5-2021

FROM SELF-SUFFICIENCY TO IMPORT DEPENDENCE IN THE REPUBLIC OF THE MARSHALL ISLANDS: DATA ISSUES AND CHALLENGES

Debra L. Claypool
California State University, San Bernardino

FROM SELF-SUFFICIENCY TO IMPORT DEPENDENCE IN THE REPUBLIC OF THE MARSHALL ISLANDS: DATA ISSUES AND CHALLENGES

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Social Sciences and Globalization

by

Debra L. Claypool

May 2021

FROM SELF-SUFFICIENCY TO IMPORT DEPENDENCE IN THE REPUBLIC OF THE MARSHALL ISLANDS: DATA ISSUES AND CHALLENGES

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

---

by

Debra L. Claypool

May, 2021

Approved by:

Kevin Grisham, Committee Chair, Geology

ABSTRACT

Although it appears likely that the profoundly asymmetrical political and economic relationship between the United States and the Republic of the Marshall Islands (RMI) has contributed to the abandonment of traditional agriculture, import-dependency, and a decrease in quality of life for the citizens of the RMI, limits in existing quantitative data make it impossible to model exactly how this occurred. Therefore, rather than seek to model this causal relationship, the researcher employed three existing ethnographic studies to establish a quantitative measure of the transformation itself. Using additional government documents to supplement the existing data, a measure of relative percentage of imports to exports was constructed. This allowed a simple quantitative analysis of the transformation from self-sufficiency to dependency on food imports that occurred in the years between 1949 and 2014 in the Republic of the Marshall Islands, which is consistent with the literature. Peculiarities in the data were also discussed in light of historical and contextual considerations, particularly the history of U.S. nuclear testing in the RMI. Further, the limitations in available data in Pacific Island region, and among Territories and former Territories of the United States were examined more closely. Using a data set comprising twenty governmental and international data banks, with twenty indicators for each of the twenty nations, the effect of nation size, population, and political affiliation were each examined in light of relative data availability. The conclusion of this preliminary analysis suggests that the limitations in available data for Pacific

Island nations, as well as U.S. Territories and former Territories, is not due to the remoteness of their location, nor to small size, nor to low population. Rather, this research strongly suggest that it is the dependent relationship with the United States that effectively limits the data availability for any given nation. This is observed in data sourced through the United Nations, the World Health Organization, the World Bank, the International Monetary Fund, and others. It is concluded that further research into this topic is necessary to enable fair and thorough investigation of the economic and demographic impact of decisions made by developed nations, particularly on vulnerable nations such as the RMI.

ACKNOWLEDGEMENTS

My deepest thanks to the faculty of the Social Sciences and Globalization Department who inspired me to examine the world with a wide lens, and to the professors in the Mathematics Departments who shared the beauty of numbers.

DEDICATION

This humble work is dedicated to those who fill in the gaps.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE:

THE TRANSITION FROM SELF-SUFFICIENCY TO IMPORT DEPENDENCE

Introduction

For nearly 4000 years - from 2000 B.C. until the early twentieth century - the Pacific Island nation now known as the Republic of the Marshall Islands (RMI) was entirely self-sufficient, supplying its population with a balanced, sustainable diet. Located above the equator, halfway between Hawaii and Australia, the RMI was relatively isolated from the rest of the world until the early 17th century, when traders and whalers began visiting the atolls, establishing trading posts and missions. Marshallese life remained mostly unchanged, however, until the early 20th century when the warring world took notice of the strategic location occupied by the tiny atoll nation. During World War I, the Marshall Islands were first occupied by Japan in 1915, then Germany until WWII, and then in 1946 the United States fought and claimed the islands, establishing a permanent military base on Majuro, eventually claiming the nation as a territory of the U.S.

Thus began the profound transformation of every aspect of life in the Marshall Islands, and in particular the loss of food self-sufficiency which is the subject of this paper. Despite the earlier Japanese influence, which emphasized trade and production of copra, as late as 1947 the nation was still self-sufficient in food production, and the bulk of land use was organized around traditional agriculture. However, in the period between 1946 and the end of the twentieth

century, the Marshall Islands steadily increased its dependence on imported foods and aid from the U.S., sacrificing self-sufficiency in the process.

As the use of traditional foods waned and dependence on imported foods increased, chronic and devastating health problems in the RMI were widely observed. Similar transformation of nutrition, with similar health outcomes, have been observed in other Pacific Island Nations, but in the Marshall Islands the relationship with the U.S. is particularly problematic. Following WWII, after the Marshall Islands had been declared a trust territory of the United States, the U.S. Department of Energy began a program of nuclear testing in the northern, centered around the northwestern, or Ratak Atoll, particularly Bikini and Enewetak atolls. The testing began in 1946 and ended in 1958. The devastation caused by the nuclear bombs, the effect of the radiation, and the subsequent studies of the effects of radiation on the Marshallese all complicate the question of nutrition, aid, and self-sufficiency. Throughout this research, the long shadow of the U.S. nuclear testing was continually present, and will be discussed throughout this paper as it may impact the issues that are addressed.

Research Question

A Model of Cause and Effect

My original intent was to examine this transformation, using demographic and economic data available through United Nations, World Health Organization, World Trade Organization databases, and other government and non-governmental databases, in order to provide a model of cause and effect

relationship between the U.S. intervention in the RMI and these fundamental changes that seem to be its consequences.

However, a deeper examination of these sources revealed a significant problem: sufficient quantitative economic and demographic data concerning the RMI prior to 1981 was not readily available in any of them. No causal model could be tested or even constructed using quantitative data accessible through public or academic channels. Due to the historical conditions dominant in 2020, travel to the RMI to gather additional data was ruled out as an option. As the research evolved, this effect became a true detriment to any kind of traditional quantitative analysis.

A Transformation of Focus

Thus, the focus of the project shifted to accommodate these limitations of data. Rather than attempt to model a causal relationship, the research presented here aims to provide a deeper understanding of the data sources which are indeed available, analyzing them more thoroughly in order to establish the groundwork for future research in this field.

This paper utilizes existing ethnographic data to model the extent of the transformation from self-sufficiency to import-dependence through an examination of consumption patterns. Although this transition is consistently referenced, along with two of the three data sets this study employs, no attempt to analyze this transformation has been previously undertaken. Given the dearth of data regarding the changing conditions in the RMI, and the dire circumstances

in which the nation currently finds itself, research which grounds the changes in data is deeply needed.

A Second Issue Emerges

During the course of researching this topic, the challenges faced in the search for data were so significant that the challenges themselves became a secondary research issue. Although the dietary transformation of the RMI and the dearth of economic and demographic data seem unrelated, when the lens is widened, it becomes possible to see how both these issues are indeed theoretically connected through ongoing political, historical, and economic relationships between the RMI and the U.S., complicated by geography and development, which in fact makes this an ideal subject for globalization research. The patterns of availability of data are not random; they have meaning, and the meaning is related to the processes of globalization.

Thus, under the heading of “Limitations of Data,” this paper also points out the challenges which accompany research in the Pacific Island region, with territories and former territories of the U.S., and in regards to the Republic of the Marshall Islands in particular. Using a preliminary sampling of sources, across these regions, this section lays the groundwork for future research in availability of data by geographical, economic, and political variables. The concluding discussion section addresses the significance of this aspect of the research, particularly for globalization studies.

Significance of This Study

Although it is widely discussed in the literature, prior to this study, the transition from food self-sufficiency to dependence on imports in the RMI had not yet been quantitatively analyzed. Anecdotal evidence combined with ethnographic data from two widely-cited 1947 and 2014 data sources regarding nutritional intake are generally used to describe the transformation. However, no attempt had been made to quantify this data for the purpose of statistical analysis of the trend. In addition, the 1980 Department of Energy data set included in this study has not been previously used in conjunction with the other two. The addition of the 1980 data and the corresponding documentation provides an additional data point, as well as content which allows the 2014 data to be expanded and more fully analyzed. This use of the 1980 data to expand the 2014 data creates an important continuity in the data which allows for a simple statistical analysis of the trend of change which clearly supports the hypothesis that the transformation from food self-reliance to import dependency has indeed taken place.

Although only tangentially related to the research question itself, it the belief of this researcher that the deeper examination of the limitations of data is significant in the larger context of globalization studies and theory. Acknowledging and analyzing such significant gaps in data availability brings attention to the "elephant in the room": where is the data, and why isn’t it available? Assumptions that data does not exist, due to remoteness of location,

small population size, or some other inconsequentiality of the community, need to be challenged. In this case, the research shows that none of these factors explain the lack of data; in fact, there is another factor which is definitely of interest to scholars of development and globalization.

Inconsistencies of data can have a substantial impact on the kinds of questions researchers ask, and how they are answered. Important causal relationships can be left unexplored and unexplained, and over time the same mistakes can be repeated. In an increasingly globalized world, one in which data continually expands, blank spots in that data need to be acknowledged and corrected for full understanding to take place.

Methodology

The primary section of this research project analyzes three existing ethnographic data sets in order to illustrate the changing pattern of food consumption in the Marshall Islands from 1949 through 2014. In addition to analyzing the data tables, content analysis is employed to further quantify the data. It does this by analyzing the entries which contain mixed-ingredient preparation using documentation of widely-used indigenous recipes and preparations contained within the text of the studies, and across the studies. Using simple statistical analysis of this data, it is possible to quantify more accurately the relative percentage of domestic versus imported foods consumed within each observation. This allowed for a statistical analysis which in turn quantified the trend away from traditional foods and toward imported foods. This

pattern is consistent with anecdotal and epidemiological data, examined in the literature section.

In the secondary research section, a sample of data sets which illustrate the limitations of existing data are quantified and analyzed. Employing a “meta-analysis” of data sets across Pacific Island nations and current and previous territories of the United States, the data in this section compares twenty existing data sets from the United Nations, World Bank, World Health Organization, U.S. Bureau of Economic Analysis, and several other international data-gathering organizations, across the Pacific Island nations and across U.S. island territories and former territories. Data availability is compared across nations, across groupings of nations, and across political standing vis-à-vis the U.S., and the findings are discussed.

Key Findings

The key findings in this study are the following. First, the analysis of the food consumption data shows that there has indeed been a profound shift in the food consumption patterns in the Marshall Islands, both in the rural areas and in the urban centers, consistent with the literature. Although the available quantitative data regarding food consumption patterns is based on qualitative observation, this trend is so striking that a quantitative change can certainly be affirmed.

Secondly, analysis of the set of data sets reveals a relative lack of quantitative data regarding imports, agricultural production, and other economic

indicators before 1991. The Republic of the Marshall Islands became an independent nation in 1979, and in 1986 signed the Compact of Free Association with the United States. Comparison with Pacific Island Nations of equal political standing vis-à-vis the U.S., similar remoteness, size and composition, and similar population reveals that the most significant factor in data availability is none of these variables, but rather the political relationship with the United States. Other similarly small, equally remote Pacific Island nations with very small populations nevertheless have relatively greater amounts of quantitative data available throughout the duration of many of the datasets. On the other hand, large, populous territories of the U.S. such as Puerto Rico, as well as smaller Pacific Island nations such as Guam, American Samoa, and the Northern Mariana Islands exhibit the same striking dearth of data. These results, although they must be seen as a preliminary finding due to the limitations in the sample size, point toward the need for greater research in this area.

Road Map

This paper begins with a brief history of the Republic of the Marshall Islands, and an examination of the legacy of nuclear testing by the United States military on the RMI. It continues with an overview of the literature regarding the dynamics of changes in the food consumption in the region. In Chapter Three, an overview of data sources is followed by an in-depth examination of the Spoehr 1947 data, the Naidu et al. 1980 data, and the Ahlgren et al. 2014 data sources. Chapter Four presents the question which will be examined, and then analyzes

the data sets, confronting the various questions that arise with each. The Summary of Findings included in this chapter summarizes the findings in a single table and two charts, which is followed by a discussion regarding the impact of data location on results, and special considerations involved in the data collected by the Brookhaven Laboratories researchers.

Following this, Chapter Five considers the secondary question of the limitations of data encountered in the course of this research. It discusses the need to examine this data availability, in light of the relevance to future research. The Data section enumerates the nations considered in this part of the study, and the data sets and questions included. The Methods sections discusses the statistical considerations involved in this preliminary analysis. Finally, the Data Availability for the Republic of the Marshall Islands section illustrates the motivation for this part of the project.

Finally, the data is examined in two groups. First, the Pacific Island nations data is ranked by size and then by population, and the data availability percentages rankings are compared to these. Then the Territories and Former Territories of the U.S. are considered, and the data is likewise ranked and discussed. Finally, the findings are discussed, and the rationale for further research is presented. The conclusion summarizes the findings of the paper.

CHAPTER TWO:

LITERATURE REVIEW

A Brief History of the Republic of the Marshall Islands

The lands currently known as the Republic of the Marshall Islands were originally settled around 2,000 B.C. by Micronesian islanders, highly skilled navigators who are the ancestors of the current day Marshallese. The Marshall Islands are located north of the equator in the Pacific Ocean, approximately halfway between the Philippines and Hawaii, and are made up of two roughly parallel atoll chains, which surround two deep volcanic lagoons. The northwestern atoll chain, dubbed Ralik (Sunset), contains Kwajalein Atoll and associated islets around one deep volcanic lagoon, while the southeastern atoll chain, or Ratak (Sunrise), contains Majuro atoll, the capital and location of the U.S military presence, and like Kwajalein, also surrounds a deep volcanic lagoon. Although the atolls and outer islands that comprise the inhabited Marshall Islands contain limited vegetation, and only a shallow lens of fresh water, for nearly 4,000 years the Marshallese were self-sufficient and healthy, thanks to a perfectly balanced seasonal rotation of indigenous crops, the abundance of coconut, and plentiful sea life.

Europeans began visiting the islands in the 16th century. In 1561, Spanish explorers encountered the islands, and throughout the 17th and 18th centuries Spanish, German, British, and Japanese explorers, whalers, and traders passed

through the islands, stopping to evangelize or set up shop in trading posts and small homesteads. In general, the Marshallese people were welcoming and did not display the aggression of some of their Pacific neighbors. As a result, relationships with European traders and whalers were often long-standing (Hezel, 1995).

Despite this, it was not until the imperialist era of the 18th century that the islands became an object of interest to European powers. In 1788 the islands were officially mapped and "named" by the British captain Charles Marshall. In 1874 the European community recognized Spain's claim on the Marshall Islands, but in 1885 the German Empire signed a treaty with several island chiefs and assumed a protectorate relationship with the islands (Hezel, 1995). German missionaries evangelized the Marshallese to Christianity, which is the official religion of the Marshall Islands to this day.

German occupation continued until 1914, when the Japanese forces captured the islands during World War I. Following the Treaty of Versailles in 1919, Germany renounced its Pacific territories, and the Marshall Islands were ceded to Japan. Japan continued to occupy the islands until World War II.

In 1944, the United States invaded the Marshall Islands, landing first on Kwalajein atoll, driving out the Japanese forces occupying the islands in a series of bloody battles which involved Marshallese natives. Following their defeat in World War II, the Japanese were forced to yield rulership of the Marshall Islands to the United States as part of the 1947 Trust Territory of the Pacific Islands

agreement, which included also Micronesia, Palau and the Northern Mariana Islands. Thus, the Marshall Islands officially became a trust of the United States, and military bases were installed on Majuro and other islands.

The Nuclear Legacy

Following World War II, the U.S. began making plans to test nuclear weaponry in the Pacific. In 1946 the U.S. government met with the leaders of the Marshall Islands and convinced them to permit testing on the outer atolls. The inhabitants of Bikini Atoll were moved to Rongerik Atoll in order to begin the process of testing nuclear weapons. Shot Able, pictured below, was the first nuclear bomb test in 1946, detonated at Bikini Atoll, followed by Shot Baker a few weeks later. In 1948 Shot Yoke, a fission bomb, was detonated on Bikini Atoll. Testing continued through 1949 and 1950, then in 1951, the inhabitants of Enewetak Atoll were relocated by the U.S. Navy, and under Operation Greenhouse, nuclear tests at Enewetak Atoll, commenced. This was followed by Operation Ivy in 1952, which included the hydrogen bombs Shot Mike and King Shot, as well as others.

