Coastal Fisheries Division

Ciguatera Fish Poisoning (CFP) Monitoring Program Report Card

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Final Quarter 2023

Funafuti

Introduction

Ciguatera Fish Poisoning (CFP) is a foodborne illness caused by the consumption of fish that have accumulated toxins from bottom-dwelling dinoflagellates, such as *Gambierdiscus* species. These toxins, namely gambiertoxins and ciguatoxins (CTXs), are transformed into more potent forms as they move through the marine food web.

Purpose

This report presents the findings of ecological investigations carried out at twenty-six sites in Funafuti Lagoon during the fourth quarter of 2023. The sites were selected because they were associated with ciguatera incidents in the past. As part of its responsibilities, the Tuvalu Fisheries Department (TFD) monitors these reefs to determine whether the organisms responsible for ciguatera (toxic dinoflagellates, particularly *Gambierdiscus toxicus, Prorocentrum concavum, P. lima. and Ostreopsis sp.*) are present in these areas. The aim is to identify reefs with active outbreaks, and the densities of any dinoflagellates found present on a quarterly basis. Based on this information, we make recommendations to guide fishers in avoiding areas of reef where the toxins are present. This preventative measure aims to reduce further cases of poisoning of humans and livestock.

Methodology

The abundance of *Gambierdiscus toxicus* and other dinoflagellates was determined using a method similar to that outlined by Yasumoto *et al.* (1980). This is a simple washing procedure designed to separate dinoflagellates from host macroalgae. It has been used successfully in other field studies in Tuvalu and Kiribati, with minor modifications, by other workers (McCarthy and Tebano, 1984; Tebano, 1984, 1988; Kaly & Jones 1994, 1996; Kaly *et al*, 1991).

Samples of macroalgae (close to 100g each) were collected from the reef top and slope of each site. The macroalgae samples included Dictyota, Hypnea, Blue-green algae, Sargassum, Padina, Halimeda and Caulerpa species. The samples were then weighed when wet, and placed in a plastic container to which filtered seawater was added. The contents of the container were then shaken vigorously for 2 minutes (~250 shakes) and then passed through sieves with mesh sizes of 180 and 38 microns. The residue on the 38-micron sieve was washed into a 25 ml vial and mixed with 5ml of concentrated. Samples were taken back to the laboratory for microscopic analysis.

To estimate the abundance of *G. toxicus* and other potentially toxic dinoflagellates in each sample, each vial was first shaken vigorously and then a subsample of 0.1ml was drawn using a micropipette. The subsample was mounted on a microscope slide and all target dinoflagellates counted. The volume of sample in each vial and initial wet weight were then used to back-calculate actual abundances of cells per 100g of host macroalgae (Kaly, 2000).

Results

Fourth Quarter 2023

Figure 1 shows high levels of *G. toxicus* in several survey areas. This is ***not a good indication***, and suggest a high likelihood of fish poisoning may occur in some areas on the main settlement (Funafuti lagoon).

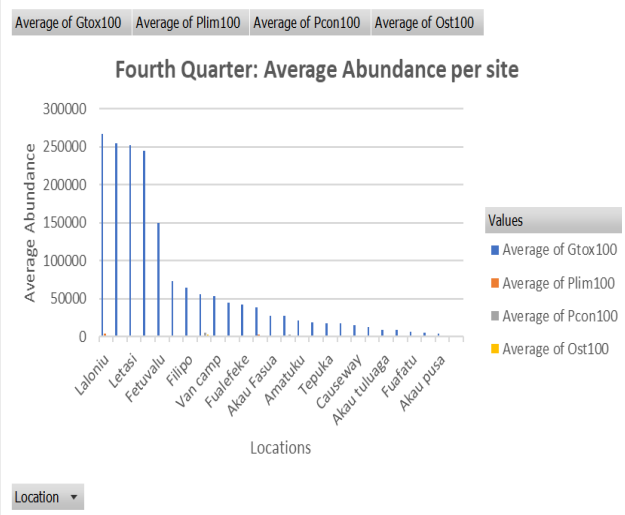

Figure 1: Average abundance of *Gambierdiscus toxicus (Gtox), Prorocentrum spp. (Pcon and Plim) and Ostreopsis sp. (Ost)*

Figure 2 shows the location and density of *G. toxicus* and other toxic dinoflagellates. The highest densities of *G. toxicus* are found at Laloniu, Lotokava, Letasi, Sam P Teo and Fetuvalu. However, all sites were below the average density of *G. toxicus*.

