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著者	YAMAMOTO Sota
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# Food Security in Small Islands: Case Studies in the Federated States of Micronesia

YAMAMOTO Sota

*Research Center for the Pacific Islands, Kagoshima University*

## Abstract

In the 1950s, people in the Federated States of Micronesia (FSM) still ate a “traditional” diet based on starchy staple crops and marine resources, but this began to be replaced by imported food such as rice, flour, sugar, fatty foods, and other processed foods after the United States Department of Agriculture started its supplementary feeding program in the 1960s. This phenomenon accelerated after a Compact of Free Association was signed between the FSM and the United States in 1986. Since then, the FSM has faced serious public health problems due to this new diet and other lifestyle changes. On small islands and atolls, imported foods and medicines may not arrive for more than a month if a typhoon or an oil crisis occurs. In this study, a detailed study of household food consumption is shown to represent the present situation of food security on Piis-Paneu Island (Chuuk Atoll, Chuuk State) and Pingelap Island (Pohnpei State).

**Keywords:** banana, breadfruit, canned fish and meat, ethnobotany, MIRAB, root and tuber crops (*Alocasia*, *Colocasia*, *Cyrtosperma*, *Xanthosoma*, etc.)

## Introduction

The Federated States of Micronesia (FSM) consists of four states (Yap, Chuuk, Pohnpei, and Kosrae, from west to east) composed of approximately 600 small islands, which amount to an area of approximately 700 km<sup>2</sup>. However, the FSM is spread over more than 2,600,000 km<sup>2</sup> of the Pacific Ocean and spans approximately 2,500 km from east to west. In the 1950s people in the FSM still ate a “traditional” diet based on starchy staple crops (e.g., breadfruit, tuber and root crops, banana, etc.) and marine resources (e.g., fish, octopus, clams, turtles, etc.) (MURAI 1954), but this began to be replaced by a diet rich in rice, flour, sugar, fatty foods, and other imported or processed foods after the United States Department of Agriculture started its supplementary feeding program in the 1960s (ENGLBERGER *et al.* 2003). This phenomenon accelerated after a Compact of Free Association was signed between the FSM and the United States in 1986 (HEZEL 2004). Since then, the FSM has faced serious

public health problems due to this new diet and other lifestyle changes, and the government, non-governmental organizations (NGOs), and researchers have attempted to promote a return to local foods because of their higher carotenoid and vitamin contents compared to modern foods (e.g., ENGLBERGER *et al.* 2009). However, the outlook for these programs is still bleak. In the present paper, a detailed study of household food consumption is shown to represent the present situation of food security in Piis-Paneu Island, Chuuk Atoll, Chuuk State and Pingelap Island, Pingelap Atoll, Pohnpei State, the FSM. This paper includes results of presented papers at “Research and Education linkage between Pattimura University and Kagoshima University”, at “the 113th and the 116th annual meeting of Japanese Society for Tropical Agriculture”, at “the ISISA Islands of the World XIII”, and at “the 9th International Conference on Small Island Cultures.”

### Materials and Methods

Food consumption survey was conducted to three households in Piis-Paneu Island from September 2012 to August 2013 and to two households in Pingelap Island from August 2012 to January 2014 with Questionnaire sheets (Fig. 1). These households were selected to survey dietary patterns because of an average family size and income. Questionnaire items are as follows: starchy staples (rice, breadfruit, *Cyrtosperma merkusii*, banana, others), marine resources (fresh fish, dried fish, canned fish, others), meat (fresh, canned), others (instant noodle, coconut, vegetable, fruit). Frequency of each item in one month is calculated using a following formula: Frequency (%) = (total number of appearances of each item / total number of meals in one month) × 100.

### Results and Discussions

#### Imported food (rice, canned fish and meat, instant noodles, etc.)

Rice consumption of households in Piis-Paneu Island is very high (PIS-A: 99.3%, PIS-B: 96.3%, PIS-C: 72.1%, 12-month average) compared to that in Pingelap Island (PLP-A: 65.7%, PLP-B: 33.2%, 18-month average) (Table 1). Households in Piis-Paneu Island also used imported food more frequently than those in Pingelap Island, e.g., canned fish (PIS-A: 78.3%, PIS-B: 34.6%, PIS-C: 23.4%, PLP-A: 2.8%, PLP-B: 1.0%), canned meat (PIS-A: 52.1%, PIS-B: 2.3%, PIS-C: 8.1%, PLP-A: 1.4%, PLP-B: 0.5%), and instant noodles (PIS-A: 87.4%, PIS-B: 51.2%, PIS-C: 43.1%, PLP-A: 22.5%, PLP-B: 9.9%). This is partly because of the limited access to Pingelap Atoll. Villagers in Pingelap Island said that a public ship operated