Two years later, in 1954, the infamous Castle Bravo nuclear bomb was detonated on Bikini Atoll. This was the first of six weapons in the Castle series. Fallout from Castle Bravo spread across the region, contaminating everything on Rongelap and Utirik atolls, which were inhabited at that time. Ashy snowflakes fell onto the inhabitants of the nearby islands to be consumed with the food and water, and through the skin. (Lessard, n.d.). Testing continued with Operation

Sandstone, and finally concluded with Operation Hardtack 1, a series of 35 total tests, in 1958 (AHF, 2019).

Figure 1: Shot Able Test, Bikini Atoll, July 1, 1946.

Source: Atomic Heritage Foundation, 2019.

The Marshallese were evacuated from Bikini and Enewetak Atolls before the testing. Immediately following the contamination of Rongelap and Utirik due to the 1954 Bravo detonation, those people were also evacuated. They were

permitted to return to Rongelap in 1957, and at that time Brookhaven National Laboratory researchers began regular medical examinations of the inhabitants. Sponsored by the U.S. Atomic Energy Commission, this research has recently been seen as suspect in that it allowed the Marshallese to be exposed to continual radiation in order to study the effects (AHF, 2019). Certainly the undated government report does not hesitate in presenting detailed findings in this regard (Lessard, n.d.). Residents were permitted to return to Bikini Atoll in 1969, but were removed once again in 1978, due to high levels of contamination and the resultant health issues. In 1980 the people of Enewetak were permitted to return. Researchers from Brookhaven continued to monitor their exposure to radioactive materials, and one of the sources used in this paper is part of this research effort.

Much of this research was hidden from the public, along with the extent of the damage done to the Marshallese people. In the late 1970's, pressure to release the information began to build. In 1983, Marshallese activist Darlene Keju made an historical presentation at the World Council of Churches assembly in Canada, bringing the plight of the Marshall Islands to the world stage for the first time (Johnson, 2014). This led to pressure in the United Nations for greater accountability on the part of the United States, which granted the RMI political independence under a Compact of Free Association in 1986. A Marshall Islands Nuclear Claims Tribunal was established at the same time, to help compensate the survivors of the nuclear testing.

The relevance of this history between the United States and the Republic of the Marshall Islands shall be explored throughout the course of this paper. The abuse of the islands, the questionable motives of the U.S. research agenda, along with the legacy of hidden data and misinformation, casts a long shadow over any research into the RMI, informing the questions which need to be answered regarding every change that has occurred in the lives of the Marshall islanders.

Since this time, the Republic of the Marshall Islands has continued to struggle with health challenges resulting from the lingering contamination of the islands. The dislocation of communities has led to overcrowding in the capital, Majuro. In addition, the transition from native foods to imported foods has had severe health effects which have exacerbated these problems.

The Change in Consumption Patterns

Although it is widely discussed in the literature, prior to this study the transition from food self-sufficiency to dependence on imports in the RMI had not yet been quantitatively analyzed. Indeed, similar data availability obstacles have been observed throughout the Pacific Island region (Englberger et al., 2003; Hawkes et al., 2009; Johnson, 2017). Anecdotal evidence combined with ethnographic data from two widely-cited 1947 and 2014 data sources regarding nutritional intake are generally used to describe the transformation (B. Davis, 2008; Palafox et al., 2003; Yamada & Palafox, 2001). However, no attempt has been made to quantify this data for the purpose of statistical analysis of the trend.

In addition, the 1980 Department of Energy data set included in this study has not been previously used in conjunction with the other two. The addition of the 1980 data and the corresponding documentation provides an additional data point, as well as content which allows the 2014 data to be expanded and more fully analyzed. This use of the 1980 data to expand the 2014 data creates an important continuity in the data which allows for a simple statistical analysis of the trend of change which clearly supports the hypothesis that the transformation from food self-reliance to import dependency has indeed taken place.

The Impact of Import Consumption

As early as 1949, anthropologist Alexander Spoehr observed that the people were healthy when they consumed their native diet, but that their preference for imported foods, particularly white rice and sugar, would inevitably have a negative impact on their health (Spoehr, 1949, p. 152). And in fact, that is what occurred. In the years between 1946 and 2014, imported foods did indeed "supplant the native diet", as Spoehr predicted, and the health of the Marshallese plummeted, reaching crisis levels by 2014. The 2019 Global Nutrition Report profile of the Marshall Islands categorized the RMI as “off course to meet all all targets for maternal, infant, and young child nutrition” (Global Nutrition Report, 2019, p.1), a widely-shared assessment (Ahlgren et al., 2014; B. Davis, 2008; Johnson, 2017; Palafox et al., 2003).

The Role of Preferences

A notable trend in the literature is to suggest that a preference for imported foods over traditional foods, inherent to the Marshallese people, is largely responsible for this transition. This model focuses on Marshallese preference and choice, suggesting that when imported foods were made available, the traditional foods were willingly abandoned. Thus, Spoehr (1949) notes,

> Since the war, circumstances have forced the villagers to rely more heavily again on their native foods. But the liking for store foods remains, and if they increase in quantity in the stores and the villagers can obtain enough cash income to procure them, the trend toward greater consumption of store food relative to locally produced food may well be resumed. (Spoehr 1949, p. 152).

This observation is repeated throughout the ethnographic literature, including Naidu et al, who observed, “There is a tendency for the islanders to prepare and cook less local foods as imported foods become more and more available.’ (Naidu et al. 1980, p. 9) More recently, Ahlgren et al. observed,

> Canned tuna and sardines (in oil or tomato sauce) are often preferred to their abundant fresh counterparts because of both convenience and prestige. (Ahlgren et al. 2014, p. 73)

A related theme is lack of understanding of nutrition on the part of the Marshallese. Introducing the Diabetes Wellness Program sponsored by

Canvasback Missions Inc and funded by Loma Linda University, Brenda Davis describes the urban diet of the Marshall Islands which is responsible for the chronic diabetes levels as being the result of lack of understanding. She writes,

> Many locals believe that when it comes to nutrition, the only that matters is having a full stomach. The value of fresh fruits and vegetables is largely unappreciated. (Davis 2018, para. 7)

This recurring theme in the literature identifies the cause of import dependence as residing primarily in the Marshallese themselves. A more nuanced interpretation of this theme is offered by Thow and Snowdon in their examination of the impact of changing trade policies in the Pacific Island nation region: They note the introduction of imported foods had the following effect:

> As this occurred, Western attitudes toward traditional Pacific foods – particularly a dislike of the 'uncivilized' staple crops, and concern over the lack of meals as defined by Western-educated nutritionists – conferred a high status to the consumption of imported foods. (Thow and Snowdon, 2019, p. 148)

This observation forms part of their model of the impact of trade policy on dietary change throughout the region. Although their focus is the region as a whole, their causal model lays significant groundwork for research into the RMI in particular.

<u>The U.S. Role in Imports</u>

A more critical and less prominent theory regarding the predominance of imported foods suggests that the U.S and other developed nations imported

foods to the Pacific Islands region which damaged the recipient communities. In their exhaustive review of the literature concerning food and nutrition in the Federated States of Micronesia (FSM), Engleberger, Marks and Fitzgerald conclude that U.S. nutritional programs undertaken in the FSM were “often inappropriate for small island communities”(Englberger et al., 2003, p.6) These include the United States Department of Agriculture supplemental feeding programs, which provided surplus commodities to the FSM, and the Expanded Food and Nutrition Education Program, which promoted U.S. style foods and nutrition information, promoting the use of imported and non-native foods (Englberger et al., 2003).

This research forms a part of the literature regarding the relationship between food policy, trade, and health in vulnerable nations (Feeny, 2007; Firth, 2006; Henningham, 1995; Yamada & Palafox, 2001). An important contribution to the field is the compilation of articles presented at the Forum on Trade and Healthy Foods and Diets, which took place at McGill University in 2007. In partnership with the Department of Ethics, Equity, Trade and Human Rights of the World Health Organization, the contributors included Anne Marie Thow, and Wendy Snowdon, among others (Hawkes et al., 2009). Although the topics considered in this compilation cover the range of issues regarding the transformation of consumption patterns, only the Thow and Snowdon research specifically addressed the Pacific Island nations (Thow & Snowdon, 2009).

The Federated States of Micronesia are a close neighbor to the Republic of the Marshall Islands; like the RMI they were part of the initial Trust Territories of the Pacific, and like the RMI they gained independence in the 1970's, and became sovereign in 1986, with a Compact of Free Association with the U.S. However, they do not share the same history as the RMI with the United States. The nuclear testing that took place in the Bikini and Enewatak Atolls had an extensive impact on the production of native foods, and the provision of imported ones. The disruptions caused by relocation related to nuclear testing and subsequent fallout, overcrowding in the urban center of Majuro, and overtaxing of natural resources all impact the dependence on imported foods (Ahlgren et al., 2014; Johnson, 2006; Wairiu et al., 2012). Imported foods were widely provided in the wake of the testing, although the extent of this aid is not documented (Lessard, n.d.).

It is beyond the scope of this paper to examine the full extent of the impact of the U.S. nuclear testing program in the Republic of the Marshall Islands. Such a study has been undertaken elsewhere, and indeed is an ongoing project (AHF, 2019; Johnson, 2014) However, it is impossible to ignore it. The ongoing political relationship between the U.S. and the RMI always has this devastating history as a backdrop, and research into any aspect of life in the Marshall Islands brings this tragic history to the fore.

CHAPTER THREE:

DATA AND METHODS

Overview of Data Sources

This project contains two sections, which utilize two different types of data. The first section analyzes data collected from published source material. The final results, contained in Table 6:"Changes in Food Consumption, 1949-2014", were calculated using this material.

Data for the first section of this project was diligently sought over a wide range of governmental and non-governmental documents and data locations. Finally, three data sets based on qualitative ethnographic research conducted in the RMI were identified as source material for the Changes in Food Consumption data. These three data sets will be described below. Literature referencing two of these same data sets reinforced this researcher's observation that data regarding actual food consumption patterns in the RMI is indeed limited to these few sources. These original data sets are included in their entirety in Appendix A.

Quantitative data was sought regarding import levels and domestic food production levels from 1949 to the present in order to investigate the theory that these levels were negatively correlated. This data proved even more elusive. The dearth of available data was shocking to this researcher. Undoubtedly, data exists in some form in U.S. government or local RMI archives, but it is not available to the public via open access databases.

The second section utilizes data collected from databases openly accessible via governmental and non-governmental data sources. The final results, contained in Tables 7-11, in the Limitations of Data section, were calculated from these databases. This section samples twenty large-scale databases, in order to support a discussion of the issues faced by researchers of the RMI and other similar nations. These data sources will be described in more detail below, and the entire data set is included in Appendix B.

Food Consumption Data Sources

Spoehr, 1947

All studies of food consumption patterns in the RMI begin with Alexander Spoehr's exhaustive and detailed anthropological study of Majuro Island and the southern atolls of the then-Marshall Islands (Spoehr, 1949). His research, conducted in 1947 but published in 1949, meticulously documents physical and cultural conditions at the very beginning of the U.S. occupation following World War II, and provides an indispensable baseline for all subsequent research in this area. Spoehr's work contains maps of land use and ownership, U.S. military-based aerial photographs of Majuro in 1947, along with detailed inventory of food production regions. Were other similar photographic and land use documents readily available, Spoehr's work could lay the foundation for a useful geographical record of changing land-use over time.

Although Spoehr's classic ethnographic study was published by the Chicago Natural History Museum on November 17, 1949, the preliminary

foundation upon this work was built began during WWII. While serving in the U.S. Navy, Spoehr had been stationed in Majuro, and after the war ended became interested in pursuing a formal ethnographic study of the region, as he writes, "as a civilian" (Spoehr, p. 3). Yet, although the field work was officially a Chicago Natural History Museum expedition, the project was funded and supported by the Pacific Science Board of the National Research Council, which, working with the resources of the U.S. Navy Department, comprised the Co-ordinated Investigation of Micronesian Anthropology (CIMA). This was a military undertaking, working through a Museum organization. The Navy supported Spoehr directly by transporting him to Marshall Islands, by funding his research, by housing him, and by providing support staff (Spoehr, pp. 3-4). Thus, although this work seems to be entirely academic, with no military overtones whatsoever, it reflects an early military interest in the Marshall Islands that will prove to be a recurring theme.

Seven Households. Spoehr was a diligent and meticulous researcher, and the first data set used in this paper is found on page 153 of the text, in the table "Total Food Consumption by Household (June 9-29, 1947)." Listed here are quantities of types of food consumed by seven households in the area of Majuro atoll during the ten days listed. The households observed by Spoehr include six “commoner” households and one “noble” household, in accordance with the observed class divisions within the Marshallese society at that time. It is significant that he observed there to be little difference in what was consumed in

the seven households. More significant differences are observed in the manner of collecting the food, rather than in its consumption (Spoehr, p 153-154).

The drawback of this data set is that it does not detail variations in preparation of foods, or precise quantities. In this, as in the other two data sets, the percentages must be seen as approximate rather than exact. A trend is observed, rather than an exact proportion. However, given that this data set forms the baseline for all subsequent discussion of this topic, it can be appropriately employed in this project.

Naidu, Greenhouse, Knight, and Craighead, 1980

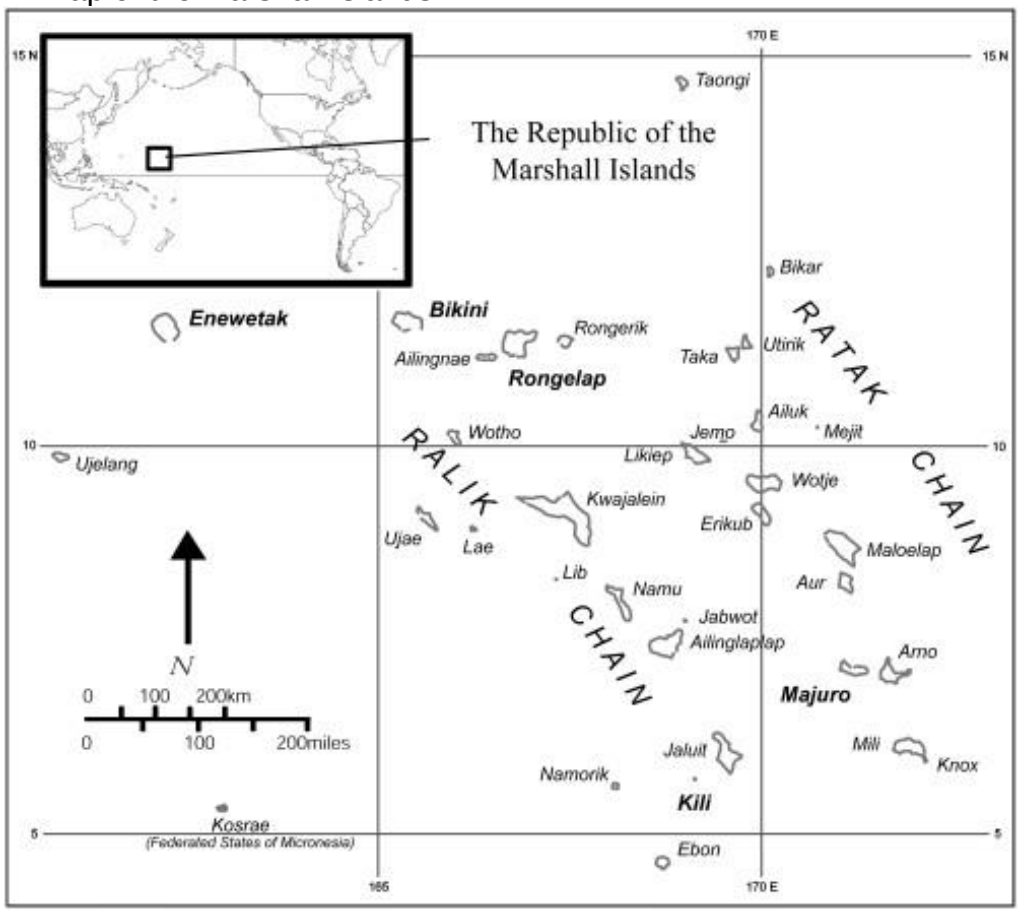
The second data set was found in a government document published by the Brookhaven National Laboratory, under contract with the United States Department of Energy, July 1980. Titled "Marshall Islands: A study of diet and living patterns", with authors J.R. Naidu, N.A. Greenhouse, G. Knight and E.C. Craighead of the Safety and Environmental Protection Division, this ethnographic study of the Marshall Islands. Unlike Spoehr's wide-ranging account of every aspect of Marshallese life, this study focused exclusively on the preparation of food, the details of food consumption, caloric intake, and the allocation of work and free time observed in men, women and children.

