REGIONAL DEMOGRAPHIC CHANGE IN CHUUK STATE, FEDERATED STATES OF MICRONESIA

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The islands currently composing Chuuk State in the Federated States of Micronesia have experienced considerable population change since the beginning of sustained contact with non-Micronesians in the late nineteenth century The following study examines the demographic evolution of this island group, exploring changes in the number of inhabitants and their geographic distribution. First, the foreign presence in the eastern Carolines and the demographic impacts of these outsiders are briefly summarized. Shifts in the regional arrangement of population are then described, focusing on data from censuses conducted between 1920 and 1989. Data on fertility, mortality, and migration provide insights on possible causes of population change. The application of selected spatial statistics to the geographic arrangement of population indicates a high degree of consistency in the distribution of people and the persistence of geographic subregions over time. The study closes by discussing sociocultural, economic, and ecological repercussions of the regional population change experienced in this multiisland state in the heart of Micronesia.

Introduction

MOST SOCIOCULTURAL SYSTEMS in Micronesia experienced major changes following contact with Europeans. One of the most widespread consequences of this interaction, and indeed one of the most far-reaching in terms of impacts on traditional cultures, was demographic change. For most of the area the story was remarkably similar. Shortly after the beginning of frequent contact with people from outside Oceania, a period of depopulation

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commenced--often due to diseases introduced by the outsiders to islanders with no previous exposure and hence no immunity. Eventually population decline ceased and the number of inhabitants began to grow, usually as a consequence of decreased mortality resulting from some combination of improved health care and acquired natural immunity to introduced illnesses (Taeuber 1963). With the exception of particularly isolated islands and atolls, the demographic history of most of Micronesia followed this pattern, the timing and degree of change varying between places. In the case of Chuuk State in the Federated States of Micronesia (FSM), the avoidance of sustained contact with outsiders until the late nineteenth century both delayed and reduced the depopulation that occurred (compared to other parts of Micronesia).[1] Following several decades of relatively constant total population during the first half of the 1900s, Chuuk State witnessed a period of steady demographic growth, with increasing proportions of the state population residing on certain islands. By 1989 Chuuk State contained more than three times the population recorded only fifty-four years earlier, with about 80 percent of the total concentrated in Chuuk Lagoon.

The following study is the fourth in a series that explores regional demographic development in the FSM (see Gorenflo and Levin 1991, 1992: Gorenflo 1993b). As in the previous three efforts, I begin with a brief overview of interaction between islanders and non-Micronesians, providing the background necessary to understand the demographic impacts of other societies on this group of islands. The study then summarizes demographic data by municipality, focusing primarily on nine censuses conducted between 1920 and 1989. An examination of available data on fertility, mortality, migration, and population structure provides clues to possible causes of demographic change. An examination of the geographic distribution of population with selected spatial statistics, in turn, measures changes in the regional arrangement of the population. Finally, I consider ecological, economic, and sociocultural repercussions of this demographic change--notably the challenge of incorporating growing numbers of people, many of them residing in Chuuk Lagoon, within a sustainable component of the FSM.

Non-Micronesians in Chuuk State and Their Demographic Impacts

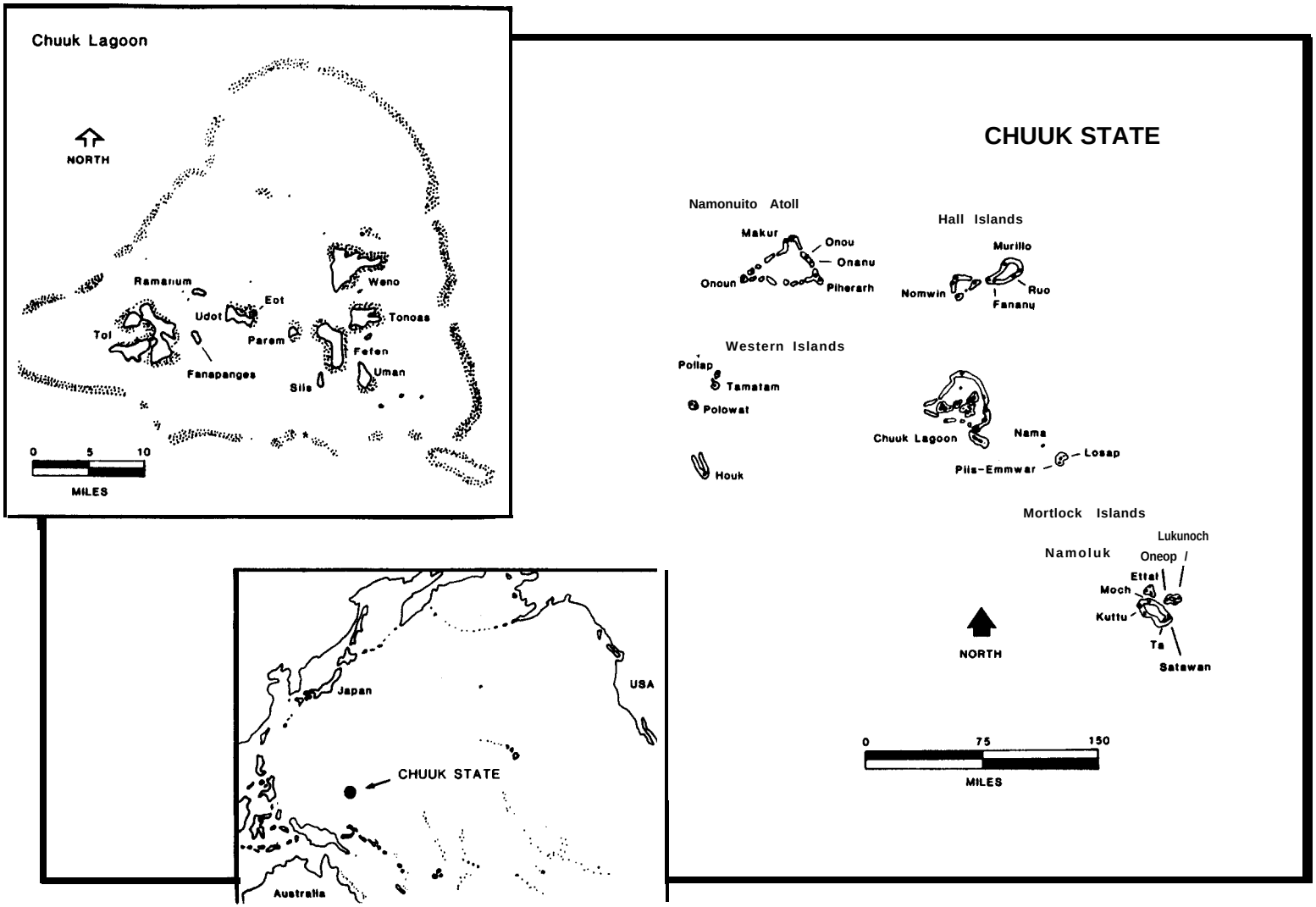
Chuuk State lies between 5° and 10° north latitude, and between 149° and 154° east longitude, in the eastern Caroline Islands (Bryan 1971). It consists of Chuuk Lagoon, a complex of nineteen volcanic islands and twenty-four coralline islands encircled by a barrier reef (Stark et al. 1958:5), and twelve coralline outer islands and atolls scattered across a broad expanse of the

Pacific (Figure 1). Geographically, Chuuk State comprises five main groups of island units: Chuuk Lagoon, the Western Islands, Namonuito Atoll, the Hall Islands, and the Mortlock Islands (with the Upper Mortlocks of Nama Island and Losap Atoll often split off from the remaining Lower Mortlocks). For the purpose of examining population change over time, I present data for eleven municipalities in Chuuk Lagoon and twenty-four municipalities in the outer islands--consistent with the reporting of demographic data for Chuuk State throughout the twentieth century.