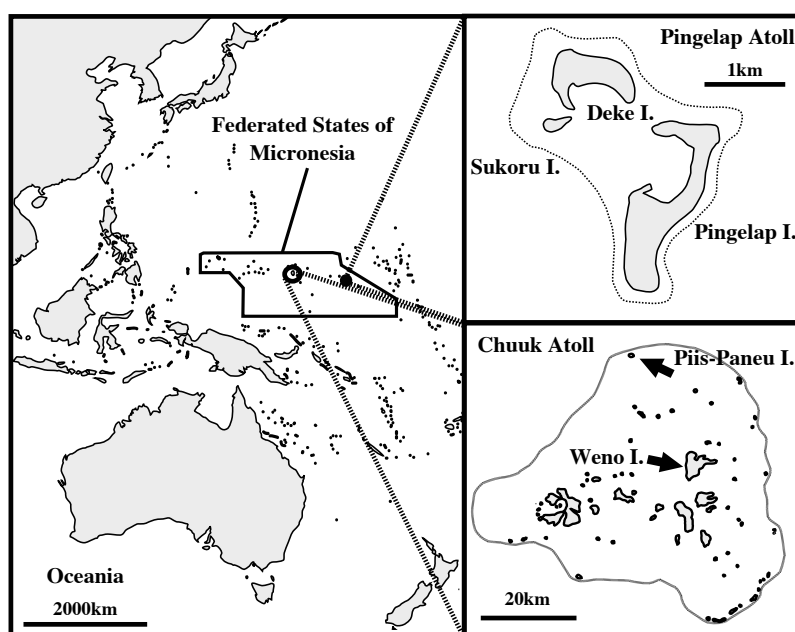


Fig. 1. Location of Piis-Paneu Island, Chuuk Atoll, Chuuk State and Pingelap Island, Pingelap Atoll, Pohnpei State, the Federated States of Micronesia.

Table 1. Frequency (%) of food consumption of households in Piis-Paneu Island, Chuuk State and Pingelap Island, Pohnpei State.

	Piis-Paneu Island Sep. 2012 to Aug. 2013 (12-month average)			Pingelap Island Aug. 2012 to Jan. 2014 (18-month average)	
	PIS-A	PIS-B	PIS-C	PLP-A	PLP-B
<b>Starchy staples</b>					
Rice	99.3	96.3	72.1	65.7	33.2
Breadfruit	90.2	37.6	77.3	20.4	13.7
<i>Cyrtosperma</i>	41.5	10.1	13.5	18.7	16.7
Banana	62.4	32.6	49.1	41.2	22.5
Others	66.7	0.0	11.2	5.2	1.5
<b>Marine resources</b>					
Fresh fish	81.1	68.5	69.2	67.4	54.9
Dried fish	42.9	34.1	33.4	0.2	0.1
Canned fish	78.3	34.6	23.4	2.8	1.0
Others	42.1	12.2	29.0	1.2	4.7
<b>Meat</b>					
Fresh	27.5	30.5	12.5	5.4	2.7
Canned	52.1	2.3	8.1	1.4	0.5
<b>Others</b>					
Noodle	87.4	51.2	43.1	22.5	9.9
Vegetable	67.9	0.5	16.5	1.2	0.1
Fruit	59.7	4.5	11.9	27.7	9.7

by the government (approximately USD 12 per person from Pohnpei Island, the main island of the FSM, to Pingelap Island) came to this island only two times from August 2012 to August 2013. There is a 300 m airstrip in Pingelap Island, and Caroline Islands Air serves a light aircraft (for eight persons) to the island, but a flight schedule is irregular and one way costs USD 190. If people would like to send some stuff to Pingelap Island via Caroline Islands Air, it costs USD 0.75 per pound, which is very expensive to villagers. Compared to Pingelap Island, people in Piis-Paneu Island can easily access to Weno Island, the main island of Chuuk Atoll, and buy any kind of imported food there.

### **Local food (breadfruit, root and tuber crops, marine resources, etc.)**

All households in Piis-Paneu and Pingelap islands ate fruits of breadfruit with high frequency in especially May to September because of the seasonality of breadfruit. Preserved breadfruit was also used. If they cannot get breadfruit, they ate banana and/or *Cyrtosperma merkusii*. The frequency of use of marine resources was not very different among months; fresh fish (PIS-A: 81.1%, PIS-B: 68.5%, PIS-C: 69.2%, PLP-A: 67.4%, PLP-B: 54.9%), dried fish (PIS-A: 42.9%, PIS-B: 34.1%, PIS-C: 33.4%, PLP-A: 0.2%, PLP-B: 0.1%), and other marine resources such as clam, octopus, land crab, sea turtle etc. (PIS-A: 42.1%, PIS-B: 12.2%, PIS-C: 29.0%, PLP-A: 1.2%, PLP-B: 4.7%).