The location of the study also varied from the 1949 observations. Whereas Spoehr's research took place primarily in the areas surrounding the most populated atoll, where the U.S. military base was located, the Naidu et al. study took place across the Republic of the Marshall Islands, in unspecified

communities selected not only from Majuro Atoll, but also from the islands nearest to the Bikini Island Atoll where atomic testing had taken place twenty years earlier. Although this scholarly and detailed work was clearly the result of the highest professional standards, it too was produced with U.S. government funding, and reflects certain military research interests that were predominant at that time. A discussion of a related document which sheds light on the motivation of the study will be discussed below.

Communities A, B and C. For the purposes of the research question, the "Results and Discussion" section of the paper was utilized, in particular Tables 1, Table 2 and Table 3 in which exact quantities of all local foods consumed were carefully tabulated, based on extensive interviews and participant observation. These observations were organized around three communities: A, B and C, in unspecified locations across the RMI. Community A is described as an outer island with extremely limited access to imported foods, relying almost exclusively on traditional means of food gathering and preparation, with a highly depressed economy; Community B, an overpopulated region with low availability of local foods, with the exception of fish, but with a good supply of imported foods which are purchased using the income from fishing and significant access to U.S. government employment; and Community C, which was described as urban, crowded, with limited access to domestic foods or fishing, but with a large government food program providing maximum access to subsidized aid and U.S. imports, and having the means to purchase them (Naidu et al., pp. 8-9).

Figure 2: Map of the Marshall Islands



Source: (S. Davis, n.d.)

Although the location of Communities A, B and C are not specified, Naidu et al. gathered data across the entire stretch of the Marshall Islands, including communities in the southern and more populated regions of Majuro, and Kili, through Wotho, and up to the Bikini atoll and surrounding regions. Specifically, the areas include Rongelap in Rongelap Atoll, Utirik in Utirik Atoll, Mejit, Ailu, Wotho, Jabor in Jaliut Atoll, Killi Island, and Majuro.

A Notable Omission. Significantly, Naidu et al.'s calculations of yearly consumption of foods did not include any imported foods. Instead, the text suggests that quantities of imported foods can be calculated using a “typical maximum diet” (Naidu et al., p. 10), which will be discussed in detail below. However, calculations based on this estimation do not match the estimations embedded in the text. The treatment of this inconsistency is discussed in the Findings section, below.

Another aspect of Naidu et al.'s data was an extremely detailed "List of Local Foods and Conversion Factors" (Naidu et al., p. 19), which described cooking methods and what could be considered recipes for domestic food preparation. For example, the varied and ubiquitous use of coconut in all its forms was detailed, which included many uses which were not immediately obvious. Coconut milk and coconut meat were included in virtually every mixed-food preparation. This provided a useful addition to the next data set in which far less detail was provided.

Ahlgren, Yamada, and Wong, 2014

The third set of data came from an ethnographic study conducted by Ingrid Ahlgren, and discussed by Ahlgren, Seiji Yamada, and Allen Wong in "Rising Oceans, Clmimate Change, Food Aid, and Human Rights in the Marshall Islands." In this oft-cited 2014 journal article, Ahlgren’s observations are summarized in a single table, "Observed dietary practices in the Marshall Islands, per meal, per person," which contained the summation of data collected by

Ahlgren between 2007 and 2014 in nine unspecified atolls in the outer islands of the RMI (Ahlgren et al., p 73). This data set is by far the most problematic of the three, since it contains items such as "pancakes", "coffeebread" and "fried doughnuts", without specifying the contents of these home-baked items. A thorough discussion of the ways in which this data was adapted for use is included in the Data section, below.

Emergency Household Necessities. The Ahlgren et al. article also includes a second table, "Nutritional value of food aid supplied to Wotho during 2014 RMI drought", which in turn itemized quantities of imported foods that were provided by the RMI Emergency Operations Center to the Marshallese people living in Wotho in 2014. Further, the article describes additional items that were requested by the Emergency Operations Center but not provided by the international donors (Ahlgren et al., p. 75). This list provided an important supplemental insight into imported food items which were widely considered to be essential items for everyday food preparation and consumption. Items not considered necessary, but which are nevertheless included in the Marshallese diet, such as sugared soda and powdered drink mix, were not included in this list. Although the literature on contemporary Marshallese diet does document widespread use of these non-essential items, they were not included in Ahlgren's table (B. Davis, 2008; Palafox et al.., 2003).

Using this itemized list of daily food necessities, along with the descriptions included in Naidu et al., it was possible to estimate constituent

elements of these products. Again, this data set was much less precise, and therefore presumably much less reliable than the previous two; however, with careful work, it did yield a proportional division between consumption of imported and domestic foods. It had the additional virtue of being the only contemporary accounting of food consumption available, which perhaps helps explain its importance as a reference document. Although it may seem limited in scope, this data set is widely cited and used as source material for many subsequent studies (e.g., Davis, 2008; Hawkes et al.., 2009; Johnson, 2017; Palafox et al.., 2003). Ahlgren's field research, collected in the RMI, comprises one of the few actual data sources available during this time period.

All three data sets in their entirety are included in Appendix A.

Variables

In each of the data sets, food items were sorted by the criteria, "Domestic" versus "Imports". Domestic foods include anything grown, gathered, fished or hunted on any of the islands or atolls in the RMI. “Imports” includes any foods not produced in the RMI. Anything canned was included in imports, as production of canned meats, fish or vegetables did not occur in the RMI during any of the documented periods. Salted fish, on the other hand, was produced in the RMI and was included in domestic foods, based on both Spoehr's and Naidu's description of the process.

Total food consumed was based on weight and quantity of foods. In some cases, conversions were performed to allow for more accurate comparisons. For

example, Spoehr's data includes numbers of individual limes and bananas; in order to approximate a pound unit, these were bundled into groups of six. It was not possible to calculate totals exactly, due to the imprecise measures of some of the imported foods, as well as the domestic foods (e.g., a "bag" of flour, a "tin" of biscuits). However, the standard basket of goods in the U.S. was used the standard weights and quantities as they appeared in contemporary grocery stores in each of the time periods referenced (TPH, 2020).

Theoretical Significance

Given all this, the resulting percentages obtained from analysis of this data should not be taken as statistically exact. Rather, they should be considered significant primarily as indicating trends which support what is documented in the literature regarding this topic. In addition, issues of location in data gathering impact the results. As will be discussed below, the actual trends are most likely stronger than this current research suggests. Thus, despite the shortcomings of the data, the results can be seen as theoretically significant.

Why Do This

The "Changes in Food Consumption" data is useful in substantiating the claims made throughout the literature, and widely observed by participants in the region. As mentioned above, it utilizes data sources that are widely referenced in a loose manner, and brings an increased precision to estimations of change in consumption patterns over time. Even with the data challenges inherent in this project, the results are strong enough to justify this additional attention.

CHAPTER FOUR:

FINDINGS

The Question

This section seeks to answer the primary research question, which is to determine whether there was in fact a decrease in the relative proportion of domestically sourced foods, in relation to imported foods in the years following WWII until 2014, and if so, of what magnitude was the percentage change. The sections below examine the relative proportions of domestic to imported foods consumed at each of the three data points represented by the source data, and the summary section examines the change over time.

The Data

The Spoehr Data

Alexander Spoehr's meticulous accounting of food consumption and type over a variety of households on Majuro atoll is summarized in a single table, “Total Food Consumption by Household, (June 9-29, 1949) The original table can be found in Appendix A.

In adapting Spoehr's original data for current use, the entries were sorted into Domestic and Imported categories, based on the description of each type given in the text. After standardizing quantities in the manner described in the Data section, above, the total was calculated, and percentages given for each food type, and for the two primary research categories.

Table 1. Domestic Food Versus Imported Food Consumption, 1949

Imported Foods	**Per Household**							**% of Total**
Fish, canned (lbs)	1	1	3	2	3	0	2	0.30%
Meat, canned (lbs)	16	10	16	10	24	0	0	1.88%
Rice (lbs)	20	19	32	5	18	7	18	2.95%
Flour (lbs)	16	7	24	1	2	1	4	1.36%
Sugar (lbs)	11	9	9	0	8	5	3	1.11%
Biscuits (1-lb. box)	1	0	1	3	0	0	1	0.15%
Tea (large pots)	14	3	17	0	4	7	9	1.34%
Coffee (large pots)	0	4	2	0	6	7	11	0.74%
Milk (6-oz. can)	0	17	0	0	0	0	0	0.42%
Pineapple (canned) (lbs)	2	0	0	0	0	0	0	0.05%
							Total imported foods	**10.31%**
Domestic Foods	**Per household**							
Breadfruit	206	85	86	130	152	81	85	20.44%
Coconuts (green)	195	61	198	97	145	46	179	22.82%
Coconuts (ripe)	11	24	24	13	10	11	69	4.14%
Chicken	0	1	0	0	0	0	0	0.03%
Fish (fresh)	67	17	60	153	62	55	66	11.89%
Fish (salted)	0	5	10	1	11	0	5	0.79%
Shellfish	0	20	300	0	0	0	200	12.88%
Jekaro (qts)	133	53	14	213	152		42	15.04%
Limes (bundle of 6)	0	3	6.33	0	11.5	0	1.83	0.56%
Bananas (bundle of 6)	10	0	0	8.33	2	0	0	0.50%
Pumpkin	3	0	0	0	0	0	0	0.07%
Taro (6" roots)	0	0	0	0	0	12	14	0.64%
							Total domestic foods	**89.69%**

Source: Spoehr, 1949, Food Consumption by Household, p. 153.

As can be clearly seen in the table above, approximately 90% of food consumed in Majuro atoll during the ten days of June 9-19, 1949, was domestically sourced. Only 10% of the food was imported. It is important to note the location of this study: even in 1949, Majuro was the most densely populated

and most urbanized atoll in the Marshall Islands, with the greatest access to imported food items, due to the presence of the U.S. Naval Base there. The outer islands, and the northern atolls had less access to imported foods, and thus it can be realistically theorized that these communities would have consumed even less of them. Spoehr's study does not include the outer atolls, which to relied more heavily on traditional, domestic food production and consumption. This becomes significant when the next data set is considered, which comprises data collected in the northern atolls and outer islands.

The Naidu Data

Based on research undertaken in 1978, the 1980 Naidu et al. report, "Marshall Islands: Study of Diet and Living Patterns" painstakingly documented the details of domestic food preparation and usage. In the “List of Local Foods and Conversion Factors” (p. 19) detailed descriptions of, for example, the uses and applications of coconut through every stage of development, and every method of preparation are thoroughly described.

Thus, in the following table, adapted from the original data collected by Naidu et al., no alterations were made to the overall quantities, as every quantity was meticulously calculated. However, certain foods categories were consolidated into a single group. These categories include coconut, pandanus and breadfruit products, bananas, and papayas. In the original data, these foods were differentiated based on their use and preparation, but for the purposes of this research, these distinctions are not important. Thus, the following table

enumerates the total quantities of each type of domestic food consumed over the course of one year in communities A, B, and C, and compares these quantities to a “typical maximum diet”, which will be discussed below.

Table 2: Yearly Consumption of Domestic Foods, 1980.

	Communities			
Food type (grams)	**A Rural**	**B Fishing**	**C Urban**	**Typical Maximum**
Coconut products	1517152	498324	366574	982207
Pandanus products	113508	72384	47918	59680
Breadfruit products	104228	15778	22180	76250
Arrowroot	1946	0	0	7800
Local vegetable foods	7182	0	0	0
Pumpkin	2000	0	1700	5000
Sweet potato	364	0	0	5200
Bananas	15000	6800	6000	7000
Papayas	24720	0	4200	5200
Fish	160368	70928	30680	110000
Poultry	500	1200	0	4375
Wild bird	2037	3250	200	1750
Pork	850	500	250	3500
Turtle	1000	41	125	1750
Lobster	500	50	150	7000
Giant clams	750	4250	0	7000
Snails	11400	4250	5325	8679
Octopus	913	7125	1013	5250
Coconut crab	4500	350	638	7000
Clams	2150	1075	1950	0
Total Consumption	1971068	686305	488903	1304641
Percentage of Typical Maximum	**151%**	**53%**	**37%**	**100%**

Adapted from: Naidu et al., 1980.

The “Typical Maximum Diet”. Perhaps the most intriguing element of the Naidu data is the construction of a “typical maximum diet.” This is an estimation

based on the calculation of the “most conservative estimate on the total gram weights of the various local foods which could conceivably be consumed under the assumption of a 100% local diet” (Naidu et al, 1980, p.10, original emphasis), which is summarized in Table 4B of the document (see Appendix B).

More Than The Maximum. However, this estimation is exceeded by the observed quantity of local food consumed by Community A. In fact, the data show that Community A consumed nearly 150% of the maximum. This rather confusing statistic is explained within the text:

> The interview data does not provide the “typical average” of the local food consumed by the islanders of the various communities. Rather they provide estimates which approach the “typical average” of local food actually consumed. An interview of forty-four questions cannot provide a direct and straight forward “typical average” of local food actually consumed. The islanders provide better estimates on food they prepare rather than on food actually eaten. (Naidu et al, 1980, p. 7, original emphasis).

Thus, the inconsistency is due to the method of data collection used in the study, in which families reported the quantity of food prepared each night, rather than the exact quantity consumed. In actual practice, the food traditionally prepared exceeds the maximum consumption level by a significant amount. Nairu et al. suggest that the widespread practice of food sharing among

extended families, along with a significant amount of wasted food, accounts for this discrepancy (Naidu et al., 1980, p.7).

Estimating Imports from Consumption of Domestic Foods

Although the exact use of this “typical maximum” is unclear, the text suggests that this estimation can be used to calculate an estimation of imported foods consumed, in the following way. Begin by assuming the estimated typical maximum diet of local foods represents what would be consumed in a “100% local diet”. Subtract from that estimate the total quantity of local foods consumed in any given community. The difference between the two measures a shortfall in the diet. By default, that shortfall would necessarily represent the amount of imports that have been added into the diet (Naidu et al., 1980, p. 9). Using this method, the results should be consistent with what is found in the final row of Table 2, above. However, when this method is employed, the results appear nonsensical; clearly, an intermediate step has been employed in the use of the typical maximum estimation. This intermediate step is not specified in the text.

Reported Consumption of Local Foods. Instead, in the body of the text, the following percentages are reported for consumption of imported foods: Community A, 100%; Community B 33%, and Community C 75% (Naidu et al., 1980, page 9). As seen above, an examination of the data in the context of the written text suggests that the estimated typical maximum diet could not in fact have been used directly to generate these estimates. Instead, it appears from the conclusions cited above, that Community A may have been used as the baseline

quantity of domestic foods. If Community A consumes 100% domestic foods, then the estimates for Community B and Community C may be based on that total. However, as seen below, the percentages generated in this way are not exactly as reported in the text, either.