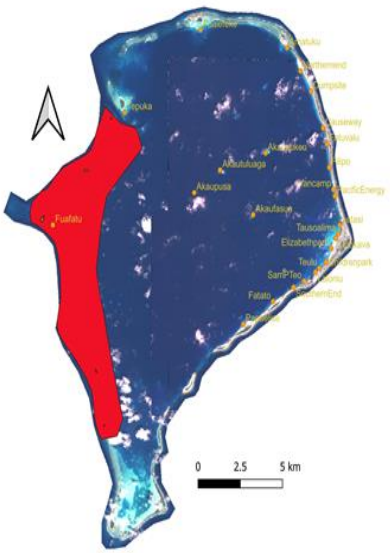

Figure 2. GIS map of the location and density of *G. toxicus* and other potentially toxic dinoflagellates based on survey results.

Table 1. The average density of *G. toxicus (Gtox), Prorocentrum spp. (Pcon and Plim) and Ostreopsis sp. (Ost)* per 100g of host algae for the second quarter of 2022. The colour scale shows high, moderate and low densities for *Gambierdiscus toxicus*.

Row Labels	Average of Gtox100	Average of Plim100	Average of Pcon100	Average of Ost100
Laloniu	266607	4397	1099	2198
Lotokava	254514	0	0	0
Letasi	252470	0	0	0
Sam Teo	244436	0	0	0
Fetuvalu	150104	0	0	0
Dump site	72823	0	0	0
Filipo	64599	0	0	0
Papaelise	55923	0	5663	3539
Van camp	53931	0	0	0
Children Park	45093	2404	0	1202
Fualefeke	42994	0	0	0
Fatato	39166	2748	0	1374
Akau Fasua	28138	0	0	0
Pacific energy	28088	0	2478	1652
Amatuku	21493	0	0	0
Teulu	19590	0	1728	0
Tepuka	17743	0	0	0
Southern end	17601	0	0	0
Causeway	15031	0	0	0

Elizaberth park	12368	0	0	0
Akau tuluaga	9449	0	0	0
Northern end	8620	0	0	0
Fuafatu	6644	0	0	0
Tausolima	5761	0	0	0
Akau pusa	4214	0	0	0
Akau pukeu	1679	0	0	0
KEY:	High risk	Medium risk	Low risk	

The abundance of *Gambierdiscus toxicus* and other potentially toxic dinoflagellates in the fourth quarter (**Figures 1 and 2)** is higher than the third quarter of 2023 for several sites. Hence, the high risk of incident of Ciguatera Fish poisoning (CFP) could increase in sites that have been assessed (**Table 3**) if the average density has not exceeded ≥100,000 per 100g and medium risk for sites which has an average density ≥10,000 per 100g. (Kaly, 2000). Reasons for the increase in the average density of dinoflagellates for the fourth quarter is unknown. Others have suggested a link between outbreaks of ciguatera and nutrient enrichment (Lehane and Lewis 2000). Several recent studies have identified significant problems with nutrient pollution from wastewater in Funafuti lagoon (Sharma, 2010; Fujita et al 2013; Newland 2018).

The chosen 26 sites were specifically identified due to their history of having the highest number of CFP incidents according to data from Princess Margaret Hospital (PMH) and independent Fisheries surveys on CFP cases for almost a decade. As a result of this continuous monitoring, no new cases have been recorded since the last case of CFP admitted to PMH in 2021.

Conclusion

The assessment of CFP has confirmed that five sites in the final quarter exhibited higher than average densities of *Gambierdiscus toxicus* and other potentially toxic dinoflagellates compared to the third quarter of 2023. Although all sites were below the average density of *Gambierdiscus toxicus*, the Coastal Fisheries Section continues to monitor all sites to ensure that residents in the capital are kept informed about the areas that could potentially contain toxins.

Recommendations

It is recommended that the **Coastal Fisheries Section** within the **TFD** continues to carry out public awareness programme to remind people of the nature and causes of ciguatera and to inform them of the area's most likely to be toxic and the fish species most likely to pose a danger.

References

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