People from Melanesia settled the eastern islands of Micronesia by about 1000 B.C., with the central Carolines occupied by groups subsequently migrating westward (see Hezel 1983:3; Kiste 1984:14; see also Gladwin 1970:4). Chuuk State's prehistory is best documented in Chuuk Lagoon, occupied as early as 500 B.C. (Parker and King 1981; see also King and Parker 1984). Following the initial settlement, an apparent temporal gap occurred, with little evidence of occupation between A.D. 500 and 1300 (Parker and King 1981:24-25). Beginning in the fourteenth century, human habitation in the lagoon resumed. Archaeological data indicate that people lived throughout the lagoon by the seventeenth or eighteenth centuries, with most inhabiting defensible inland villages--providing indirect evidence of the native conflicts that characterized much of the area during the late 1800s.

Although possibly seen by Saavedra in 1529 (Fischer and Fischer 1957: 19), the first certain sighting of Chuuk Lagoon was by the Spanish explorer Alonso de Arellano aboard the *San Lucas* in 1565 (Office of the Chief of Naval Operations 1944:18; Gladwin and Sarason 1953:39). Shortly after entering the lagoon, a flotilla of canoes from Tonoas Island surrounded and attacked the *San Lucas* (Hezel 1973:52; Hezel 1983:23-26)--the first of many recorded instances of hostile behavior against outsiders. Attacked a second time by islanders in canoes from Tol Island the following morning, Arellano decided to leave the waters of the lagoon, only to lose two members of a landing party to a native attack on Pollap Atoll one day later (Hezel 1983:25-26). For reasons unknown, cartographers included only Pollap Atoll (under the name *Los Martires*) on maps of the day; the exclusion of Chuuk Lagoon possibly helps to explain why no Western ships visited those islands for the next 250 years. With the exception of Murillo and Namonuito atolls, discovered in the mid-sixteenth century by Spanish explorers (Office of the Chief of Naval Operations 1944:17-18), the outer islands of Chuuk State remained unknown to the West until the final decade of the 1700s.

Despite its geographic prominence in the Caroline Islands, the people of Chuuk Lagoon apparently had no further interaction with non-Micronesians until the early nineteenth century. Contact resumed in 1814 when the brig


Chuuk Lagoon
NORTH
Ramanum
Eot
Udot
Weno
Tonoas
Tol
Parem
Fefen
Uman
Fanapanges
Siis
0 5 10
MILES
CHUUK STATE
Namonuito Atoll
Makur
Onou
Onanu
Onoun
Piherarh
Hall Islands
Murillo
Nomwin
Ruo
Fananu
Western Islands
Pollap
Tamatam
Polowat
Houk
Chuuk Lagoon
Nama
Losap
Piis-Emmwar
Mortlock Islands
Lukunoch
Namoluk
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0 75 150
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CHUUK STATE
Australia

San Antonio, under the command of Manuel Dublon, entered the lagoon, though virtually no record remains of this brief visit (see Kotzebue 1967, 3: 116-117). Subsequent visits by more prominent explorers, including Duperrey (in 1824) and Lütke (in 1828), provided little more information on the lagoon and its inhabitants (see Duperrey 1825:vii-viii; Lütke 1835, 2:93-95, 328; Lesson 1839, 2:530-531). It was not until Dumont d'Urville's second voyage of exploration in the Pacific that the natural and cultural characteristics of Chuuk Lagoon received careful attention (see Dumont d'Urville 1843: 120-167, 309-328). Among other things, the accounts of Dumont d'Urville's crew indicate that as late as 1838 lagoon inhabitants showed virtually no indication of having interacted with people from outside Micronesia. This paucity of contact continued throughout the mid-nineteenth-century period of whaling in the central Pacific, probably due to the relative lack of natural resources, accessible female companionship, and highly productive whaling grounds compared to other parts of Micronesia (Hezel 1973:61-63), coupled with the bellicose reputation of lagoon residents. Traders similarly tended to avoid Chuuk Lagoon, with seasoned entrepreneurs such as Cheyne (in 1844) and Tetens (in 1868) running afoul of its residents and narrowly escaping with their lives (Cheyne 1852:126-128; Tetens 1958:90-92). Warnings about potential hostilities, such as those issued by Cheyne (1852:126-127; see also Doane 1881:210), undoubtedly served to reinforce avoidance of Chuuk Lagoon (Office of the Chief of Naval Operations 1944:18; Hezel 1983:256). Trading ventures did not resume in the lagoon until the 1870s, followed shortly thereafter by the first Christian mission inside the reef in 1879 (Office of the Chief of Naval Operations 1944:24; Hezel 1973:69, 72).

In contrast to the pattern of limited interaction with non-Micronesians that characterized Chuuk Lagoon, many of the outer islands apparently had contact relatively early with outsiders, despite a lack of resources that would attract Western ships. Although the French explorer Freycinet observed no Western material culture when he passed through the Western Islands in 1819, the eagerness with which islanders visited his ships, coupled with their immediate fear at the sight of cannons, indicated familiarity with Europeans (Freycinet 1829:69-72). In contrast to the single day his ship spent anchored outside the lagoon, Lütke spent three weeks in the Mortlock Islands, noting considerable evidence of European contact in the form of relatively widespread imported Western goods, a general knowledge of other Western material culture, and individuals who spoke several words of Spanish (Lütke 1835, 2:61-81, 89-108). Evidence for outside contact prior to 1825 also existed for Namonuito Atoll, in the form of Western materials and behavior (see Mertens 1830). The presence of non-Micronesian goods and customs

in certain outer islands probably was due to visits by whaling ships and traders to the islands themselves, as well as to interaction with islanders from places in Micronesia familiar with (or occupied by) Westerners (Office of the Chief of Naval Operations 1944:21; Hezel 1973:57). Nevertheless, compared to other parts of Micronesia the outer islands of Chuuk State established sustained contact with Westerners relatively late. Although traders knew of these islands (e.g., Shineberg 1971:320-321), the lack of resources usually led these entrepreneurs to focus their attention elsewhere. Missionaries also entered the outer islands relatively late, though the missions established on Lukunoch and Satawan atolls in 1874 were instrumental in gaining a foothold in Chuuk Lagoon five years later (Hezel 1983:258-259; Hezel 1991:122).

Spain claimed Chuuk State and the rest of the Caroline Islands when explorers under its flag encountered these islands in the sixteenth century. But the Spanish showed little interest in the Carolines until traders from other countries (particularly Germany) became active there in the second half of the 1800s. Although Spain attempted to administer the Carolines between 1886 and 1899, placing military personnel and administrators on selected high islands, it took virtually no notice of Chuuk State--once again possibly due to the violent reputation of lagoon residents (Gladwin and Sarason 1953:40; Fischer and Fischer 1957:172). German trading activities in Chuuk State continued throughout the brief period of Spanish presence in the Carolines, expanding during the 1880s with trading stations established on Losap, Lukunoch, Pollap, and Satawan atolls and in Chuuk Lagoon (Office of the Chief of Naval Operations 1944:22-23). Missionary activities also continued during this period, building on the ten mission stations in the lagoon established by 1884 (Office of the Chief of Naval Operations 1944:24-25).

Beyond limited economic and religious activities, the influence of non-Micronesians remained minimal throughout the periods of early contact and Spanish rule. Demographic effects similarly were limited. Relatively few foreigners resided in Chuuk State, with only one white man living in the lagoon as late as 1881 (Hezel 1973:51, 72). The diseases that decimated so much of Micronesia failed to gain an early foothold in Chuuk State, although evidence of introduced illnesses began to appear in the Lower Mortlocks, Losap Atoll, Nama Island, and Chuuk Lagoon by the late 1870s (Kubary 1880:235; Sturges 1880; see also Gladwin and Samson 1953:33; Severance 1976:54). Details on the demographic effects of these diseases unfortunately are lacking. For instance, the impact of smallpox is unknown though this malady appeared in Chuuk State during the late nineteenth century (Office of the Chief of Naval Operations 194493; see also Pelzer and

Hall 1946:12). Ultimately, the greatest demographic effects of Westerners in Chuuk State during the nineteenth century may well have been from the recruitment of labor. As early as the late 1860s, ships began taking individuals from Namonuito Atoll to work in the Northern Mariana Islands, though the figures of 604 individuals from Onoun Islet in 1867 (Driver 1976:19) and 230 individuals taken from another, unspecified islet in the atoll (Spoehr 1954:71) appear high. The notorious blackbirding ship *The Carl* also visited the area, taking 20 men from Satawan Atoll and another 27 from other parts of the Mortlocks to Fiji in 1872 (Sturges 1874:255; Hezel 1973:67-68, 1983: 238-239)--scarcely one year after a German ship had taken 80 men from the same island units to work on plantations in Samoa (Doane 1874:203-204; Finsch 1893:299-300).