It is most likely that a more complex means was used to generate the abovementioned relative quantities. The document does not include that information. Thus, given what is provided in this source document, the following relative percentages have been calculated:

Table 3: Domestic Food Versus Imported Food Consumption, 1980

	Using typical maximum diet estimations		Using Community A baseline estimations		Average over both estimates	
	Domestic	Import	Domestic	Import	Domestic	Import
Community A	151%	0%	100%	0%	125.5%	0%
Community B	53%	47%	35%	65%	44%	56%
Community C	37%	63%	25%	75%	31%	69%
Average % for all communities	80%	37%	**53%**	**47%**	67%	42%

Adapted from Naidu et al., 1980.

Splitting the Difference. Since there is no clear indication of the way in which the original data was analyzed, it seemed appropriate to take an average value between the rates derived from the typical maximum diet estimations, and the Community A baseline created by this researcher. Taking the average value across all three communities, and over both methods of estimation, the final percentages of 67% domestic to 42% imported foods is obtained. Seasoned statisticians will note that these two percentages do not add up to 100%. This

presents problems in the context of this research, in which percentage of total consumption is the object of consideration.

Thus, due to the peculiarities of this data set, for use in this project, only the Community A baseline estimations will be used. This is also consistent with the data embedded in the Nairu text. Thus it will be concluded that average estimated percentage of domestic food consumed in 1980 was 53%, while imported foods comprised 47% of the Marshallese diet.

Taking an Average. A second question arises in regards to this data set: is it appropriate to take an average value across the three communities, A, B and C? The variation between the most isolated and least isolated communities' rate of consumption of domestic food is 75%. The most isolated island with almost no access to imports was observed to consume more than 100% domestic foods (since there was waste and sharing), while the least isolated community with abundant access to imported foods, and agricultural aid, consumed only 25% domestic foods. The description of Community C seems to match the description of Majuro; while the description of Community A seems to match the outer islands, and the community in which all domestic food is difficult to find, but U.S. government employment is plentiful, may be in the northern atolls where there is heavy government involvement. Although, as mentioned above, the communities are not specified in this document, this would seem to reflect a representative sample of the Marshall Islands domestic economies of the time. Yet this range of percentage is still unusually large.

This points to an issue that is somewhat buried in this data but nevertheless highly relevant. In 1978, when Naidu et al. were collecting data in the northern islands surrounding Bikini Atoll, much of the land was completely contaminated with radioactive waste. Although the particular data collection sites are not mentioned by name, the U.S. government, through the Atomic Energy Commission, was actively collecting data in the Bikini Atoll and Rongelap region on the effects of radioactive fallout from the extensive nuclear testing in the RMI. Only fourteen years after the 1954 Castle Bravo bombing of Bikini Island, in 1968, Marshallese had returned to resettle Bikini Island. Only three years after the same bombing - in1957 - the residents of nearby Rongelap had also returned. In 1978, around the time of the Naidu research, the inhabitants of Bikini Island were once again evacuated; in 1986, the inhabitants of Rongelap were also removed, due to excessive levels of radiation. As was mentioned above, these highly radioactive areas were among the areas included in this study. Undoubtedly, the involvement of AEC impacted the provision of imported foods, but it is not possible to quantify by what extent.

For this reason, it is the conclusion of this researcher that it is, indeed, appropriate to take an average across the three communities represented in this study, and to presume that Naidu et al. were indeed seeking a fairly representative sample of the range of Marshallese life at that time and under those conditions.

The Ahlgren Data

The journal article which contains the third data set utilized in this study differs from the Spoehr and Naidu in several important respects. First, there is no U.S. military or government involvement or sponsorship in this project. The article, co-authored by Ingrid Ahlgren, Seiji Yamada and Allen Wong, using data collected by Ingrid Ahlgren, was published in the journal “Health and Human Rights”. Although, like Spoehr and Naidu et al., Ahlgren also undertook ethnographic research, her work did not focus on identifying precise quantities of food, but instead provided a more qualitative overview of living conditions in the RMI, with the express intent of garnering support for aid reform and greater attention to health policy intervention. Nevertheless, this small data set is often cited by researchers in this topic. In this Ahlgren also included important data gathered from the RMI Emergency Operations Center during the years 2009-2014, which have been used to supplement the consumption data, as was described above.

The Ahlgren data is nowhere near as detailed as either Spoehr's or Naidu's. The original table summarizing her observations regarding a typical weekly menu for Marshallese residents, both in Majuro and on the outer islands, between the years of 2009-2013 is reproduced below.

Table 4: Observed Dietary Practices in the Marshall Islands, 2009-2013.

Day	Meal 1	Meals 2 and 3 (1 serving each)
1	Pancakes (eggless)	Rice* + canned tuna**
2	Fried dougnuts	Rice + Spam** + pandanus

3	Ichiban ramen	Rice + ½ a local lobster or crab
4	Pancakes (eggless)	Rice + local fish + pandanus
5	Coffeebread (eggless)	Rice + canned tuna
6	Coffeebread (eggless)	Salted fish + 1/3 breadfruit
7	Rice + Spam	Coffeebread + local fish

* serving of rice observed per person (per meal) is 3-4 scoops of cooked rice.
** servings of tuna or Spam (and occasionally corned beef) is one 8-oz. can (in oil) shared between 4-6 people, equaling 1.5 to 2 oz, per person.

Source: Alhgren et al., 2014.

The level of precision is illustrated by the unspecified preparation of foods, and the indeterminate quantities. However, what makes this data important is that it can be more deeply analyzed, using information found in the Naidu text, as well as the additional information included in the RMI Emergency Operations list of requested items, found in this document in Appendix A.

Clearly, the data collected by Ahlgren serves a different purpose than that collected by Naidu et al.. The absence of consistent measurement or description of constituent parts of food items defies any attempt to calculate caloric intake or grams of protein. Instead, a general impression of relative quantities of domestic to imported, natural to processed foods is given. Elsewhere in the text additional information is given regarding “serving size” of rice (3 cups), and supplemental foods consumed in an informal manner (additional Ramen, coffee and tea). Finally, the lists of foods requested by RMI Emergency Services suggest the most commonly used household items, as shall be examined below. Given all this, it was possible to derive a more concretely itemized list of foods consumed. The report includes the following observation:

> In addition to these regular meals, Marshallese commonly snack on uncooked ramen noodles throughout the day, and drink tea and coffee throughout the day and night. A typical serving of coffee (one 16-20 ounce cup) includes one to two tablespoons of instant coffee, one to three tablespoons of instant creamer, and four to six tablespoons of sugar. (Ahlgren et al., 2014, p. 73)

Additional protein sources mentioned in the text but not included in the table include chicken, which was reportedly eaten approximately twice monthly, along with pig, dog, and turtle which were prepared every few months, for special occasions. In addition, Ahlgren, Yamada and Wong report that islanders show a marked preference for canned fish to fresh. The observation that canned goods are perceived as more desirable than their fresh counterparts, even in the rural areas, is substantiated by other researchers (B. Davis, 2008; Johnson, 2017, 2017; Naidu et al.., 1980; Palafox et al.., 2003). This trend holds over all categories of food, including vegetables, due to perceived value and prestige associated with imported and canned foods (Ahlgren et al., p. 73).

For the sake of comparison, the Ahlgren et al. table has been modified to more clearly illustrate the percentage of domestically produced versus imported foods consumed on a weekly basis, by serving. Foods which are produced using imported ingredients have been roughly broken down into their constituent ingredients, in order to more closely evaluate the consumption of basic imported goods. These constituent ingredients are consistent with the minimum

consumption basket identified by the RMI Ministry of Health (See Appendix B, Table 2). Each food category has been evaluated as part of the total percentage, thus allowing us, in a broad way, to compare data from Spoehr and Naidu.

The Problem of Units. The units employed have been by far the most troubling issue in converting this data. The original data employed the concept of "serving". In this qualitative way, a "serving" of pancakes might be the replacement for a "serving" of pandanus or breadfruit. However, when breaking down a serving of pancakes, for example, the constituent ingredients are a "serving" of sugar, of flour, of baking soda, oil, and possibly canned or dried milk. Clearly, the "serving" of sugar contained within a "serving" of pancakes is not an equivalent-sized serving. Thus, every effort has been made to estimate the total quantities in cups for these ingredients. This estimation yields the following:

Table 5: Domestic Food Versus Imported Food Consumption, 2009-2013

Imported Foods	Servings	Constituent ingredients, estimated quantity	Servings	% of total servings consumed
Pancakes (eggless) (flour, oil, sugar, baking soda)	2	Sugar (cups)	3.5	5.04
Fried donuts (flour, oil, sugar)	2	Flour (cups)	3.5	5.04
Ichiban ramen	11	Baking powder (cups)	0.25	0.36
Rice (3-cup serving)	6	Oil (cups)	0.5	0.72
Biscuits	7	Powdered milk (cups)	0.25	0.36
Coffeebread (eggless): (flour, oil, sugar, baking soda)	3	Ramen	11	15.83
Canned meat (Spam)	2	Rice (cups)	6	8.63
Canned fish/tuna	1	Canned meat (serving)	2	2.88
Coffee (instant coffee, creamer, sugar)	14	Canned fish (serving)	1	1.44
Tea (tea, sugar)	14	Biscuits	7	10.07
		Coffee (cups)	14	20.14

		Tea (cups)	14	20.14
		Total imported foods		**90.65%**
Domestic Foods				
Pandanus	2	Pandanus	2	2.88
Shellfish, local	1	Shellfish	1	1.44
Fish, fresh	1	Fish, fresh	1	1.44
Fish, salted	1	Fish, salted	1	1.44
Breadfruit	1	Breadfruit	1	1.44
Other protein	0.5	Other protein	0.5	0.72
		Total domestic foods		**9.35%**

Adapted from Ahlgren et al., 2014.

Thus, from this data it becomes clear that the composition of foods consumed in 2014 is roughly 9% domestic, and 91% imported.

The Missing Ingredient. Most notable in this chart is the absence of coconut, which traditionally formed a large percentage of the Marshallese diet, both as a foodstuff and as a beverage. In 2014 a substantial drought in the RMI wreaked devastating damage to the coconut groves and other indigenous plants, moving consumption patterns even further toward imported foods and beverages, as aid flooded into the RMI (B. Davis, 2008). This chart does not include soft drinks, which have elsewhere been documented as comprising a large percentage of sugar and liquid intake (Johnson, 2017). Given the predominance of both coconut products, and sweetened soft drinks observed by others, it is difficult to determine whether this is an oversight in Ahlgren's data, or in fact the foundational transformation it would appear to be. The lack of more thorough accounting is a flaw in this data set. Nevertheless, the trend toward

imports and away from local foods is unmistakable. By 2014, over 90% of food consumed was imported, while less than 10% was domestically sourced. Indeed, this is the root of the crisis that is so widely observed in the RMI.

Summary of Findings

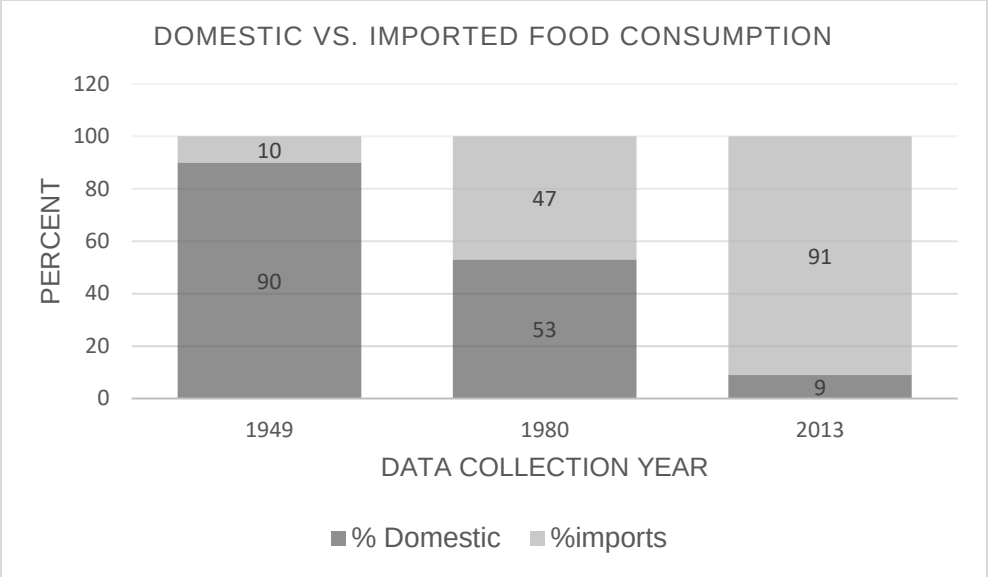
Taking these data together, the overall findings are as follows:

Table 6: Changes in Food Consumption, 1949-2014

Year	% Domestic	% Imports
1949	90%	10%
1980	53%	47%
2014	9%	91%

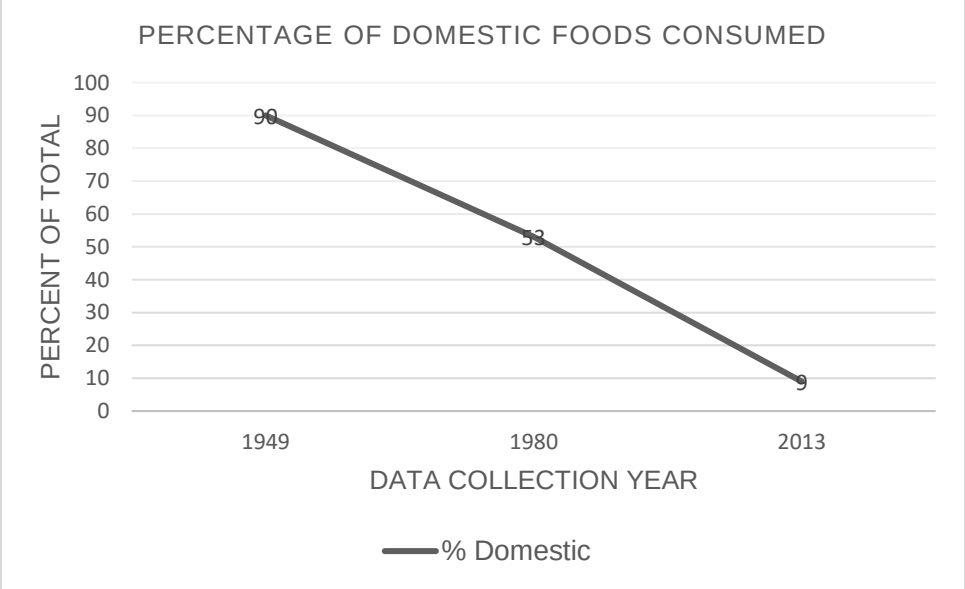
Considering this data in graph form emphasizes the magnitude of the transition.