### **Good candidates for food security crops**

It is found that people in two islands still use crops and marine resources obtained from the island (or atoll) with high frequency. However, people in Piis-Paneu and Pingelap islands somewhat depended on the imported rice. Moreover, the frequency of other imported food such as canned fish, canned meat, and instant noodles was high in Piis-Paneu Island. On small islands and atolls, imported foods and medicines may not arrive for more than a month if a typhoon or an oil crisis occurs. Therefore, it is very important to re-discover plants already naturalized on each island, for food security. From this perspective, *Alocasia macrorrhizos* and *Tacca leontopetaloides* are a very important starchy crop for emergency in Piis-Paneu and Pingelap islands. However, a young generation has never eaten them and/or does not know how to cook (Fig. 2). It is necessary to document how to eat these plants for the next generation.

One more important candidate plant for food security is chili peppers (*Capsicum frutescens*), which can serve not only as a spice (fruits) but also as a vegetable (leaves) rich in carotenoids and vitamins (RESOURCES COUNCIL OF THE SCIENCE AND TECHNOLOGY AGENCY 2001). People in Piis-Paneu and Pingelap islands don't often eat vegetables (PIS-A: 67.9%, PIS-B: 0.5%, PIS-C: 16.5%, PLP-A: 1.2%, PLP-B: 0.1%). However, it is known that leaves of chili peppers are used in the FSM as a vegetable (Table 2). YAMAMOTO (2011) reported



Fig. 2. *Alocasia macrorrhizos* (upper left, upper right, lower left) and *Tacca leontopetaloides* (lower right) in Piis-Paneu Island.

Table 2. Use of leaves of chili peppers (*Capsicum frutescens*) in Chuuk, Pohnpei, and Kosrae states (YAMAMOTO 2011, 2012, 2013b).

	Use of leaves of <i>C. frutescens</i> as vegetable			Frequency of use of leaves of <i>C. frutescens</i> per <sup>*2</sup>				
	Yes	No	Total	Week		Month		Year
				Several times	One time	Several times	One time	Several times
<b>Chuuk State</b>								
Weno	19 [SO:18, FR: 4] <sup>*1</sup>	19	38	0	7	5	4	3
Romanum	15 [SO:15, FR: 0]	4	19	0	1	2	4	8
Piis	15 [SO:13, FR: 2]	4	19	0	4	1	7	4
Sub-total	49 [SO:46, FR: 6]	27	76	0	12	8	15	15
<b>Pohnpei State</b>								
Pohnpei	23 [SO: 23, FR: 2]	17	40	0	0	7	10	6
Mokil	20 [SO: 20, FR: 1]	0	20	3	8	3	6	0
Pingelap	35 [SO : 35, FR: 2]	1	36	5	13	3	14	0
Sub-total	78 [SO: 78, FR : 5]	18	96	8	21	13	30	6
<b>Kosrae State</b>								
Kosrae	17 [SO: 12, FR:12]	5	22	1	0	3	3	10
<b>Total</b>	144 [SO:136, FR:23]	50	194	9	33	24	48	31

[ ]<sup>\*1</sup>: They used leaves for SO: soup and FR: fried vegetables. Results from multiple answer.

<sup>\*2</sup>: Questions for people who eat leaves of *C. frutescens*.

that, in Pohnpei State, the frequency of using the leaves is much higher in remote atolls, such as Mokil and Pingelap, than on the main island, Pohnpei Island. This phenomenon was also confirmed in Chuuk Atoll (YAMAMOTO 2012). It is known that the lifestyle on Pohnpei Island is more modernized than that on Mokil and Pingelap atolls (KAWAI *et al.* 2010), which seems to have affected the use of *C. frutescens* leaves. YAMAMOTO (2009) also reported that the indigenous people of Taiwan seem to rarely use the leaves of *C. frutescens* because they can buy other vegetables at markets. These results suggest that the leaves of *C. frutescens* may be used less in modern society. To improve the situation of food security and public health on Pacific islands, there should be a renewed focus on these naturalized plants on each island.

Maluku Province in Indonesia, where Pattimura University is, has the very similar geographical characteristic to the FSM. It is very important to compare the data of this paper with research results/resources in Pattimura University from the viewpoint of food security in small islands of the Asia-Pacific region. I have great hopes of a further collaboration research with Pattimura University in the near future.

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