The above impacts notwithstanding, the influences of non-Micronesians on Chuuk State population during the late nineteenth century probably paled in comparison to natural and cultural factors. The most important factor was typhoons. For example, the typhoon that struck Lukunoch Atoll (and probably the rest of the Lower Mortlocks; see Nason 1975b:123) in 1874 left many dead or starving, both from its initial impact and the subsequent disruption of the food supply (Logan 1881: 19; Alexander 1895:204). A typhoon that had struck the Western and Hall islands sometime earlier in the nineteenth century caused an unknown number of deaths, requiring the relocation of populations from these outer islands to Chuuk Lagoon while their home atolls recovered (Pelzer and Hall 1946:18, 27). The most important cultural factor affecting Chuuk State demography prior to the twentieth century was warfare. Conflicts between rival polities characterized most of the lagoon during the nineteenth century (Pelzer and Hall 1946: 15; Gladwin and Samson 1953:40-41; Fischer and Fischer 1957:81; Stark et al. 1958:7; Goodenough 1978:25, 206; Oliver 1989, 2:970). Warfare also occurred on the outer islands, particularly the Mortlocks. For example, warriors from Losap Atoll, aided by men and arms provided by the trader Alfred Tetens, allegedly decimated the population of Nama Island during the late 1860s (see Tetens 1958:94-96). A slightly later conflict in the Mortlock Islands about 1870, pitting residents of Ettal and Namoluk atolls against the other islanders in that group, eventually led to the deaths of between 28 and 38 individuals (Girschner 1912:171-172). Warfare even occurred within island units-such as the conflicts between inhabitants of certain islets within Lukunoch Atoll throughout much of the nineteenth century (Westwood 1905:92)--though its precise demographic impacts are unclear.[2]

Germany was one of the first nations from outside Micronesia to establish a commercial foothold in Chuuk State, with the main goal of exploiting the island group's economic potential (primarily through copra production)

(Gladwin and Samson 1953:42; Goodenough 1978:25; Peattie 1988:28; see Schnee 1920:352). German companies established permanent trading stations in Chuuk Lagoon in 1879 and 1884 (Hezel 1973:71-72). In 1885 the German government challenged Spanish authority throughout much of Micronesia, including Chuuk State, raising the German flag over the lagoon and several other high islands (Office of the Chief of Naval Operations 1944:19). Eventually Germany purchased the Carolines in 1899, following Spain's defeat in the Spanish-American War (Brown 1977). Once Germany assumed control of the lagoon in 1903 (Gladwin and Samson 1953:41; Goodenough 1978:8, 25), colonial administrators imposed their rule not through the native sociopolitical hierarchy (as employed in much of Germany's Micronesian holdings; see Office of the Chief of Naval Operations 1943:13) but by appointing a single native ruler for each high-island community (Fischer and Fischer 1957:172)--though these designated leaders often came from traditional ruling lineages. This approach helped reinforce the ban on warfare imposed by the Germans in the early 1900s (see Krämer 1932:17), established a suprafamilial leadership previously lacking in the lagoon, and largely eliminated the continual realignment of factions that had perpetuated earlier conflicts (Hezel 1973:71; see also Pelzer and Hall 1946: 21; Oliver 1989, 2:979). Similar intervention to stop interpolity warfare and modify the traditional administrative system occurred in the outer islands (see Tolerton and Rauch n.d.:46-48; Nason 1975b:121; Flinn 1990:104).

Despite the many changes introduced during the German administration, the effect on demography was minimal. Relatively few Germans or other foreigners actually moved to Chuuk State. Typhoons continued to play an intermittent though important role in shaping the population of the outer islands. A severe typhoon struck the Hall Islands and Namonuito Atoll in 1905, though its precise impact is unknown (Fischer and Fischer 1957:6). A more devastating storm struck the Mortlock Islands in March 1907: official totals noted 227 deaths on Ettal, Lukunoch, and Satawan atolls directly attributable to the storm, with another 100 dying on Satawan Atoll the following year (*Deutsches Kolonialblatt* 1907:864-865; *Deutsches Kolonialblatt* 1908:745). German ships subsequently evacuated 600 to 700 survivors from the Mortlocks to Chuuk Lagoon, Saipan, and Pohnpei Island (Hezel 1995; see also Tolerton and Rauch n.d.:7; Fischer and Fischer 1957:81; Hempenstall 1978:95; Hezel 1991:123). A few other islanders were relocated for other reasons. German administrators exiled to Pohnpei for a cooling-off period those few native leaders in the lagoon who refused to stop fighting (Gladwin and Samson 1953:41). Some labor recruitment persisted, with islanders from the Mortlocks and Chuuk Lagoon sent as contract laborers to the Angaur and Nauru phosphate mines (Yanaihara 1940:285-286; Sever-

ance 1976:55). Diseases continued to be a problem, though their effects still were not devastating. The virtual introduction in 1910 of measles, tuberculosis, and intestinal diseases by Mortlockese returning home from their evacuation to Pohnpei three years earlier attests to the isolation from Western sicknesses that persisted on many outer islands into the early twentieth century (see Tolerton and Rauch n.d.:7).

To provide data for administrative purposes during these rapidly changing times, the German administration initiated efforts to collect demographic data in a systematic manner. It is unclear precisely how the Germans obtained these data, which in some cases may represent detailed estimates rather than complete censuses, but the result nevertheless was a series of population figures for portions of Chuuk State in the early 1900s. An "official accounting" of the population in Chuuk Lagoon recorded 13,115 residents in 1903 (Krämer 1932:17), providing the first reliable figure on population in that complex geographic and cultural setting. As presented below, demographic data also are available for several outer islands at different points in the German administration, though they do not cover all of Chuuk State in any particular year.

When Germany became involved in World War I in 1914, Japanese military forces occupied German-held Micronesian territories (Kiste 1984:43; see Peattie 1988:43). In 1920 a Class C Mandate from the League of Nations officially awarded to Japan all German possessions in the Pacific north of the equator, including Chuuk State (Clyde [1935] 1967). Initially Chuuk became one of five naval districts established in this newly annexed territory; when the civilian government of Micronesia was formed in 1922, Tonoas Island became the location of the central Carolines Branch Government (Peattie 1988:68-70). Japan assumed a particularly active role in administering its new Pacific territory. With an initial goal of expanding economic development beyond the copra industry established during the German period, Japan promoted commercial fishing, agriculture, and associated ventures such as trochus, sponge, and pearl production (Office of the Chief of Naval Operations 1944:136-139; Pelzer and Hall 1946:44; Gladwin and Samson 1953:43; Goodenough 1978:26; Peattie 1988:135-140). As part of its effort to develop Chuuk and the other districts of the Mandated Territory, Japan implemented a systematic program to educate the islanders in the ways of Japanese culture. The Japanese also constructed a hospital (on Tonoas Island in 1922) and implemented a public health program specifically focused on epidemic control (Office of the Chief of Naval Operations 1944:99; Peattie 1988:87). Administrative activities were carried out through the system imposed during the German period, the Japanese adding further bureaucratic levels to the native leadership, which had to be confirmed by

colonial officials (Pelzer and Hall 1946:20; Purcell 1967:161-162). Tonoas Island and its main community, the town of Dublon, which had emerged as a government center during the German period, maintained central economic and administrative roles (Peattie 1988:182-184).

As the end of the 1930s approached, military concerns replaced economic goals in Japanese development efforts throughout the Mandated Territory. Although Chuuk Lagoon's location ensured its military importance in maritime strategy, the mountainous terrain on most lagoon islands provided few locations for airstrips (Peattie 1988:231-232). Japanese leaders began to fortify the lagoon during the late 1930s, establishing the headquarters of the Fourth Fleet and the Fourth Base Force there by December 1941 (Peattie 1988:344). Despite considerable fortifications and a large contingent of Japanese troops, once the battle fleet moved west a major aerial attack by the U.S. Navy in February 1944 soundly defeated the remaining forces. After neutralizing the lagoon and outer-island garrisons through air strikes, American forces bypassed Chuuk State in their push through the Pacific. Remaining Japanese military forces stationed there surrendered in September 1945 (Peattie 1988:303, 309).