Figure 3: Domestic Versus Imported Food Consumption, by Percentage



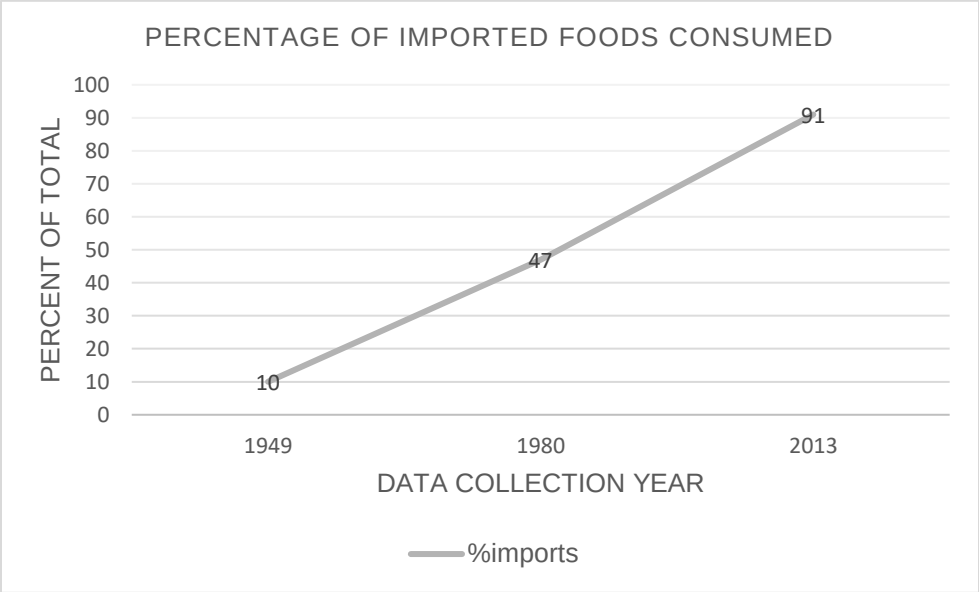
Separating out the consumption rate of domestic food clearly illustrates the downward trend in the consumption of domestically sourced foods:

Figure 4: Change in Consumption Level of Domestic Foods



Likewise, examining the upward trend of the imported foods consumed illustrates the steadily increasing consumption of these foods:

Figure 5: Change in Consumption Level of Imported Foods



Thus, it is clear from this data that the transformation to a primarily domestically sourced diet to a primarily imported diet has indeed taken place in the Republic of the Marshall Islands.

Discussion

The Importance of Location

It must be mentioned that location of data collection impacts the results of all three of these data sets. As universally observed, the more remote the island or atoll, the less access to imported foods, and thus the more likely to consume domestically sourced foods. As we have seen particularly in the Naidu data, which, there is a wide range of food consumption patterns across the outer islands to the urban centers. Majuro is the most densely populated and the U.S. government center of the Marshall Islands. Even in 1949, Spoehr observed that the consumption of imported foods is highest there, and lowest in the outer

islands (Spoehr, p. 152). The Spoehr data was collected in Majuro; thus, the consumption of imported foods can be presumed to be on the high end of the current range. In contrast, Ahlgren collected data on the outer islands, which traditionally rely most heavily on traditional foods. Thus the Ahlgren data can be presumed to be on the low end of the current range. Only the Naidu data samples across diverse regions.

What this means for the results is that the overall national percentage of domestic foods consumed is most likely higher than what appears in the Spoehr data, and most likely lower in the Ahlgren data. This means that the transformation from domestic food to import dependence is likely more pronounced than this data suggests.

Special Considerations in the Naidu Data

If it is taken as merely an ethnographic study of the diet and living conditions of the Marshallese people in 1980, the Naidu et al. document is quite puzzling in that while it focuses obsessively on the preparation and consumption of domestic foods, at the same time it ignores the use of imported foods, and quite loosely estimating the rate of import consumption. Presumably, such a detailed report could easily have accounted for the quantity of imports consumed at the same time as it measured the quantity of domestic foods and the way in which they were prepared. Further, the consumption of imported foods would necessarily be mixed in with the consumption of domestic foods, since most meals which contain imported foods also contain at least some domestic foods

with them (such as rice and fish, or breadfruit and sugar). However, no imports are included on any of the food preparation lists or the estimation of caloric value. The meticulously quantified barrage of food details is perplexing when contrasted with the cavalier estimation of imports.

It is important, then, to step back and consider that the Naidu et al. study, undertaken by the Safety and Environmental Protection Division (SEP) of the Brookhaven National Laboratory, as part of the Northern Marshall Islands Radiological Survey (NMIRS) of 1978, was funded by the United States Department of Energy (Naidu et al., p. 1), and the stated objective is as follows:

> The goal of this study is the evaluation of dietary and living patterns among the inhabitants of the Northern Marshall Islands. These data will be used as input to the dose estimation models (external and internal) that are being developed for the Marshallese who continue to inhabit or will inhabit areas previously contaminated by radioactive fallout from U.S. Pacific Nuclear tests (Naidu et al., p. 1)

A “dose estimation model” is an estimate of the amount of radiation a person will receive, either externally through the skin, or internally, through the consumption of irradiated food, water, or air (Mori et al., 2019). At the time of this study, an ongoing U.S. Department of Energy research effort known as Project 4.1 was actively gathering data on the effects of radiation on Marshellese islanders who had been exposed to the fallout from the extensive nuclear testing

in the northern islands surrounding Bikini Atoll (AHF, 2019). When considered in the context of this purpose, the minutely quantified details of living habits and consumption patterns were significant in the context of dose estimation. Naidu et al.'s meticulous research allowed the researchers at Brookhaven to correlate observed radiation levels in the food and environment with outcomes of thyroid cancer and other results of radiation exposure and ingestion.

Examination of an undated Brookhaven National Laboratories slide report No. 403041, entitled "Review of Marshall Islands Fallout Studies," apparently from this same era, references food consumption and preparation data to estimate the amount of radioactive ash that was ingested directly following the first tests, and in the subsequent years (Lessard, n.d.). Estimated quantities of ingested radioactive ash are carefully calculated using data that could only have been gathered by experienced anthropologists such as G. Knight and J.R. Naidu, who remained in the RMI for several years during this time (Naidu et al., p. 1). The undated Brookhaven reports contains a chillingly scientific account of radiation levels measured from urine and bodily samples, combined with photographs of Marshallese people employing the very methods of food preparation and consumption so carefully described in the Naidu report. For example,

> During the 1970's diet and living patterns for the Marshallese were studied. The data was derived from literature, answers to questionnaires, direct observation by us while living with the Marshallese for periods

> extending from months to years, and from direct participation in their activities. Complex interactions, such as, the gathering of local foods, the receipt of food aid through programs, like school-lunch, and typoon-relief, and in recent times, the availability of cash for the purchase of imported foods were observed. The data provided us with necessary information for input into models that were used to assess the radiological impacts attributable to fallout ((Lessard, n.d., p. 53).

.At the time this study was being conducted, activists within the RMI and internationally were beginning to pressure the U.S. for recognition and reparations regarding the damage done by the nuclear testing in the RMI (AHF, 2019; Henningham, 1995). This begs the question whether the Brookings findings had some impact on the vast increases in imported foods that subsequently arrived in the RMI as aid had any correlation with the findings of these studies. This question is, however, beyond the reach of this study and will remain for future researchers to consider.

CHAPTER FIVE:

LIMITATIONS OF DATA

The Question

The original intent of this research project was to attempt to model the exact relationship between levels of U.S. agricultural aid provided to the Marshall Islands and dependence on that aid. As shown above, the transformation from food self-sufficiency to import dependency has been established; however, in order to create a model of causality, data regarding the actual levels of aid provided was required.

As mentioned in the Introduction, this data was not forthcoming in the large-scale data sets which are necessarily employed for economic and demographic analysis. It is an understatement to say that this was an obstacle to research. But in and of itself, this was an interesting research outcome. The question presented itself: what patterns could be seen in data availability, or lack thereof, and what might that imply for future research?

The following section presents a preliminary analysis of this research question based on the data sources used in the course of this project. It should be noted here that a more thorough examination of this topic is required, and the observations contained below represent trends observed within this limited data set rather than statistical certainties. Additional research on this topic is clearly called for; a future project would necessarily include a scientifically random and representative sampling of available data sets, which would then permit a deeper

data analysis. Because there is no claim that the current data set is scientifically sampled, no regression analysis has been performed. The following data simply represents the results found in the course of research on this topic. No data points have been eliminated or added; in that sense, it is an organically if not scientifically sampled set.

Nevertheless, given these limitations, the findings in this section are striking enough to warrant further examination of this topic.

Data

Searching for those indicators which would support the hypothetical relationship between aid received, or levels of imports, or agricultural production, and consumption of imported foods, the researcher turned to large-scale quantitative data sets such as those published by the World Bank, the United Nations, the International Monetary Fund, the World Health Organization, and others. Meeting an absolute dead end in finding data on the RMI during the years of interest, the researcher began compiling a secondary data set, entitled "Availability of Data". Working now on the level of nations rather than on individuals, the "Availability of Data" data set includes the first year in which data was recorded, and the total years of recorded data for each nation, in each of the twenty data sets, across chosen variables. This data set in its entirety is included in Appendix B.

Nations Included

The nations included as cases in this data set were chosen in two groups. The first group comprises the Pacific Island Nations, including the regions of Micronesia and Melanesia, but excluding Australia and New Zealand. These nations were chosen on the basis of location and size. The second group comprises Territories and former Territories of the U.S., excluding those Territories which later became states. These nations were chosen on the basis of common relationship to the U.S.

The twenty nations in total are included in this part of the study are: American Samoa, the Northern Mariana Islands, the Federated States of Micronesia (FSM), Fiji, French Polynesia, Guam, Kiribati, The Republic of the Marshall Islands (RMI), Nauru, New Caledonia, Palau, the Philippines, Puerto Rico, Samoa, the U.S. Virgin Islands, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Several nations belong to both the Pacific Island Nations group and also the Territories or former Territories groups.

Of these, the nations included in the Pacific Island nation group are:

- American Samoa
- The Commonwealth of the Northern Mariana Islands,
- The Federated States of Micronesia (FSM)
- The Republic of the Marshall Islands (RMI)
- Fiji
- French Polynesia

- Guam
- Kiribati
- Nauru
- New Caledonia
- Palau
- Papua New Guinea
- Samoa
- Solomon Islands
- Tonga
- Tuvalu
- Vanuatu

The nations included in the Territories or Former Territories are:

- American Samoa (U.S.Territory)
- Guam (U.S. Territory)
- The Northern Mariana Islands (U.S. Territory)
- FSM (Independent 1979, Compact of Free Association 1986)
- RMI (Independent 1979, Compact of Free Association 1986)
- Palau (Independent 1981, Compact of Free Association 1994)
- Philippines (Independent, 1946)
- Puerto Rico (U.S. Territory)
- U.S. Virgin Islands (U.S. Territory)

Those former territories which are now states are excluded from the list. Also excluded is Cuba, due to the added complications implied by political organization during the Cold War era.

Data Sources

The data sources, along with the variables chosen as test variables, which were sampled include the following:

- World Health Organization, "Global Health Expenditure Database"(WHO, n.d.-a)
- World Health Organization, "Global Health Observatory(WHO, n.d.-b)"
- World Health Organization, "Covid-19 Situation in Western Pacific"(WHO, 2021)
- U.S. Bureau of Economic Analysis (BEA, 2020)
- U.S Bureau of Labor Statistics (BLS, n.d.)
- Pan American Health Organization (PAHO, 2020)
- United Nations, "Commodity Trade Statistics Database - Trade of Goods (UNData, n.d.)"
- International Monetary Fund, "International Financial Statistics - Balance of Payments" (IMF, n.d.)
- World Health Organization, "Population."
- U.N. Data Bank, World Development Indicators (WB, n.d.). This Index was created using a variety of data sources to create the most complete data set for each variable:

- “Adjusted net income per capita” (current $US)
- “Agricultural land” (% of land area)
- “Food Imports” (% of merchandise imports)
- “Gross Domestic Product” (current $US)
- “Net bilateral aid, United States” (current $US)
- “Net official development assistance and official aid received” (current $US)
- “Diabetes prevalence” (% of population, ages 20-79)

As can be seen by the above list, the search was not limited only to those economic and demographic indicators which would support the initial research question. When nothing else was available, demographic data regarding simple variables such as population size were also sought. Admittedly, this makes the data set less consistent; however, as the purpose is to illustrate limitations of data rather than to present a statistically reliable source, it serves the purpose required. A systematic and more extensive study of this topic may certainly be undertaken in the future.

Methods

For each data set examined, data concerning the variable was sought for each nation in the subject list. For each nation, the first year that data appeared in the data set, for that one variable, was noted. This was repeated for each nation, and for each variable.

A “maximum data available” value was created based on the first year data for the variable was observed for any nation in the subject list. This was used to calculate a percentage value for each nation on each variable.

The percentage of available data was calculated by dividing to maximum possible years of data availability by the years of data availability recorded for each nation.

Relative Maximum Versus Absolute Maximum

It will be noted that this maximum data available value was based on the set of subject nations included in each group, rather than on all nations included in the global data set. This resulted in a relative maximum rather than the absolute maximum for any data set. Every nation in the subject group shared at least one characteristic vis-à-vis the global set of nations as a whole; either inclusion in the Pacific Island region, or dependent political relationship with the United States.

Thus, the level of data availability is ranked within similar nation groups, rather than across all global nation groups. This was done to simplify the data and to isolate the effect of these variables *within the groups*, rather than globally. Of interest was variation within the group, rather than between, say, the Pacific Island nations and the rest of the world. Differences between Pacific Island nations and the rest of the world were not the subject of this study. The variables implied by inclusion in the group – relative geographic isolation, small size, small population –relative to the rest of the world were thus effectively controlled for by

selection. Within the narrower range of values provided by this simplification, smaller group-wide distinctions were more easily discerned.

Data Availability for the Republic of the Marshall Islands

Below can be seen the initial data that motivated this section of the project. The first column identifies the list of data questions and data sets examined for the group of Pacific Island Nations and the U.S. Island territories (excluding Hawaii and Cuba). The second column lists sample variables in each data set, the third column lists the first year in which data for this or any other variable appears in each data set; and the fourth column identifies the first year in which data appears for the Republic of the Marshall Islands. At the bottom is calculated the percentage of the relative total maximum data years observed for the Republic of the Marshall Islands.

37% Versus 43%

The reader will observe that the total percentage of 37% data availability seen in Table 7 differs from the 43% that is used in Tables 8-15, below. This is due to the inclusion of several U.S. data sets that were only relevant to the RMI and territories. These are included here but disregarded in the overall total in the tables below. The reader may thus recall that the ranking of the RMI in data availability is actually lower than what will be represented in the Pacific Island nations analysis, a result which further strengthens the conclusion ultimately drawn by this data.

Table 7: Data Availability for the Republic of the Marshall Islands

Organization	Variable	First year of data in group	First year of RMI data
Commodity Trade Statistics (UN Data base)	*Food Imports (% of merchandise imports);*	1996	No data
International Financial Statistics (IMF data base)	*GDP (current $US);*	1972	No data
World Health Organization Data	*Population*	1990	1990
Global Health Expenditure Database (WHO)	*Population*	2000	2000
U.S. Bureau of Economic Analysis	*Food Imports (% of merchandise imports);*	1976	No data
U.S. Bureau of Labor Statistics**	*Income per capita*	2002	No data
U.S. Census Bureau**	*Income per capita*	2017	No data
Covid-19 Situation in WHO (WHO Data base)	*Current Covid rates*	2020	2020
Pan American Health Organization (PAHO)***	*Population*	1965	No data
World Development Index (UN Data bank)*	*Income per capita*	1971	No data
*ibid**	*Agricultural land (% of land area);*	1961	1991
*ibid**	*Food Imports (% of merchandise imports);*	1962	-No data
*ibid**	*GDP (current $US);*	1960	1981
*ibid**	*Net bilateral aid from DAC donors, U.S. (current $U.S.)*	1960	1993
*ibid**	*Net official development assistance and official aid received (current $US)*	1960	1991
*ibid**	*Diabetes prevalance (% of pop, ages 20-79)*	2010	2010
The World Bank Data	*GDP*	1960	1981
World Health Organization Data	*Population*	1960	1960
Food and Agriculture Organization of the United Nations (FAOSTAT)	*Agricultural land (% of land area);*	1961	No data
Total years of data in group		747	274
RMI percentage of total data			**37%**

As can be seen in this table, even when data was available for decades throughout the Pacific Island nations and the U.S. Territories, many data sets do not include any data regarding the RMI. Further, only one data point is available for the RMI before 1979 when the RMI became an independent nation. Even after 1979, data on the RMI is quite scarce: The RMI entered the United Nations in 1991. Taken altogether, the RMI included only 37% of the total data observed within this group.

