

Quantifying non-metric measurements of seafood products at the Suva market

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Fishery resources play a crucial role in Fiji's economy, contributing to food security, employment and exports, in addition to their recreational and social attributes (Lee et al. 2020). There is growing concern about the declines in populations of popular reef fish species, with 17 species assessed as having <20% spawning potential ratio, the international limit reference point above which fish stocks should be maintained to minimise the risk of stock decline (see Table 1 in Prince et al. 2019). While estimating the production and status of these resources is a complex and challenging process (Gillett et al. 2014), assessing and monitoring their harvest and sale is essential for effective fisheries management.

The Suva municipal market is the largest in Fiji and where a diversity of seafood – including finfish, invertebrates, marine algae and freshwater species – are sold. While there has been weekly monitoring by the Ministry of Fisheries' Inshore Fisheries Management Division of finfish species and sizes sold at major municipal seafood markets in Fiji, there is a scarcity of information on the production volume of invertebrates and algae. The ministry is interested in finding innovative, cost-effective ways to fill this data gap and expanding their programme to include invertebrates and marine algae.

However, one of the challenges is that invertebrates such as bivalves and algae traded at for example the Suva market, are not sold according to standard metric units, and therefore there is no information on the volumes, sizes, and numbers being sold. "Non-metric units" used in markets include heaps (or piles), bags, strings, and plates for a range of invertebrates and algae (Thomas, et al. 2020). For example, seagrapes (*nama*) and sea cucumbers (*dairo* or *sucuwalu*) are sold in a heap on plastic plates, rather than by weight. Freshwater mussels (*kai*) are sold in heaps separated into two sizes – medium and large. This issue makes it challenging to calculate the volume of invertebrates and marine algae traded, and their contribution to the Fijian economy.

The Wildlife Conservation Society and Fiji's Ministry of Fisheries carried out a study to convert non-metric measurements of freshwater and marine species sold at the Suva market to standardised units. Specifically, the conversion factor was determined to turn non-metric units (e.g. 1 pile of *kai*) into estimates of the number of pieces and/or weight in kilograms. The information documented from this study can be integrated into the ministry's market survey programme to monitor the trade of invertebrates and algae being sold at municipal markets around Fiji to provide information critical for managing fisheries resources.

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Seagrapes sold in heaps on plastic plates at the Suva market.



Wildlife Conservation Society Fiji Fish Specialist, Waisea Naisilisili, and Ministry of Fisheries Field Officer, Semisi Seru measure the weight of freshwater mussels.



Methodology

This study collected data on four invertebrate and two algal species sold at the Suva market that are sold in non-metric units. Data on sea cucumbers were not included due to a national sea cucumber ban in place. Invertebrates and algae were purchased from vendors at the Suva municipal market. For each invertebrate species, data were collected on individual size, total count, volume and price per non-metric unit. The size of key invertebrate species sold was measured with Vernier callipers to the nearest millimeter. The count per non-metric unit was derived from the total number of counts or individuals in a unit (e.g. heap, bag, plate). An electronic scale was used to measure the volume of both the samples and individuals with the individual weight measured to the nearest gram. To determine the final weight of seafood products, the weight of the container or plastic used in weighing seafood was subtracted from the sample weight. The price of each unit of seafood product was also documented.

Results

The data in Table 1 show the average volume of the freshwater and marine species being sold when sellers use non-metric units. The average volume can be used as a conversion factor to turn non-metric units into standardised weight measurements that can be used for fisheries reporting. This is done by simply multiplying the number of heaps, plates or bags being sold of each species by the average weight or non-metric unit to calculate the overall volume of the species sold. For instance, the ministry simply needs to count the number of plates of seagrapes sold (e.g. 50 plates) and multiply this by the average weight per plate (conversion factor of 0.18 kg average weight/plate) to provide the overall volume of seagrapes sold (e.g. 9 kg). The standard deviation for all products was not exceptionally high (less than 50% of the average), thus representing a reliable dataset. However, more samples can be collected if the Ministry of Fisheries wanted to further refine the conversion factor.

Table 1. The price, average number and volume of invertebrates and algae per non-metric unit. Currency is in Fijian dollars. N/A = not available, meaning the average counts per non-metric unit was not applicable to species surveyed.

Seafood products	Species	Local name	Non-metric unit	No.	Price	Average count	Average volume ± standard deviation (kg)	Volume range (kg)
Saltwater clams	<i>Anadara antiquata</i>	<i>Kaikoso</i>	heaps	20	FJD 5	40	2.09 ± 0.56	1.01–2.78
Freshwater mussels	<i>Batissa violacea</i>	<i>Kai</i>	heaps (small)	9	FJD 4	91	3.63 ± 1.19	2.36–5.39
			heaps (large)	15	FJD 5	48	2.96 ± 0.69	1.90–4.31
Seagrapes	<i>Caulerpa racemosa</i>	<i>Nama</i>	plates	20	FJD 2	N/A	0.18 ± 0.04	0.10–0.28
Seaweed	<i>Hypnea</i> spp.	<i>Lumi cevata</i>	heaps (small)	19	FJD 2	N/A	0.15 ± 0.10	0.05–0.35
			heaps (large)	6	FJD 3	N/A	0.09 ± 0.02	0.07–0.12
Sea urchins	<i>Tripneustes gratilla</i>	<i>Cawaki</i>	bags	12	FJD 5	35	5.31 ± 0.78	4.39–7.31
Turban shells	<i>Turbo chrysostomus</i>	<i>Vivili</i>	bags	18	FJD 3	432	1.50 ± 0.24	1.15–1.89

Determining the weight of sea urchins using an electronic scale.



Freshwater mussels sold in heaps at the Suva market.



Summary

The study shows a quick, relatively cost-effective method to calculate conversion factors to enable the Ministry of Fisheries to convert non-metric units of sale of invertebrates and algae into weights. This negates the need to measure individual non-metric units each time, thus saving time and resources. This method can also be used to collect weight data on other bivalve species, or potentially crustacean species, if for example they are being sold in strings. The method and approach used in this study have been successfully tested and may be valuable for market survey monitoring programmes being implemented in other Pacific Island countries. The conversion factor is an essential component in market surveys and can also be used to convert non-metric data collected during fisheries value chain analyses (e.g. Mangubhai et al. 2017) or broader socioeconomic surveys (e.g. Thomas et al. 2020). The approach used can be applied to other places and proves to provide reliable data. Managers can determine for their geography and management needs how much data and sample sizes they wish collect to build a more robust dataset. This survey should be repeated every two to three years, in case conversion factors need to be adjusted.

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