The most immediate impact on the demography of Chuuk State during the Japanese administration was an influx of immigrants from Japan and Okinawa. By the mid-1930s, roughly 700 Okinawan fishermen and traders resided in Chuuk Lagoon, mostly on Tonoas and Tol islands; another 800 Japanese nationals lived in Dublon town about the same time (Peattie 1988:182-184; see also Goodenough 1978:26). By 1937 the number of Okinawans living in Chuuk State had increased to more than 2,300, with many of the additional immigrants serving as laborers, while the number of Japanese immigrants had increased to roughly 1,300 (Office of the Chief of Naval Operations 1944:30). During the war the number of non-natives residing in Chuuk Lagoon increased dramatically--possibly peaking at 50,000 and still in excess of 38,300 as late as June 1945 (Pelzer and Hall 1946:55; Stark et al. 1958:8-9). The Japanese established smaller garrisons on Lukunoch, Namonuito, Polowat, and Satawan atolls during the war (Nason 1970: 220; M. Thomas 1978:33; Peattie 1988:303).

In addition to bringing non-Micronesians to Chuuk State, the Japanese also relocated local residents. The main reason for such relocation was to provide labor; indeed, by the end of the Japanese administration virtually every able-bodied man on certain island units had spent at least some time working elsewhere in the Mandated Territory (see Nason 1970:213; Marshall 1975:168-169; Severance 1976:57). During the early 1920s, the Japanese sent laborers from Chuuk State to work plantations on Saipan and Pohnpei (Office of the Chief of Naval Operations 1944:142; Hezel 1995).

Administrators similarly recruited laborers to work in the phosphate mines of Angaur--particularly from the lagoon and the Mortlocks (Yanaihara 1940: 286-287; Purcell 1967:192; Nason 1970:217; see also M. Thomas 1978:44; Flinn 1992:30), though in theory each island unit was to contribute a number of workers proportional to its population (Pelzer and Hall 1946:18). During the war the movement of islanders continued. In some cases this forced migration was to insure islander safety, such as the relocation of Polowat Atoll residents to Houk Atoll (Gladwin 1970:8), the relocation of residents of Satawan and Ta islets to Kuttu Islet within Satawan Atoll (Reafsnyder 1984:104), and the relocation of Tonoas Island residents elsewhere in the lagoon. In other cases the Japanese moved islanders to places needing additional laborers, such as the 1,200 Nauruans brought to Chuuk Lagoon in 1943 (Hezel 1991:159). A few islanders also relocated during the Japanese administration to attend schools in the lagoon and on Lukunoch Atoll (Fischer 1961; Purcell 1967:230-231; Marshall 1975:168; Nason 1975b:130; M. Thomas 1978:33).

Natural disasters and diseases continued to affect the demography of Chuuk State. At least two typhoons struck during the three decades of Japanese rule: a typhoon in 1925 struck the lagoon itself, causing considerable damage but an unknown number of casualties; a second typhoon, in 1935, caused substantial damage in Chuuk Lagoon and throughout the Lower Mortlocks, although once again demographic impacts are unknown (Office of the Chief of Naval Operations 1944:6; Nason 1970:38). Introduced diseases occurred throughout most of Chuuk State into the Japanese administration. Although smallpox was virtually eradicated by World War II (Gladwin and Sarason 1953:33), tuberculosis, intestinal parasites, typhoid fever, venereal disease (particularly syphilis), and measles all persisted--the latter killing “many” during an epidemic that swept through the lagoon in 1918 (Office of the Chief of Naval Operations 1944:93-94; Goodenough 1978: 25)--challenging the proposition that the Japanese brought all epidemics (except for dengue fever) under control during their administration (Purcell 1967:243-244). Localized outbreaks of certain illnesses also occurred. For example, an unidentified disease struck Ettal Atoll in 1927, killing an unspecified number of individuals, and a highly contagious respiratory disease killed 50 to 60 persons on Namoluk Atoll a decade later (Marshall 1975:161, 166, 170; Nason 1975b:130-131).

One of the most serious sources of demographic change during the Japanese period was depopulation associated with World War II, although once again particulars are unfortunately scarce. The general tendency for depressed fertility throughout Micronesia during the war (Fischer and Fischer 1957:79) probably holds for Chuuk State as well. Attacks by U.S.

military forces in 1944 no doubt killed some islanders, particularly in Chuuk Lagoon, though precise numbers are unknown and the relocation of the native population from the coast to the interior of many islands probably minimized the number of casualties (Stark et al. 1958:7). Following the attacks on Japanese military installations in 1944, a U.S. blockade cut off the area from supply lines--causing great hardship in some parts of the state, particularly the lagoon, but an unknown number of deaths (Gladwin and Sarason 1953:45; Goodenough 1978:25; Marshall 1979c:26). Near the war's end the Japanese allegedly developed a plan to execute all Micronesians in the lagoon, though never implemented it (Peattie 1988348). Despite the many sources of potential impacts on population during the Japanese administration, the number of islanders in Chuuk State remained at about 15,000 between 1920 and 1935. Data from the lagoon indicate a decline of more than 3,100 persons between the first systematic German survey in 1903 and the first Japanese census in 1920. Available figures indicate a decline in population both in Chuuk Lagoon and the outer islands between 1935 and 1946, with the total number of islanders falling by about 1,260 to fewer than 13,300 in the latter year (Pelzer and Hall 1946:tables 1, 3).

U.S. military forces bypassed Chuuk State in 1944, occupying the area following the Japanese surrender in 1945 (Peattie 1988:303). The U.S. government repatriated Japanese civilians and military personnel, as well as other Pacific Islanders, shortly thereafter. In 1947 the island units in Chuuk State became part of the Trust Territory of the Pacific Islands (TTPI), a strategic area established by the United Nations and administered by the United States (Shinn 1984:303-305). The TTPI administration promoted democratic government and generally removed controls on relocation within the territory. Moreover, for the first time modern health care became widely available, which, coupled with the advent of antibiotics, enabled the control of many diseases that had persisted until the end of World War II (see Pelzer and Hall 1946:12; Fischer and Fischer 1957:67). Although natural disasters such as typhoons continued (see Nason 1970:38), early warnings, increased preparation, and organized disaster relief helped to minimize their effect on population (e.g., J. Thomas 1978:6; M. Thomas 1978:36; Marshall 1976, 1979b). Under successive administrations by the U.S. Navy (1945-1951) and the U.S. Department of the Interior (1952-1986), the population of Chuuk State grew rapidly. Between the last Japanese census in 1935 and the first TTPI census in 1958 the total population increased by nearly 5,000 persons; by 1980 the Chuuk State population had grown by another 17,400.

In May 1979 Chuuk and three other Caroline districts of the TTPI (Kosrae, Pohnpei, and Yap) approved a constitution and became a nation

separate from the rest of territory: the Federated States of Micronesia (Shinn 1984:323). The U.S. government ratified a Compact of Free Association in 1986, defining future relations between the FSM and the United States. One consequence of the compact was that FSM residents were granted the right to migrate to the United States or any of its territories--an opportunity that many Chuuk State residents quickly took advantage of to relocate to Guam and the Commonwealth of the Northern Mariana Islands beginning in the late 1980s (Hezel and McGrath 1989; Rubinstein and Levin 1992). Despite this emigration, the sustained population growth that characterized Chuuk State during the U.S. administration persisted throughout the 1980s. By 1989 the population had increased to nearly 48,000 persons.