When the data for the RMI is compared with the other nations within the Pacific Island nations plus U.S. Territories group, the following overall range of percentage values can be seen:

Table 8: Data by Percentage of Total Maximum

Nations considered in data set	**% of Max. Data**
American Samoa	23.63%
Northern Mariana Islands	11.89%
Micronesia, FS	60.67%
Fiji	94.21%
French Polynesia	39.33%
Guam	23.78%
Kiribati	85.82%
Marshall Islands, Republic of	**43.14%**
Nauru	35.82%
New Caledonia	63.72%
Palau	44.05%
Papua New Guinea	82.01%
Philippines	99.39%
Puerto Rico	37.96%

Samoa	77.90%
Solomon Islands	91.77%
Tonga	80.49%
Tuvalu	55.03%
Vanuatu (New Hebrides)	82.93%

In the sections below, this set is divided by characteristic and region, in order to discern a preliminary pattern regarding the availability of data.

The Pacific Island Nations

The first group to be considered are the Pacific Island nations. When these are ranked by percentage of relative maximum data available, the following is obtained:

Table 9: Pacific Island Nations, Ranked by Percentage of Data Available

Available Data Rank (most to least)	**Nation**	% of Relative Maximum Data
1	Fiji	94.21%
2	Solomon Islands	91.77%
3	Kiribati	85.82%
4	Vanuatu (New Hebrides)	82.93%
5	Papua New Guinea	82.01%
6	Tonga	80.49%
7	Samoa	77.90%
8	New Caledonia	63.72%
9	Micronesia, FS	60.67%
10	Tuvalu	55.03%
11	Palau	44.05%
12	Marshall Islands, Republic of	43.14%
13	French Polynesia	39.33%
14	Nauru	35.82%

15	Guam	23.78%
16	American Samoa	23.63%
17	Northern Mariana Islands	11.89%

By this table, it is possible to see that of all the Pacific Island Nations, the RMI ranks 12th, with a total of 43% of maximum data available. The least data available is the Northern Mariana Islands, with approximately 12% maximum data available, and the most is Fiji, with approximately 94% data available. The following sections examines possible patterns in this data.

The Size Effect

It may be tempting to attribute the lack of data regarding the Republic of the Marshall Islands, or any other Pacific Island nation, to the relatively small size of land mass they contain. In the case of the RMI, there is no doubt that, at 181 square kilometers, the RMI is not a large nation. Among the Pacific Island nations, it ranks as the 15rd out of 17 nations in terms of size. Only Tuvalu and Nauru are smaller.

Table 10: Pacific Island Nations, Ranked by Size

Size rank (largest to smallest)	**Nation**	Size (km^2)
1	Papua New Guinea	462,840
2	Solomon Islands	28,896
3	New Caledonia	18,575
4	Fiji	18,274
5	Vanuatu	12,189
6	French Polynesia	4,167
7	Samoa	2,831
8	Kiribati	811
9	Tonga	747

10	Micronesia, FS	702
11	Guam	544
12	Northern Mariana Islands	464
13	Palau	459
14	American Samoa	224
15	**Marshall Islands, Republic of**	**181**
16	Tuvalu	26
17	Nauru	21

However, if these same nations are ranked by percentage of maximum data, it is clear that size does not determine data availability among the Pacific Island nations.

Table 11: Pacific Island Nations, Ranked by Data Availability and Size

Data Rank (Most to least)	Size rank	**Nation**	% of Maximum Data
1	4	Fiji	94.21%
2	2	Solomon Islands	91.77%
3	8	Kiribati	85.82%
4	5	Vanuatu	82.93%
5	1	Papua New Guinea	82.01%
6	9	Tonga	80.49%
7	7	Samoa	77.90%
8	3	New Caledonia	63.72%
9	10	Micronesia, FS	60.67%
10	16	Tuvalu	55.03%
11	13	Palau	44.05%
12	15	**Marshall Islands, Republic of**	43.14%
13	6	French Polynesia	39.33%
14	17	Nauru	35.82%
15	11	Guam	23.78%
16	14	American Samoa	23.63%
17	12	Northern Mariana Islands	11.89%

When the nations are ranked by data availability, it becomes clear that size is not the primary indicator of data. For example, the largest nation in the group, Papua New Guinea, ranks 5th in data availability, below the much smaller nation of Kiribati, which ranks 3rd. The tiny nation of Tuvalu ranks higher in data availability than the RMI, while French Polynesia, ranking 6th in size, ranks 13th in data availability. And while both Tonga and the Federated States of Micronesia are very close in size to the Kiribati, differing from each other in approximately 100 km^2, Kiribati has nearly 86% of maximum data availability, Tonga has approximately 80%, and FSM has only 61%. These variations suggest that the most important variable in determining data availability is not size.

The Population Effect

Due to size differences, employment possibilities and natural limitations, the Pacific Island nations vary in levels of population. It may be that population level is more consistently associated with data availability than mere size alone. Below, the Pacific Island Nations are ranked by population size.

Table 12: Pacific Island Nations, Ranked by Population Size

Rank by Population (largest to smallest)	Nation	Population
1	Papua New Guinea	7,300,000
2	Fiji	935,970
3	Solomon Islands	685,100
4	Vanuatu	303,009
5	French Polynesia	295,120
6	New Caledonia	293,608

7	Samoa	203,770
8	Guam	168,801
9	Kiribati	111,800
10	Tonga	106,100
11	Micronesia, FS	102,440
12	**Marshall Islands, Republic of**	**77,920**
13	Northern Mariana Islands	51,660
14	American Samoa	46,360
15	Palau	21,690
16	Tuvalu	11,340
17	Nauru	9,770

When the list is ranked according to data availability, it becomes clear that population size may in fact be a slightly better predictor of data availability, in most cases, as can be seen below.

Table 13: Pacific Island Nations, Ranked by Data Availability and Population

Data Rank (most to least)	Rank by Population	Nation	% of Relative Maximum data
1	2	Fiji	94.21%
2	3	Solomon Islands	91.77%
3	9	Kiribati	85.82%
4	4	Vanuatu	82.93%
5	1	Papua New Guinea	82.01%
6	10	Tonga	80.49%
7	7	Samoa	77.90%
8	6	New Caledonia	63.72%
9	11	Micronesia, FS	60.67%
10	16	Tuvalu	55.03%
11	15	Palau	44.05%
12	12	Marshall Islands, Republic of	43.14%
13	5	French Polynesia	39.33%
14	17	Nauru	35.82%
15	8	Guam	23.78%
16	14	American Samoa	23.63%
17	13	Northern Mariana Islands	11.89%

Although there is not a perfect correlation, this preliminary examination suggests that population appears to be more closely correlated with data availability than mere size. The RMI ranks 12th in population, and 12th in data availability; Samoa and Vanuatu are also consistent across variables. Other nations are close to the same in both rankings, such as American Samoa, Fiji and the Solomon Islands.

However, there are a few outstanding exceptions. Some nations have large populations, but little data availability. For example, Guam is the 8th most populous nation, yet ranks 15th in data availability. French Polynesia is the 5th most populous, yet ranks 13th in data. The nation with the least amount of data availability, the New Mariana Islands, nevertheless ranks 13th in population. For these nations, having a larger population does not guarantee data visibility.

Other nations have small populations but greater data availability. For example, Tonga ranks 10th in population size, but 6th in data availabilty. Kiribati ranks 9th in size but 3rd in data availability. Palau and Tuvalu are among the least populous nations, ranking 15th and 16th, respectively, but ranking 11th and 10th in data availability. These nations have small populations, but more data collected on their behalf.

Thus, there appears to be another factor acting in this region, affecting data availability.

Lingering Political Relationships

Another way to consider these nations is in light of their relationship with the United States. Of the seventeen nations in the Pacific Islands nation region, six either are currently or have been territories of the United States. Four of these nations were established as members of the Trust Territories of the Pacific, following World War II. Established by the United Nations, they were given to the United States to administer and protect. Of these four nations, three are currently sovereign nations in Compact of Free Association with the U.S., and one is still a territory. They are as follows:

The Commonwealth of the Northern Mariana Islands

Originally one of the four members of the Trust Territories of the Pacific (TTP), it is currently an unincorporated, organized Commonwealth and territory of the United States.

The Republic of Palau

A second member of the TTP, Palau gained independence in 1994 under a Compact of Free Association with the United States, and is now a presidential republic in free association with the U.S.

The Republic of the Marshall Islands

The Marshall Islands were also members of the TTP, became an independent nation in 1979, with a Compact of Free Association with the United States, and in 1986 gained full sovereignty, becoming an associated state of the U.S. In 1991, the RMI joined the United Nations.

The Federated States of Micronesia

Also members of the TTP, the Federated States of Micronesia became independent in 1979, and then sovereign with a Compact of Free Association in 1986.

All four nations were at one time considered territories of the United States. In addition, the island nations of Guam and American Samoa still remain U.S. territories. American Samoa was claimed by the U.S. as a territory in 1900, and Guam was claimed in 1899.

It is of interest to separate the Pacific Island nations which have once or are currently territories of the United States, from those which have never been territories of the U.S. To this end, the average data availability percentage was calculated for: (1) the entire Pacific Island nation group; (2) the territories and former territories of the U.S., and (3) those nations which have never been territories of the U.S. The results are visible below:

Table 14: U.S. Affiliation and Data Availability

Nation	% of Relative Maximum Data	Territories and former territories	Never territories of the U.S.
American Samoa	23.63%	23.63%	
Fiji	94.21%		94.21%
French Polynesia	39.33%		39.33%
Guam	23.78%	23.78%	
Kiribati	85.82%		85.82%
Marshall Islands, Republic of	43.14%	43.14%	
Micronesia, FS	60.67%	60.67%	
Nauru	35.82%		35.82%
New Caledonia	63.72%		63.72%

Northern Mariana Islands	11.89%	11.89%	
Palau	44.05%	44.05%	
Papua New Guinea	82.01%		82.01%
Samoa	77.90%		77.90%
Solomon Islands	91.77%		91.77%
Tonga	80.49%		80.49%
Tuvalu	55.03%		55.03%
Vanuatu (New Hebrides)	82.93%		82.93%
Average % of Available Data	**58.59%**	**34.50%**	**71.73%**

Of all the variables that have been examined, this seems to yield the most promising results. Considering only the Pacific Island nation territories and former territories yields an average of approximately 35% data availability, whereas the Pacific Island nations which have never had U.S. territory status have an average of approximately 72% data availability.

When other current and former trust territory nations are considered, the average goes slightly up, because the addition of Philippines, which gained full independence in 1947, raises the total considerably:

Table 15: Current and Previous U.S. Territories, excluding Cuba and Hawaii

Nation	**Status viz. U.S.**	Size (km^2)	Population	Total years of data collected	% of Maximum data
Marshall Islands, Republic of	1986, CFA	181	77,920	283	43.14%
American Samoa	Territory	224	46,360	155	23.63%
Palau	1994, CFA	459	21,690	289	44.05%
Northern Mariana Islands	Territory	464	51,660	78	11.89%
Guam	Territory	544	168,801	156	23.78%
Micronesia, FS	1986, CFA	702	102,440	398	60.67%

Puerto Rico	Territory	9,104	3,142,779	249	37.96%
Philipines	1946, Ind.	300,000	109,200,000	652	99.39%
				Group average %	**43.06 %**

As can be seen, the average rate of data availability for nations which have been or currently are U.S. territories is 43%. Even with the Philippines' 99.39% added into the average, this is still below the Pacific Island nations group total of 59%.

However, the very worst rate of data availability is seen in the current U.S. territories of American Samoa, the Northern Mariana Islands, Guam, and Puerto Rico. The result is seen below.

Table 16: Data Availability for Current U.S. Territories

Nation	**Status viz. U.S.**	Total years of data collected	Percentage of Maximum data
American Samoa	Territory	155	23.63%
Northern Mariana Islands	Territory	78	11.89%
Guam	Territory	156	23.78%
U.S. Virgin Islands	Territory	143	21.80%
Puerto Rico	Territory	249	37.96%
		Group average %	**23.81%**

A shocking 24% of data is available for these nations, especially considering that they are not the most remote, nor the smallest, nor the least populated nations in the region. Indeed, Puerto Rico, with only 38% data availability, has a population of over three million people. What they do have in

common is that they are in a particular political relationship with the United States. These data suggest that relationship with the U.S. has had the effect of limiting the availability of data regarding nations that are or have once been under a dependent relationship.

Summary of Findings

To bring this back to the original research issues, combining the complex and tragic issues inherent in the U.S./ RMI relationship, it is possible that even without the legacy of the nuclear testing in the Marshall Islands, data regarding the nutritional transition that was observed may have been difficult to obtain simply because of the dependent relationship between the two nations. There was no nuclear testing in the other territories, yet the data above suggest that problems of data availability persist there as well.

CONCLUSION

In conclusion, although it has been clearly shown that there a transformation of consumption patterns has indeed taken place in the Republic of the Marshall Islands, given the current limitations of data it is not possible to model the causal factors behind this transformation. Thus researchers must rely on ethnographic studies and anecdotal accounts, until further data is uncovered or compiled.

The "Limitations of Data" data set brings attention to the difficulties inherent in researching the dynamics of change in both the Pacific Island region, and more particularly, in Territories and dependent regions of the U.S. The variables of size, location, population, and lack of economic development appear to matter less than the political relationship with the U.S. in affecting access to demographic and economic data. In the case of the Republic of the Marshall Island, a complicated military and political history potentially creates an additional obstacle to full disclosure. Compiling data on the data itself is necessary to see this pattern in data visibility. Without visible data, there can be no true understanding of the dynamics of change.

APPENDIX A

NUTRITION DATA SOURCE MATERIAL

Table S1: Original Spoehr Consumption Data

Total Food Consumption by Household (June 9-29,1947)

Households	I	II	III	IV	V	VI	VII
No. of persons per household	11	8	8	12	8	6	5
Food items							
Breadfruit	206	85	86	130	152	81	85
Coconuts (green)	195	61	198	97	145	46	179
Coconuts (ripe)	11	24	24	13	10	11	69
Chicken	0	1	0	0	0	0	0
Fish (fresh)	67	17	60	153	62	55	66
Fish (salted)	0	5	10	1	11	0	5
Shellfish	0	20	300	0	0	0	200
Jekaro (coconut sap), (qts)	133	53	14	213	152	0	42
Limes	0	18	38	0	69	0	11
Bananas	60	0	0	50	10	0	0
Pumpkin	3	0	0	0	0	0	0
Taro (6" roots)	0	0	0	0	0	12	14
Fish, canned (lbs)	1	1	3	2	3	0	2
Meat, canned (lbs)	16	10	16	10	24	0	0
Rice (lbs)	20	19	32	5	18	7	18
Flour (lbs)	16	7	24	1	2	1	4
Sugar (lbs)	11	9	9	0	8	5	3
Biscuits (1-lb. box)	1	0	1	3	0	0	1
Tea (large pots)	14	3	17	0	4	7	9
Coffee (large pots)	0	4	2	0	6	7	11
Milk (6-oz. can)	0	17	0	0	0	0	0
Pineapple (canned) (lbs)	2	0	0	0	0	0	0

Source: Spoehr, 1949

Table A1 : Ahlgren Minimum Food Consumption Data

RMI Ministry of Resource and Development, 30-day Recommended Food basket per Household

MRD Recommendation	**Estimated total**
Rice – 4 bags (est. 2 lb. per bag)	8 lbs
Flour – 2 bags (est. 5 lb. per bag)	10 lbs
Sugar – 4 bags (2 kg. per bag)	17.64 lbs
Baking powder – 4 cans	16 oz.
Tuna (can) (8 oz) – 10 cans	5 lbs
Milk powder – 2 cartons	2 lbs
Vegetable oil (quarts) (2 qt per bottle) – 2 bottles	1 gallon
Mixed veg (can) – 10 cans	5 lbs
Canned fruit (can) – 10 cans	5 lbs
Biscuits (1 tin)	16 oz

