a marginal decline, indicating a decreasing efficiency in catch relative to the effort expended.
- Quota utilization rates have varied by species and season, with stable rates for Flower Teatfish, high rates for White Teatfish, declining rates for Prickly Redfish, and low utilization for the newly introduced Golden Sandfish in 2022/2023.

- Quota utilization varies significantly amongst vessels during a particular season

5. References

MRAG. 2012. Stock Assessment for the Sea Cucumber Fishery of the Seychelles. Page 75. MRAG Ltd, London.

MRAG. 2017. Assessment of Seychelles' Sea Cucumber Fishery. Page 58. MRAG Ltd, London.