Changing Regional Demography in Chuuk State

The demography of Chuuk State was poorly documented before the Japanese Nan'yo-cho (South Seas Bureau) conducted its first systematic census of the Mandated Territory in 1920. Limited population information is available beginning in the early nineteenth century for the lagoon and a few outer islands in the form of estimates made by explorers, usually compiled after relatively brief visits (see Lütke 1835, 2:326-328; Gulick 1862:362). Figures for Chuuk Lagoon vary widely, as one might expect given the limited presence of outsiders there prior to the 1870s. The earliest estimate comes from Lütke's 1828 expedition, although the minimal attention he focused on the lagoon coupled with an admitted lack of information from other sources greatly reduce the credibility of his proposed total of 1,000 inhabitants (Lütke 1835, 2:328). The much larger figure of 35,000 lagoon residents in 1830, cited by several sources (though occasionally attributed to 1824 or 1827; see Lesson 1839, 2:197; Krämer 1932:24; Office of the Chief of Naval Operations 1944:27; Pelzer and Hall 1946:6; Goodenough 1978:25), comes from the writing of trader Benjamin Morrell (1832:424). Given Morrell's limited time in the lagoon (totaling a few days on three different visits) and the suspect quality of his other observations there (see Hezel 1973:64), this figure also is highly questionable. Equally dubious for its lack of any clear foundation is the figure of 5,000 lagoon inhabitants dating to the mid-nineteenth century (Gulick 1862:362; see Finsch 1893:299). The first believable estimates of lagoon population date to the 1880s, with the figure of 10,000 to 12,000 in 1881 (Doane 1881:210) and that of 12,000 in 1887 (Kubary and Krause 1889:55), both proposed by individuals much more familiar with the area than their predecessors. Based largely on figures from missionaries, by the early 1890s an estimated 14,000 to 16,000 people

TABLE 1: **Early Population Estimates for Chuuk State**

Area	1819	1828[a]	1850	1860[b]	1874[c]	1877[d]	1891[e]	1896	1901	1903	1907	1909	1910	1914
Chuuk Lagoon				5,000		12,000		10,000	12,000	13,115	13,514			11,000
Outer Islands														
Fananu												162		
Murillo												126		
Nomwin				50								204		
Ruo												123		
Ettal				200	600	500	500		344		150			
Lukunoch[f]				200	1,500				1,165					
Namoluk		40		300	400		350		264				200	
Satawan[f]				500	1,500				1,573					
Losap[f]		80		200	500		350		434	430				
Nama					175		500		326	320				
Makur												10		
Onanu												86		
Onou												67		
Onoun												68		
Piherarh												63		
Houk	900		350						300	300		177		
Pollap									550			60		
Polowat	2,000			100					1,100	1,100				
Tamatam	100			200								120		

Sources: Freycinet 1829; Lütke 1835; Cheyne 1852; Gulick 1862; Doane 1874; Schmeltz and Krause 1881; Kubary and Krause 1889; Finsch 1893; Christian 1899; Seidel 1905; *Deutsches Kolonial-Handbuch* 1909; Hermann 1909; Girschner 1912; Krämer 1932, 1935; Damm and Sarfert 1935.

b), and 300 in 1901 (Lütke 1835, 2:326; Gulick 1862:362; *Deutsches Kolonial-Handbuch* 1909:328). Reference to the population of "Fananu" in 1901 provided in *Deutsches Kolonial-Handbuch* (1909:328) probably is to Nomwin Atoll, which contains an islet called Fananu (which differs from Fananu Municipality [part of Murillo Atoll] as used in this study). The population of Namonuito Atoll (Makur, Onanu, Onou, Onoun, and Piherarh municipalities) was reported at roughly 200 persons in 1800, 150 in 1828 (Lütke 1835, 2:326–327), 50 in 1860 (see note *b*), 271 in 1901 (the figure referring to "Olo," which likely represents Ulul—denoted Onoun in this study—and probably refers to the entire atoll; see Hermann 1909:627), and 272 in 1903 (Krämer 1935:192, 219).

[a] Although Lütke (1835, 2:326) reported the population of "Fananou" as 150 persons, it is unlikely that he referred to the part of Murillo Atoll denoted in this study as Fananu Municipality, probably instead meaning Nomwin Atoll. Note that Lütke also reported the population of the Mortlocks as "300 fit men" and makes a nebulous reference to the population of the "islands viewed by Captain Freycinet" in 1819 (the Western Islands) as 100 persons (Lütke 1935, 2:327). After acknowledging the lack of reliable information on the demography of Chuuk Lagoon ("Roug"), Lütke estimated a population of about 1,000 based on its physical characteristics (1935, 2:328).

[b] Populations reported by Gulick (1862:362–363) are associated with no certain year. Many probably represent estimates made prior to 1860 by various explorers and traders that Gulick cites in his table of geographic and demographic information, though this is uncertain as well. Because these data provide some insights on mid-nineteenth population of various outer islands, I present them in this table—under 1860 for the sake of consistency, though recognizing that this date may be incorrect for some (or all) places noted.

[c] Doane (1874:204–205) estimated the Namoluk population at 300 to 500 in 1874 (which I report here as 400) and the population of Nama Island at 150 to 200 (reported here as 175).

[d] A resident missionary estimated the "whole population" of the Mortlocks at about 3,500 in 1877 (*Missionary Herald* 1877:202). The particular islands to which he referred are uncertain, though based on other references in the text they probably consist of the Lower Mortlocks.

[e] Based on the *Annual Mission Report* of 1891, Finsch (1893:299) noted a population of 4,450 for the Mortlocks as a whole and 1,500 for Lukunoch and Satawan atolls combined.

[f] Some of the geographic references in this table are inconsistent with the geographic focus used for population data in the remainder of the study, signifying entire atolls instead of parts of atolls (designated for census purposes as individual municipalities). Unless specifically noted, the above data refer to municipalities. In a few instances, data were available for an entire atoll but not for its individual populated components. Thus Satawan *in this table* represents the entire atoll, consisting of Kuttu, Moch, Satawan, and Ta municipalities (as reported in subsequent tables); Lukunoch here comprises Lukunoch and Oneop municipalities; and Losap here comprises Losap and Piis-Emmwar municipalities.

TABLE 2. **Population of Chuuk State by Year, Showing Population Change between Census Years: Select Years**

Year	Population	Change from Previous Listed Census Year	Average Annual Change from Previous Listed Census Year	Source
1920	**14,788**	**...**	**...**	**Nan'yo-cho 1937**
1925	**14,961**	**173**	**0.2%**	**Nan'yo-cho 1927**
1930	**15,200**	**239**	**0.3%**	**Nan'yo-cho 1931**
1935	**15,129**	**-71**	**-0.1%**	**Nan'yo-cho 1937**
1946	13,867	...	...	Pelzer and Hall 1946
1949	14,936	...	...	U.S. Dept. of the Navy 1949
1950	15,617	...	...	U.S. Dept. of the Navy 1950
1951	15,788	...	...	U.S. Dept. of the Navy 1951
1952	15,848	...	...	U.S. Dept. of the Interior 1952
1954	16,946	...	...	U.S. Dept. of State 1955
1956	17,477	...	...	U.S. Dept. of State 1957
1957	18,605	...	...	U.S. Dept. of State 1958
1958	**20,124**	**4,995**	**1.2%**	**Office of the High Commissioner 1959**
1959	21,010	...	...	U.S. Dept. of State 1960
1960	21,401	...	...	U.S. Dept. of State 1961
1961	21,309	...	...	U.S. Dept. of State 1962
1962	22,564	...	...	U.S. Dept. of State 1963
1963	23,344	...	...	U.S. Dept. of State 1964
1964	24,521	...	...	U.S. Dept. of State 1965
1965	25,820	...	...	U.S. Dept of State 1966
1967	**25,107**	**4,983**	**2.5%**	**School of Public Health n.d.**
1968	26,368	...	...	U.S. Dept. of State 1969
1969	27,453	...	...	U.S. Dept. of State 1970
1971	29,334	...	...	U.S. Dept. of State 1972
1972	32,732	...	...	U.S. Dept. of State 1973
1973	**31,609**	**6,502**	**3.9%**	**Office of Census Coordinator 1975**
1975	33,040	...	...	U.S. Dept. of State 1978
1976	34,120	...	...	U.S. Dept. of State 1978
1977	35,220	...	...	U.S. Dept. of State 1978
1978	36,350	...	...	U.S. Dept. of State 1979
1979	37,400	...	...	U.S. Dept. of State 1980
1980	**37,488**	**5,879**	**2.5%**	**U.S. Bureau of the Census 1983a**
1984	44,596	...	...	U.S. Dept. of State 1985
1989	**47,871**	**10,383**	**2.8%**	**Office of Planning and Statistics 1992a**

Notes: Census years in **boldface.** Data for 1920-1935 are for Pacific Islanders only. Intercensal estimates generally are de jure population; census data are de facto population. For all tables, "-" denotes zero or a percentage that rounds to less than 0.1; "NA" = not available; ". . ." = not applicable.

resided in the lagoon and the Mortlocks (Finsch 1893:299). As noted above, German administrators obtained careful population counts for parts of Chuuk State between 1900 and 1909 (see Yanaihara 1940:29), including the lagoon in 1903 and 1907, and several outer islands in 1901, 1903, 1907, and 1909 (*Deutsches Kolonial-Handbuch* 1909:328; Hermann 1909:627-628; Krämer 1932:17; Damm and Sarfert 1935:20; Krämer 1935:169-173, 195-196) (Table 1).[3] In some cases German officials collected this information, while in others native chiefs or missionaries provided the desired data (see Finsch 1893:299; Bollig 1927:225). Unfortunately, no single set of demographic estimates or census is available for all of Chuuk State at one time prior to the Japanese administration.