Adapted from Ahlgren et al., 2014

Table N1: Consumption table for Community A

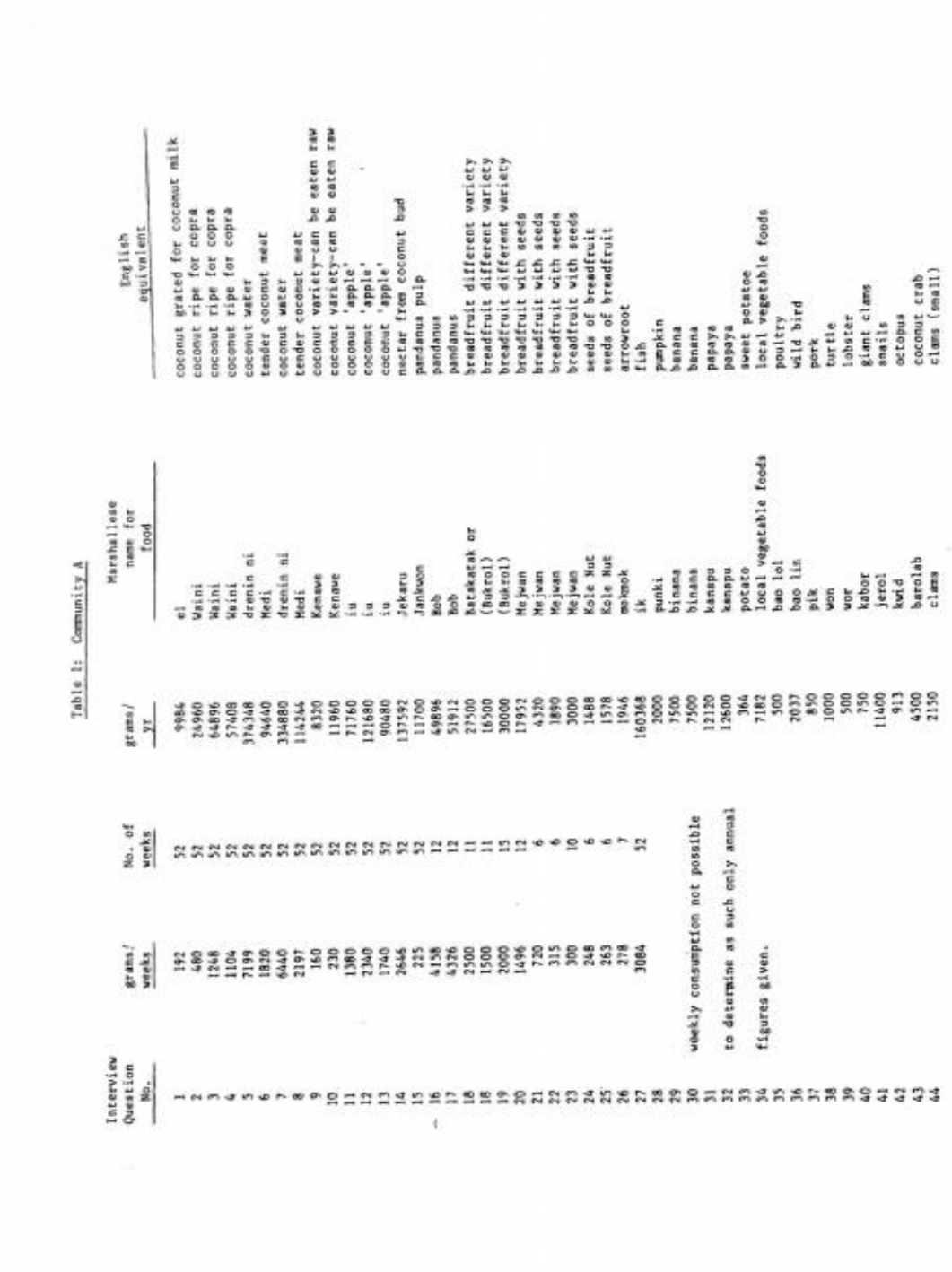


Table I: Community A

Interview Question No.	grams/ weeks	No. of weeks	grams/ yr	Marshallese name for food	English equivalent
1	192	52	9984	el	coconut grated for coconut milk
2	480	52	24960	Waini	coconut ripe for copra
3	1248	52	64896	Waini	coconut ripe for copra
4	1104	52	57408	Waini	coconut ripe for copra
5	7199	52	374348	drenin ni	coconut water
6	1820	52	94640	Medi	tender coconut meat
7	6440	52	334880	drenin ni	coconut water
8	2197	52	114244	Medi	tender coconut meat
9	160	52	8320	Kenawe	coconut variety-can be eaten raw
10	230	52	11960	Kenawe	coconut variety-can be eaten raw
11	1380	52	71760	iu	coconut 'apple'
12	2340	52	121680	iu	coconut 'apple'
13	1740	52	90480	iu	coconut 'apple'
14	2646	52	137592	Jekaru	nectar from coconut bud
15	225	52	11700	Jankwon	pandanus pulp
16	4158	12	49896	Bob	pandanus
17	4326	12	51912	Bob	pandanus
18	2500	11	27500	Batakatak or	breadfruit different variety
18	1500	11	16500	(Bukrol)	breadfruit different variety
19	2000	15	30000	(Bukrol)	breadfruit different variety
20	1496	12	17952	Mejwan	breadfruit with seeds
21	720	6	4320	Mejwan	breadfruit with seeds
22	315	6	1890	Mejwan	breadfruit with seeds
23	300	10	3000	Mejwan	breadfruit with seeds
24	248	6	1488	Kole Nut	seeds of breadfruit
25	263	6	1578	Kole Nut	seeds of breadfruit
26	278	7	1946	mokmok	arrowroot
27	3084	52	160368	ik	fish
28			2000	pumpkin	pumpkin
29			3500	gunki	banana
30	weekly consumption not possible		7500	binana	banana
31			12120	kanapu	papaya
32	to determine as such only annual		12600	kanapu	papaya
33			364	potato	sweet potatoe
34	figures given.		7182	local vegetable foods	local vegetable foods
35			500	bao loi	poultry
36			2037	bao lin	wild bird
37			850	pik	pork
38			1000	won	turtle
39			500	wor	lobster
40			750	kabor	giant clams
41			11400	jerol	snails
42			913	kwid	octopus
43			4500	barolab	coconut crab
44			2150	clams	clams (small)

Source: Nadu et al., 1980, p. 11

Table N2: Consumption Table for Community B

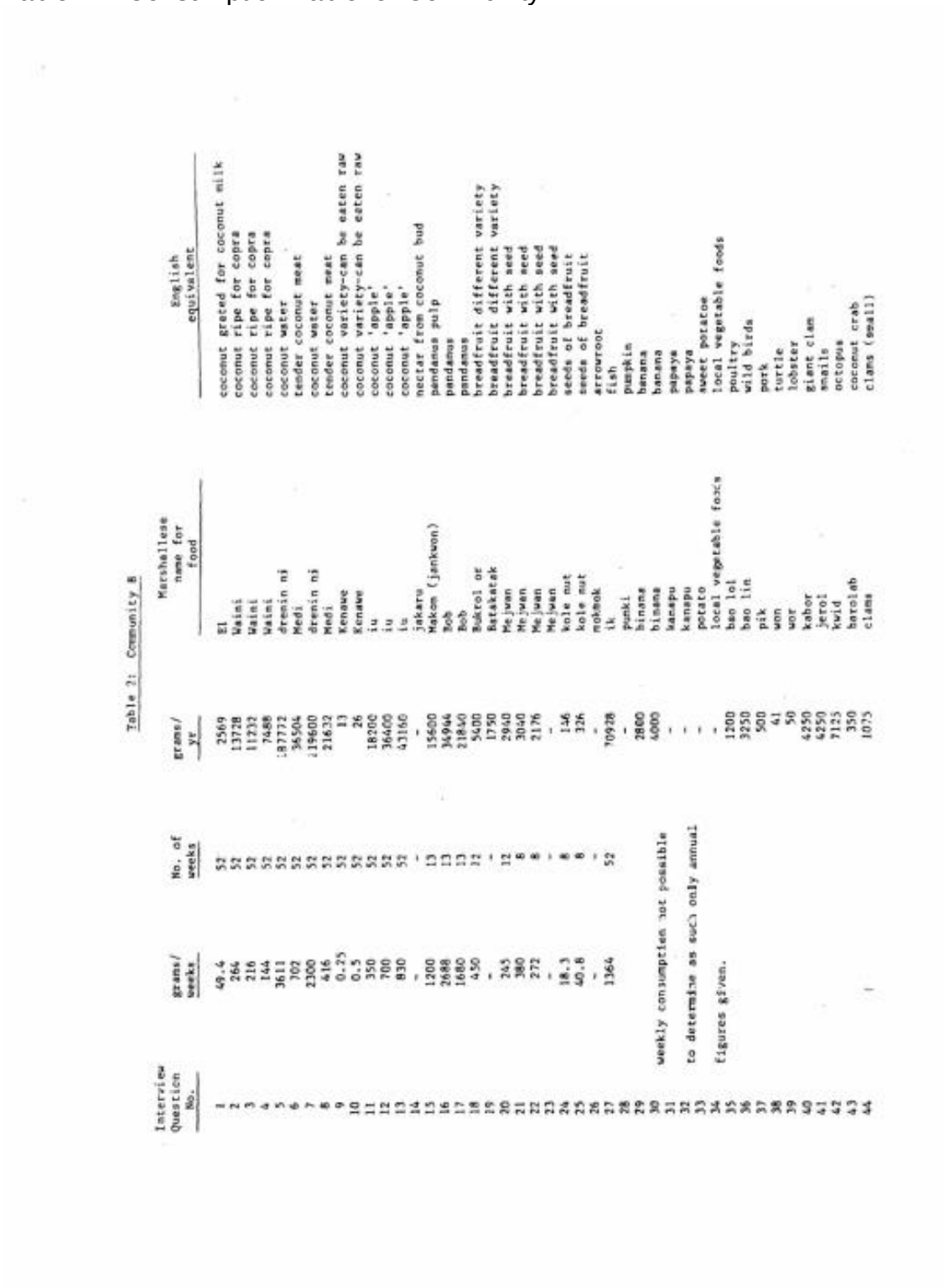


Table 2: Community B

Interview Question No.	grams/ weeks	No. of weeks	grams/ yr	Marshallese name for food	English equivalent
1	49.4	52	2569	EI	coconut grated for coconut milk
2	264	52	13728	Waini	coconut ripe for copra
3	216	52	11232	Waini	coconut ripe for copra
4	144	52	7488	Waini	coconut ripe for copra
5	3611	52	187772	drenin ni	coconut water
6	702	52	36504	Medi	tender coconut meat
7	2300	52	119600	drenin ni	coconut water
8	416	52	21632	Medi	tender coconut meat
9	0.25	52	13	Kenawe	coconut variety-can be eaten raw
10	0.5	52	26	Kenawe	coconut variety-can be eaten raw
11	350	52	18200	iu	coconut 'apple'
12	700	52	36400	iu	coconut 'apple'
13	830	52	43160	iu	coconut 'apple'
14	-	-	-	jakaru	nectar from coconut bud
15	1200	13	15600	Makon (jankwon)	pandanus pulp
16	2688	13	34944	Bob	pandanus
17	1680	13	21840	Bob	pandanus
18	450	12	5400	Bukrol or	breadfruit different variety
19	-	-	1750	Batakatak	breadfruit different variety
20	245	12	2940	Mejwan	breadfruit with seed
21	380	8	3040	Mejwan	breadfruit with seed
22	272	8	2176	Mejwan	breadfruit with seed
23	-	-	-	Mejwan	breadfruit with seed
24	18.3	8	146	kole mut	seeds of breadfruit
25	40.8	8	326	kole mut	seeds of breadfruit
26	-	-	-	mokkok	arrowroot
27	1364	52	70928	ik	fish
28			-	punki	pumpkin
29			2800	binana	banana
30	weekly consumption not possible		4000	binana	banana
31			-	kanapu	papaya
32	to determine as such only annual		-	kanapu	papaya
33			-	potato	sweet potatoe
34	figures given.		-	local vegetable foods	local vegetable foods
35			1200	bao lol	poultry
36			3250	bao lin	wild birds
37			500	pik	pork
38			41	won	turtle
39			50	wor	lobster
40			4250	kabor	giant clam
41			4250	jerol	snails
42			7125	kwid	octopus
43			350	barolab	coconut crab
44			1075	clams	clams (small)

Source: Naidu et al., 1980, p. 12.