Ten systematic censuses of Chuuk State were conducted during the twentieth century: four by the Japanese South Seas Bureau (1920, 1925, 1930, and 1935), two by the TTPI administration (1958 and 1973), one by the U.S. Peace Corps in conjunction with the University of Hawai'i School of Public Health (1967), two by the U.S. Bureau of the Census (1970 and 1980), and one by the FSM Office of Planning and Statistics (1989). The U.S. military commissioned what appears to be a fairly accurate estimate

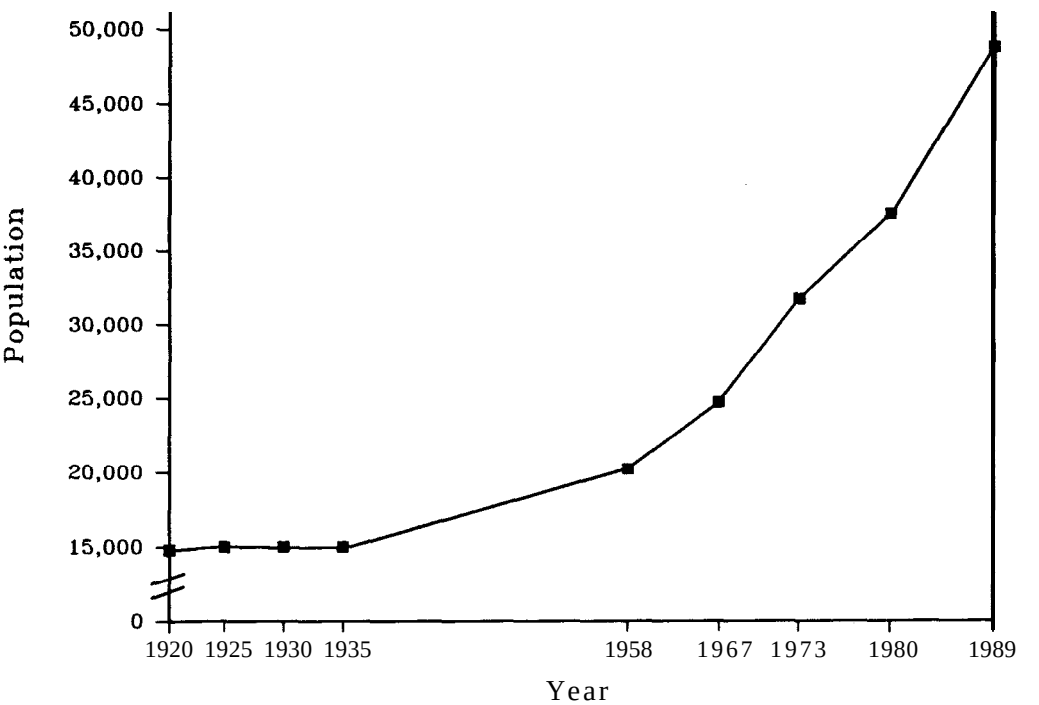


FIGURE 2. **Change in the population of Chuuk State over time (1920, 1925, 1930, and 1935 are Pacific Islanders only).**

TABLE 3. **Population by Municipality: Census Years**

Area	1920[a, b]	1925[b, c]	1930[c]	1935[c]	1958	1967	1970	1973	1980	1989[d]
Chuuk State	14,788	14,961	15,200	15,129	20,124	25,107	NA	31,609[e]	37,488	47,871
Chuuk Lagoon	9,822	9,836	10,162	10,180	14,084	18,141	NA	24,216	28,328	38,341
Eot	NA	NA	120	102	184	217	237	192	181	279
Fanapanges	NA	171	186	173	261	306	312	341	401	447
Fefen	1,623	1,173	1,221	1,236	1,546	2,042	1,688	2,478	3,076	3,902
Parem	NA	151	135	134	101	134	181	203	225	350
Ramanum	446	306	289	229	240	283	305	375	462	679
Siis	NA	149	143	112	180	244	197	241	324	438
Tol	2,284	2,416	2,508	2,367	3,624	4,486	2,211	5,439	6,705	8,346
Tonoas	1,340	1,456	1,443	1,923	1,528	2,021	2,090	2,558	3,223	3,870
Udot	649	615	535	517	623	874	558	930	1,082	1,513
Uman	913	856	969	974	1,430	1,621	1,588	1,891	2,298	2,895
Weno	2,567	2,543	2,613	2,413	4,367	5,913	NA	9,568	10,351	15,622
Outer Islands[f]	4,966	5,125	5,038	4,949	6,040	6,966	NA	7,350	9,160	9,530
Fananu	NA	126	132	114	104	155	159	179	235	238
Murillo	NA	102	118	118	171	235	239	203	325	296
Nomwin	NA	110	106	101	226	279	292	293	322	386
Ruo	NA	92	107	105	133	184	168	180	293	398
Ettal	NA	309	283	238	268	298	84	266	446	420
Kuttu	NA	371	357	330	478	496	506	383	483	423
Lukunoch	NA	635	496	476	493	549	554	505	666	745
Moch	NA	300	278	270	392	515	425	443	632	604
Namoluk	329	340	322	287	250	306	384	263	324	310
Oneop	NA	378	333	405	411	427	489	404	480	534
Satawan	NA	300	264	280	421	508	430	826	767	885
Ta	NA	116	142	149	188	249	334	329	295	294

Losap	*NA*	*310*	*311*	*326*	*455*	*482*	*NA*	*[illegible]*	*[illegible]*	*[illegible]*
Nama	NA	382	389	405	689	534	NA	702	1,021	897
Piis-Emmwar	NA	196	225	235	181	213	236	226	240	320
Makur	NA	NA	NA	NA	31	50	73	66	97	121
Onanu	NA	90	64	72	41	37	27	47	75	80
Onou	NA	65	58	55	40	38	54	41	59	91
Onoun	NA	140	131	122	187	242	271	375	434	513
Piherarh	NA	45	52	49	59	67	83	111	118	139
Houk	NA	155	226	222	235	290	331	265	205	346
Pollap	NA	156	159	153	207	304	322	316	427	315
Polowat	NA	287	364	335	288	410	378	435	441	477
Tamatam	NA	120	121	102	94	128	159	154	188	226

Sources: Nan'yō-chō 1927, 1931, 1937; Office of the High Commissioner 1959; School of Public Health n.d.; U.S. Bureau of the Census 1972, 1983a; Office of Census Coordinator 1975; Office of Planning and Statistics 1992a.

[a] Fefen included Parem and Siis, and Tol included Fanapanges.

[b] Udot included Eot.

[c] Onoun included Makur.

[d] Tol consisted of populations reported for Tol (4,846), Patta (1,299), Polle (1,327), and Wonei (874) municipalities; Weno, in turn, comprised populations reported for Weno (15,253) and Fono (369) municipalities.

[e] Includes 43 individuals whose place of residence was "not specified."

[f] For all tables, the order of outer-island municipalities incorporates geographic and cultural groupings for the Hall Islands (Fananu, Murillo, Nomwin, and Ruo), the Lower Mortlock Islands (Ettal, Kuttu, Lukunoch, Moch, Namoluk, Oneop, Satawan, and Ta), the Upper Mortlock Islands (Losap, Nama, and Piis-Emmwar), Namonuito Atoll (Makur, Onanu, Onou, Onoun, and Piherarh), and the Western Islands (Houk, Pollap, Polowat, and Tamatam).

TABLE 4. **Population Density by Municipality: Census Years (Persons per Square Mile)**

Area	1920	1925	1930	1935	1958	1967	1970	1973	1980	1989
Chuuk State	299	303	307	306	407	508	NA	639	758	968
Chuuk Lagoon	254	254	262	263	364	469	NA	625	732	990
Eot	NA	NA	632	537	968	1,142	1,247	1,011	953	1,468
Fanapanges	NA	201	219	204	307	360	367	401	472	526
Fefen	NA	226	236	239	298	394	326	478	594	753
Parem	NA	199	178	176	133	176	238	267	296	461
Ramanum	1,487	1,020	963	763	800	943	1,017	1,250	1,540	2,263
Siis	NA	648	622	487	783	1,061	857	1,048	1,409	1,904
Tol	NA	159	165	156	238	295	145	358	441	549
Tonoas	379	411	408	543	432	571	590	723	910	1,093
Udot	NA	210	183	176	213	298	190	317	369	516
Uman	454	426	482	485	711	806	790	941	1,143	1,440
Weno	341	338	347	321	581	786	NA	1,272	1,376	2,077
Outer Islands	463	478	470	462	563	650	NA	686	854	889
Fananu	NA	1,260	1,320	1,140	1,040	1,550	1,590	1,790	2,350	2,380
Murillo	NA	392	454	454	658	904	919	781	1,250	1,138
Nomwin	NA	129	125	119	266	328	344	345	379	454
Ruo	NA	657	764	750	950	1,314	1,200	1,286	2,093	2,843
Ettal	NA	423	388	326	367	408	115	364	611	575
Kuttu	NA	3,373	3,245	3,000	4,345	4,509	4,600	3,482	4,391	3,845
Lukunoch	NA	629	491	471	488	544	549	500	659	738
Moch	NA	2,727	2,527	2,455	3,564	4,682	3,864	4,027	5,745	5,491

Namoluk	*1,028*	*1,063*	*1,006*	*897*	*751*	*956*	*1,256*			
Oneop	NA	2,100	1,850	2,250	2,283	2,372	2,717	2,244	2,667	2,967
Satawan	NA	259	228	241	363	438	371	712	661	763
Ta	NA	193	237	248	313	415	373	382	492	485
Losap	NA	939	942	988	1,373	1,370	NA	1,327	1,779	1,439
Nama	NA	1,317	1,341	1,397	2,376	1,841	NA	2,421	3,521	3,093
Piis-Emmwar	NA	2,800	3,214	3,357	2,586	3,043	3,371	3,229	3,429	4,571
Makur	NA	. . .	. . .	. . .	172	278	406	367	539	672
Onanu	NA	900	640	720	410	370	270	470	750	800
Onou	NA	542	483	458	333	317	450	342	492	758
Onoun	NA	143	134	124	191	247	277	383	443	523
Piherarh	NA	145	168	158	190	216	268	358	381	448
Houk	NA	144	209	206	218	269	306	245	190	320
Pollap	NA	538	548	528	714	1,048	1,110	1,090	1,472	1,086
Polowat	NA	219	278	256	220	313	289	332	337	364
Tamatam	NA	1,333	1,344	1,133	1,044	1,422	1,767	1,711	2,089	2,511

("head count") of residents in 1946 (Pelzer and Hall 1946:6, tables 1 and 3), but due to uncertain data collection methods and the lack of island-specific estimates for the lagoon I do not discuss these figures with the censuses.[4] The demographic data available indicate that Chuuk State population increased throughout most of the twentieth century, the slow growth (including a brief period of slight decline) in total native inhabitants between 1920 and 1935 contrasting sharply with more rapid growth over the next five decades (Table 2; Figure 2).

Demographic change varied between individual island units in Chuuk State (Table 3). In part, these differences corresponded to the major geographic division between Chuuk Lagoon and the outer islands, pointing up the increased concentration of people in the lagoon, particularly in Weno Municipality after the war. Changes in population density over time document further the contrasting demographic change in different places, with many lagoon and outer-island municipalities featuring dense populations (Table 4).

Let us now briefly examine the demographic evolution of Chuuk State in regional terms, organized in six sections. The first discusses demographic data from the Japanese period, examining the four censuses between 1920 and 1935 when the population remained relatively constant. Each of the remaining five sections deals with one of the post-World War II censuses (excluding 1970), encompassing a period when the population grew substantially and became more concentrated in Chuuk Lagoon. In the interest of brevity, this discussion is confined to key data, drawing attention to likely causes of population change when possible.

Regional Demography during the Japanese Period: 1920, 1925, 1930, and 1935

In 1920 the Japanese South Seas Bureau conducted its first census of Chuuk State (then the Truk District of the Mandated Territory; see Nan'yo-cho 1937). The South Seas Bureau conducted similar censuses in 1925, 1930, and 1935, providing an extremely detailed demographic data base for the period of Japanese administration. These data describe an essentially constant population, growing slightly between 1920 and 1930 at average annual rates of 0.3 percent or less before declining slightly over the first five years of the 1930s. I discuss the four Nan'yō-chō censuses briefly below, focusing on Pacific Islanders and for the most part excluding any examination of resident Japanese.[5]

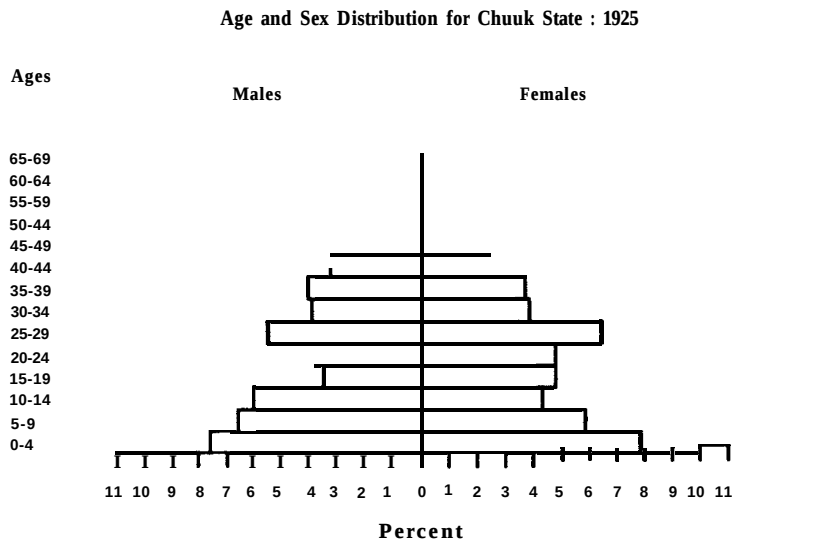
The 1920 census recorded nearly 14,800 Pacific Islanders in Chuuk State, with roughly two-thirds residing in Chuuk Lagoon (see Table 3;

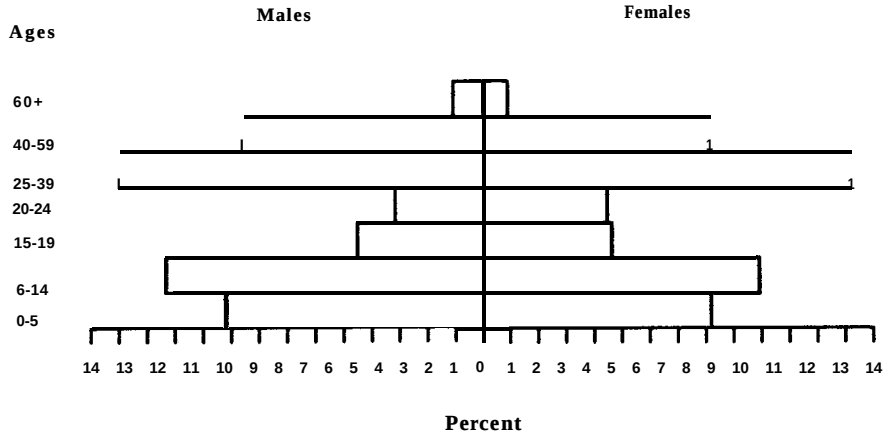
Nan'yo-cho 1937). Although reliable population figures for the entire state are unavailable for earlier years, demographic data for Chuuk Lagoon during the German period indicate that depopulation occurred between the early 1900s and 1920. Despite a lack of population data for all lagoon municipalities, clearly most residents in 1920 lived in Weno and Tol municipalities. Apart from Namoluk Atoll, population data are unavailable for the outer islands in 1920.