Table N3: Consumption Table for Community C

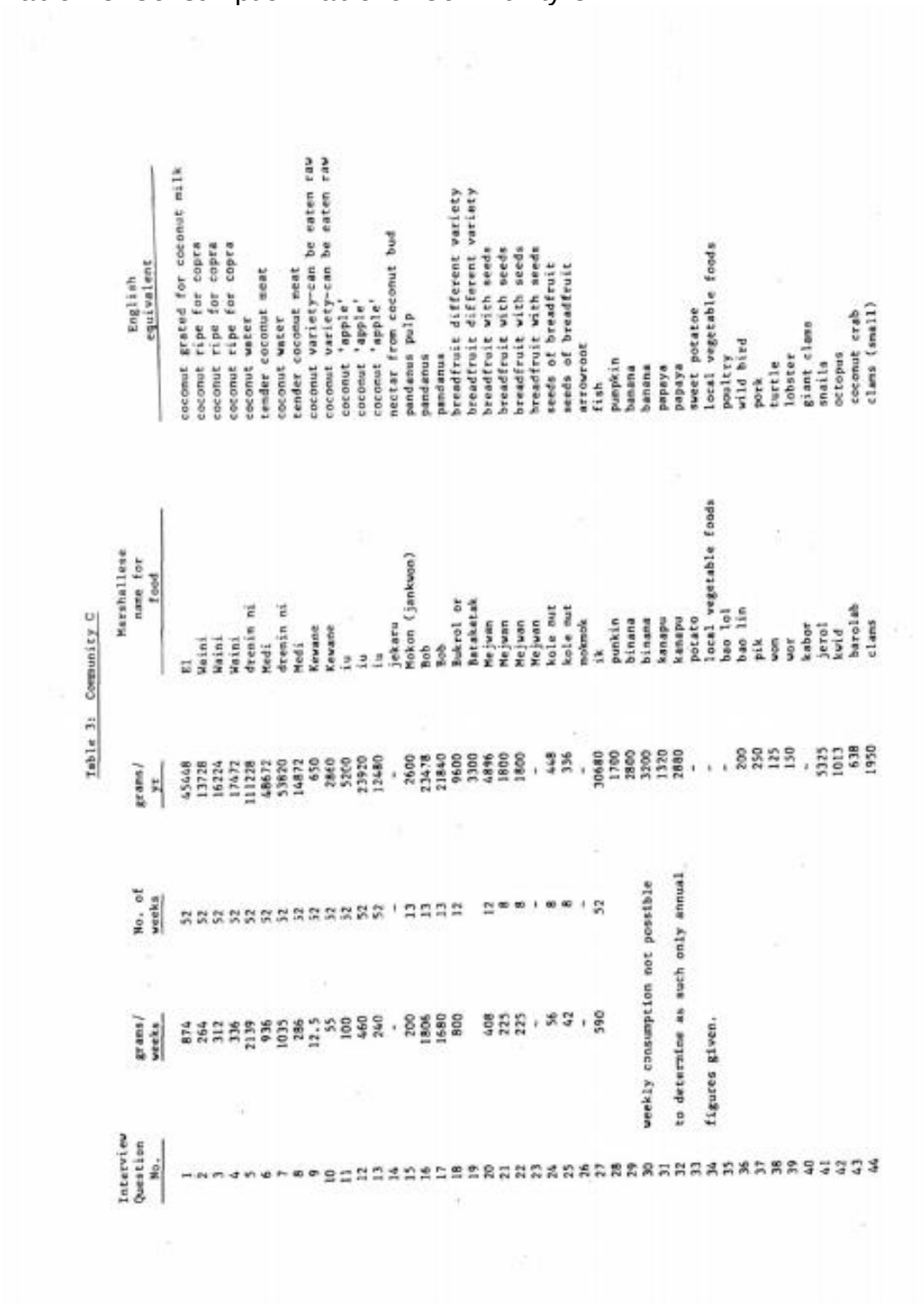


Table 3: Community C

Interview Question No.	grams/ weeks	No. of weeks	grams/ yr	Marshallese name for food	English equivalent
1	874	52	45448	El	coconut grated for coconut milk
2	264	52	13728	Waini	coconut ripe for copra
3	312	52	16224	Waini	coconut ripe for copra
4	336	52	17472	Waini	coconut ripe for copra
5	2139	52	111228	drenin ni	coconut water
6	936	52	48672	Medi	tender coconut meat
7	1035	52	53820	drenin ni	coconut water
8	286	52	14872	Medi	tender coconut meat
9	12.5	52	650	Kewane	coconut variety-can be eaten raw
10	55	52	2860	Kewane	coconut variety-can be eaten raw
11	100	52	5200	iu	coconut 'apple'
12	460	52	23920	iu	coconut 'apple'
13	240	52	12480	iu	coconut 'apple'
14	-	-	-	jekaru	nectar from coconut bud
15	200	13	2600	Mokon (jankwon)	pandanus pulp
16	1806	13	23478	Bob	pandanus
17	1680	13	21840	Bob	pandanus
18	800	12	9600	Bukrol or	breadfruit different variety
19			3300	Bataketak	breadfruit different variety
20	408	12	4896	Mejwan	breadfruit with seeds
21	225	8	1800	Mejwan	breadfruit with seeds
22	225	8	1800	Mejwan	breadfruit with seeds
23	-	-	-	Mejwan	breadfruit with seeds
24	56	8	448	kole nut	seeds of breadfruit
25	42	8	336	kole nut	seeds of breadfruit
26	-	-	-	mokmok	arrowroot
27	590	52	30680	ik	fish
28			1700	punkin	pumpkin
29			2800	binana	banana
30	weekly consumption not possible		3200	binana	banana
31			1320	kanapu	papaya
32	to determine as such only annual		2880	kanapu	papaya
33			-	potato	sweet potatoe
34	figures given.		-	local vegetable foods	local vegetable foods
35			-	bao lol	poultry
36			200	bao lin	wild bird
37			250	pik	pork
38			125	won	turtle
39			150	wor	lobster
40			-	kabor	giant clams
41			5325	jerol	snails
42			1013	kwid	octopus
43			638	barolab	coconut crab
44			1950	clams	clams (small)

Source: Naidu et al., 1980, p. 13

Table N4: Summary of Maximum Diet

Table 4B: Summary of Maximum Diet (Annual Consumption)

Question No.	Grams/ Week	No. Weeks	Grams/ Year	Marshallese	English
1	266	52	13832	EL	coconut grated for coconut milk
2				Waini	coconut ripe for copra
3	1610	52	83720	Waini	coconut ripe for copra
4				Waini	coconut ripe for copra
5	6440	36	231840	drenin ni	coconut water
5	10465	16	167440	drenin ni	coconut water
6	910	25	22750	Medi	tender coconut meat
6	2275	27	61425	Medi	tender coconut meat
7	-	-	-	drenin ni	coconut water
8	-	-	-	Medi	tender coconut meat
9	300	52	15600	Kenawe	coconut variety-can be eaten raw
10	-	-	-	Kenawe	coconut variety-can be eaten raw
11	-	-	-	iu	coconut 'apple'
12	2000	4	8000	iu	coconut 'apple'
12	2500	20	50000	iu	coconut 'apple'
13	-	-	-	iu	coconut 'apple'
14	6300	52	327600	jekaru	nectar from coconut bud
15	900	8	7200	Makon (jankwon)	pandanus pulp
16	3280	16	52480	Bob	pandanus
17	-	-	-	Bob	pandanus
18	2350	12	28200	Bukrol or	breadfruit different variety
19	450	15	6750	Ratakatak	breadfruit different variety
20	3500	9	31500	Mejwan	breadfruit with seed
21	700	5	3500	Mejwan	breadfruit with seed
22	400	7	2800	Mejwan	breadfruit with seed
23	-	-	-	Mejwan	breadfruit with seed
24	700	5	3500	kole nut	seeds of breadfruit
25	-	-	-	kole nut	seeds of breadfruit
26	560	14	7800	wokmok	arrowroot
27	2200	50	110000	iu	fish
28	1250	4	5000	punki	pumpkin
29	875	4	3500	binana	banana
30	875	4	3500	binana	banana
31	100	52	5200	kanapu	papaya
32	-	-	-	kanapu	papaya
33	100	52	5200	potato	sweet potatoe
34			-	local vegetable foods	local vegetable foods
35	weekly consumption not		4375	bao lol	poultry
36			1750	bao lin	wild bird
37	possible to determine		3500	pik	pork
38			1750	won	turtle
39	as such only annual		7000	wor	lobster
40			7000	kabor	giant clam
41	figures given.		8679	jerol	snails
42			5250	kwid	octopus
43			7000	barolab	coconut crab

Source: Naidu et al., 1980, p. 16.

APPENDIX B

DATA AVAILABILITY IN THE PACIFIC ISLAND NATIONS AND U.S. TERRITORIES

Full Data set	size (km^2)	population	CTSD (1)	IMF (2)	WHO (3)	WHO (4)
American Samoa	224	46,360	0	0	0	0
Northern Mariana Islands	464	51,660	0	0	0	0
Micronesia, FS	702	102,440	2011	0	1990	2000
Fiji	18,274	935,970	2000	1979	1990	2000
French Polynesia	4,167	295,120	1996	0	0	0
Guam	544	168,801	0	0	0	0
Kiribati	811	111,800	2005	1979	1990	2000
Marshall Islands, Republic of	181	77,920	0	0	1990	2000
Nauru	21	9,770	0	0	1990	2000
New Caledonia	18,575	293,608	1999	0	0	0
Palau	459	21,690	2017	0	1990	2000
Papua New Guinea	462,840	7,300,000	1998	1976	1990	2000
Philipines	300,000	109,200,000	1996	1977	1990	2000
Puerto Rico	9,104	3,142,779	0	0	0	0
Samoa	2,831	203,770	2012	1977	1990	2000
Solomon Ilsands	28,896	685,100	2011	1975	1990	2000
Tonga	747	106,100	2008	1972	1990	2000
Tuvalu	26	11,340	1997	0	1990	2000
Vanuatu (New Hebrides)	12,189	303,009	2006	1982	1990	2000

This data set is continued on the next page

BEA(5)	BLS (6)	USCen(7)	Cov(8)	PAHO(10)	WDI(11)	WDI(12)	WDI(13)	WDI(14)
2002	0	2017	2020	n/a	0	1961	0	2002
2002	n/a	n/a	2020	n/a	0	0	0	0
n/a	n/a	n/a	2020	n/a	2014	1991	2003	1956
n/a	n/a	n/a	2020	n/a	1980	1961	1967	1960
n/a	n/a	n/a	2020	n/a	0	1961	0	0
2002	2016	2017	2020	n/a	0	1961	0	2002
n/a	n/a	n/a	2020	n/a	1980	1961	1973	1970
0	0	0	2020	n/a	0	1991	0	1981
n/a	n/a	n/a	2020	n/a	0	1961	0	2010
n/a	n/a	n/a	2020	n/a	0	1961	1975	1965
n/a	n/a	n/a	2020	n/a	0	1961	2007	2000
n/a	n/a	n/a	0	n/a	1980	1991	1971	1960
n/a	n/a	n/a	2020	n/a	1971	1961	1962	1960
0	1976	2017	2020	not inc.	0	1961	0	1960
n/a	n/a	n/a	2020	n/a	1982	1961	1962	1982
n/a	n/a	n/a	2020	n/a	1980	1961	1970	1967
n/a	n/a	n/a	2020	n/a	1981	1961	1975	1975
n/a	n/a	n/a	2020	n/a	0	1961	1977	1990
n/a	n/a	n/a	2020	n/a	1980	1961	1970	1979

WDI (15)	WDI (16)	WDI (17)	WB (18)	WB (19)	FAO (20)
0	0	0	2002	1960	0
0	0	0	2002	1960	0
1992	1991	2010	1983	1960	1961
1965	1960	2019	1960	1960	1961
0	0	2019	1965	1960	1961
0	0	2019	2002	1960	0
1998	1960	2010	1970	1960	1961
1993	1991	2010	1981	1960	0
0	1975	2019	2010	1960	0
0	1966	2010	1965	1960	1961
1994	1992	2010	2000	1960	0
1966	1960	2010	1960	1960	0
1960	1960	2010	1960	1960	1961
0	0	2010	1960	1960	0
1967	1964	2010	1982	1960	0
1965	1961	2010	1967	1960	1961
1965	1960	2010	1975	1960	0
2009	1975	2010	1990	1960	0
1998	1960	2010	1979	1960	1961

Additional Data for Territories

Additional Data for Territories			BEA (5)	BLS (6)	USCen (7)	PAHO (10)
American Samoa	197.00	46,336.00	2002	0	2017	n/a
Guam	544.00	168,801.00	2002	2016	2017	n/a
Commonwealth of the Northern Mariana Islands	464.00	51,660.00	2002	0	2017	n/a
Puerto Rico	9,104.00	3,142,779.00	0	1976	2017	not included
U.S. Virgin Islands	346.00	105,870.00	2002	1990	2017	not included
RMI	181	77,920	0	0	0	

REFERENCES

AHF. (2019). *Marshall Islands* [National Museum of Nuclear Science and History]. Atomic Heritage Foundation. https://www.atomicheritage.org/location/marshall-islands

Ahlgren, I., Yamada, S., & Wong, A. (2014). Rising oceans, climate change, food aid, and human rights in the Marshall Islands. *Health and Human Rights*, *16*(1), 69–80. JSTOR.

BEA. (2020, December 11). *GDP for American Samoa | U.S. Bureau of Economic Analysis (BEA)*. https://www.bea.gov/data/gdp/gdp-american-samoa

BLS. (n.d.). *Bureau of Labor Statistics Data*. Retrieved March 31, 2021, from https://data.bls.gov/timeseries/SMS78000000000000001?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true

Davis, B. (2008). Defeating diabetes: Lessons from the Marshall Islands. *Today's Dietician.*, *10*(8), 24.

Davis, S. (n.d.). *Figure 1: Map of the Marshall Islands. The names of atolls and islands.* ResearchGate. Retrieved April 8, 2021, from https://www.researchgate.net/figure/Map-of-the-Marshall-Islands-The-names-of-atolls-and-islands-discussed-in-the-article-are_fig1_227531761

Englberger, L., Marks, G. C., & Fitzgerald, M. H. (2003). Insights on food and nutrition in the Federated States of Micronesia: A review of the literature. *Public Health Nutrition*, *6*(1), 5–17. https://doi.org/10.1079/PHN2002364

Feeny, S. (2007). Impacts of foreign aid to Melanesia. *Journal of the Asia Pacific Economy*, *12*(1), 34–61. https://doi.org/10.1080/13547860601083603

Firth, S. (2006). *Globalisation and governance in the Pacific islands: State, society and governance in Melanesia*. ANU E Press. https://www.jstor.org/stable/10.2307/j.ctt2jbj6w

Global Nutrition Report. (2019). *2018 Nutrition country profile: Marshall Islands*. globalnutritionreport.org. https://globalnutritionreport.org/nutrition-profiles/oceania/micronesia/marshall-islands/

Hawkes, C., Blouin, C., Henson, S., Drager, N., & Dubé, L. (2009). *Trade, food, diet and health: Perspectives and policy options*. John Wiley & Sons.

Henningham, S. (1995). *The Pacific island states: Security and sovereignty in the post-Cold War world*. St. Martin's Press, Macmillan Press ; St. Martin's Press.

Hezel, F. X. (1995). *Strangers in their own land: A century of colonial rule in the Caroline and Marshall Islands*. Center for Pacific Island Studies, School of Hawaiian, Asian & Pacific Studies, University of Hawai'i : University of Hawai'i Press, University of Hawai'i Press.

IMF. (n.d.). *International Monetary Fund: International financial statistics*. Retrieved April 8, 2021, from https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b&sId=-1

Johnson, G. (2006). Exposing the US nuclear test legacy in the Marshall Islands. *Pacific Journalism Review*, *12*(2), 188–191. https://doi.org/10.24135/pjr.v12i2.871

Johnson, G. (2014). *Don't ever whisper* (One edition). CreateSpace Independent Publishing Platform.

Johnson, G. (2017, November 10). *Child nutrition crisis in Marshall Islands sparks intervention plan*. Radio New Zealand. https://www.radionz.co.nz/international/pacific-news/343519/child-nutrition-crisis-in-marshall-islands-sparks-intervention-plan

Lessard, E. T. (n.d.). *Review of Marshall Islands fallout studies* (No. 403041; p. 86). Brookhaven National Laboratory.

Mori, A., Takahara, S., Yoshida, H., Sanada, Y., & Munakata, M. (2019). Development of an external radiation dose estimation model for children returning to their homes in areas affected by the Fukushima Nuclear Accident. *Health Physics*, *117*(6), 606–617. https://doi.org/10.1097/HP.0000000000001100

Naidu, J. R., Greenhouse, N. A., Knight, G., & Craighead, E. C. (1980). *Marshall Islands: A study of diet and living patterns* (BNL 51313; p. 79). Brookhaven National Laboratory, Safety and Environmental Protection Division.

PAHO. (2020, October 1). *PAHO/WHO Data - Mortality by cause of death: Level by country | PAHO/WHO*. Pan American Health Organization / World

Health Organization. https://www.paho.org/data/index.php/en/indicators-mortality/mortality-by-cause-of-death-level-by-country.html

Palafox, N. A., Gamble, M. V., Dancheck, B., Ricks, M. O., Briand, K., & Semba, R. D. (2003). Vitamin A deficiency, iron deficiency, and anemia among preschool children in the Republic of the Marshall Islands. *Nutrition*, *19*(5), 405–408. https://doi.org/10.1016/S0899-9007(02)01104-8

Spoehr, A. (1949). *Majuro, a village in the Marshall Islands.* Chicago Natural History Museum.

Thow, A. M., & Snowdon, W. (2009). The effect of trade and trade policy on diet and health in the Pacific Islands. In *Trade, Food, Diet and Health: Perspectives and Policy Options*. Trade, Food, Diet and Health: Perspectives and Policy Options.

TPH. (2020). *Our current price basket of goods, services and cost of living*. The People History. http://www.thepeoplehistory.com/pricebasket.html

UNData. (n.d.). *UN Comtrade | International trade statistics database*. Retrieved April 8, 2021, from https://comtrade.un.org/pb/

Wairiu, M., Lal, M., & Iese, V. (2012). Climate change implications for crop production in Pacific Islands region. In A. Aladadjiyan (Ed.), *Food production—approaches, challenges and tasks*. InTech. http://www.intechopen.com/books/food-production-approacheschallenges-and-tasks/climate-change-implications-for-crop-production-in-pacific-islands-region

WB. (n.d.). *World development indicators* | *DataBank*. Retrieved April 8, 2021, from https://databank.worldbank.org/source/world-development-indicators

WHO. (n.d.-a). *Global health expenditure database*. Retrieved March 31, 2021, from https://apps.who.int/nha/database/Select/Indicators/en

WHO. (n.d.-b). *Global health observatory*. Retrieved March 31, 2021, from https://www.who.int/data/gho

WHO. (2021, March 31). *WPRO COVID-19 dashboard*. World Health Organization, Western Pacific Region. https://who.maps.arcgis.com/apps/opsdashboard/index.html#/345dfdc82b5c4f6a815f1d54a05d18ec

Yamada, S., & Palafox, N. (2001). On the biopsychosocial model: The example of political economic causes of diabetes in the Marshall Islands. *Family Medicine*, *33*, 702–704.