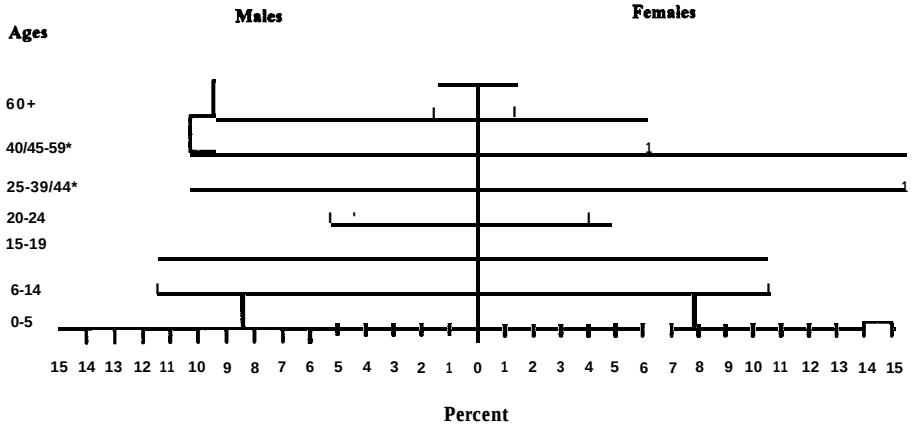
The number of Pacific Islanders living in Chuuk State grew by 173 persons between 1920 and 1925, the result of 0.2 percent average annual growth (see Table 2; Nan'yō-chō 1927). The 1925 census recorded the population of each municipality in Chuuk State with the exception of Eot and Udot in the lagoon, which it combined, and Makur and Onoun islets in Namonuito Atoll, which it also combined (see Table 3). Once again, nearly two-thirds of the total population resided in Chuuk Lagoon, though the demographic dominance of the lagoon declined slightly from that recorded in 1920, and again, the largest number of lagoon residents lived in Weno and Tol municipalities. Most outer islands had small populations in 1925; Lukunoch, the outer-island municipality with the largest number, had only 635 persons--about 4.2 percent of the state total. In addition to the number of Pacific Islanders residing in various portions of Chuuk State, the 1925 census also recorded information on the age and sex composition of the state population. Males slightly exceeded females in 1925 (Figure 3), with the median age for the entire population 22.1 years.

The Pacific Islander population continued to grow slowly over the second half of the 1920s, the 0.3 percent average annual rate of increase resulting in a total of 15,200 resident islanders by 1930 (see Table 2; Nan'yo-cho 1931). Slightly more than two-thirds lived in the lagoon (see Table 3). The lagoon population increased slightly between 1925 and 1930, as did the populations of most component islands, with the largest numbers once again residing in Weno and Tol municipalities. In contrast, the population of the outer islands declined slightly during the same five years. The 1930 census once again recorded the age-sex composition of the Pacific Islander population, the overall breakdown and median age (21.6 years) being similar to 1925 (see Figure 3). In addition, the 1930 census provided for the first time information on age (and sex) composition of individual municipalities (Table 5). In general, the lagoon contained relatively fewer young (less than 15 years of age) and old (60 years or older) than either the outer islands or the state as a whole. The age composition of municipalities varied considerably, particularly those with small populations.

Little information on births, deaths, and mobility is available for the years of Japanese administration. The general fertility rate varied between 1923







*DIFFERENT AGES USED FOR MALES (25-39, 40-59) AND FEMALES (25-44, 45-49).

FIGURE 3. **Population pyramids (Pacific Islanders only): 1925, 1930, 1935.**

TABLE 5. **Pacific Islander Population by Age and Municipality: 1930**

Area	Total Persons	Age Group (Percentage) <15	15-24	25-59	60+
Chuuk State	15,200	38.5	16.7	42.9	1.9
Chuuk Lagoon	10,162	38.0	17.0	43.3	1.6
Eot	120	40.8	16.7	41.7	0.8
Fanapanges	186	37.6	17.2	43.5	1.6
Fefen	1,221	36.5	15.2	45.4	2.9
Parem	135	20.7	20.7	57.8	0.7
Ramanum	289	31.8	16.6	50.9	0.7
Siis	143	35.0	17.5	47.6	-
Tol	2,508	39.4	14.7	44.1	1.9
Tonoas	1,443	41.0	23.4	34.8	0.8
Udot	535	30.7	18.9	48.4	2.1
Uman	969	42.3	15.8	40.0	1.9
Weno	2,613	37.2	16.6	44.9	1.4
Outer Islands	5,038	39.6	15.9	41.9	2.6
Fananu	132	34.8	12.1	53.0	-
Murillo	118	35.6	9.3	54.2	0.8
Nomwin	106	36.8	16.0	46.2	0.9
Ruo	107	38.3	13.1	46.7	1.9
Ettal	283	37.8	15.9	41.0	5.3
Kuttu	357	45.9	15.7	35.0	3.4
Lukunoch	496	46.2	12.3	37.3	4.2
Moch	278	43.2	16.2	39.6	1.1
Namoluk	322	36.6	19.9	40.1	3.4
Oneop	333	43.8	12.9	40.8	2.4
Satawan	264	38.6	17.0	41.3	3.0
T a	142	36.6	15.5	42.3	5.6
Losap	311	40.5	18.3	36.0	5.1
Nama	389	44.0	14.4	40.1	1.5
Piis-Emmwar	225	42.2	22.2	31.1	4.4
Onanu	64	42.2	15.6	42.2	-
Onou	58	34.5	19.0	44.8	1.7
Onoun[a]	131	44.3	13.7	41.2	0.8
Piherarh	52	32.7	30.8	36.5	-
Houk	226	30.1	23.5	44.7	1.8
Pollap	159	31.4	15.7	52.8	-
Polowat	364	29.1	12.9	57.4	0.5
Tamatam	121	43.8	15.7	40.5	-

Source: Nan'yo-cho 1931.

Note: In this and following tables, percentages may not sum to 100.0 due to rounding. Others reasons for not summing to 100.0% are noted in each case.

[a] Included Makur in 1930.

and 1930, ranging from a low of 91.0 in 1929 to a high of 130.7 in 1930 for women aged 15 to 50 years (Yanaihara 194035). The crude birth rate averaged 23.8 for the years 1925 through 1929 inclusive, exceeded slightly by the crude death rate of 24.1 over the same five years (Yanaihara 1940:46).[6] More detailed data on mobility are available for 1930, through comparing residence in 1930 with place of registration (Table 6). These data indicate that the vast majority of the 1930 Pacific Islander population of Chuuk State resided in the same municipality where registered, with most of the remainder registered elsewhere in the state.

Chuuk State population declined slightly between 1930 and 1935, the total number of Pacific Islanders decreasing by 71 individuals during the five-year period (see Table 2; Nan'yō-chō 1937). This decline occurred in the outer islands. The lagoon population actually increased slightly during the early 1930s (see Table 3), accounting for about 67 percent of the total state population in 1935. Although Weno and Tol continued to feature the largest numbers of Pacific Islanders of any municipalities in the lagoon, both experienced population declines between 1930 and 1935. Population growth on Tonoas Island more than compensated for these declines, as Dublon town grew both in size and importance. Most outer islands also experienced slight decreases in population over the first five years of the 1930s.

The age composition of the 1935 Pacific Islander population generally resembled that found in the previous two censuses (see Figure 3), a median age of 21.3 years indicating an increasingly youthful total population. Data on age composition by municipality, also available for 1935 (Table 7), underscore the minimal demographic changes that occurred during the preceding five years. Chuuk Lagoon continued to contain a larger proportion of persons in the two central age groups (15-24 and 25-59 years) than the outer islands, possibly an indication of individuals coming to the lagoon to work or attend school. The age composition of Tonoas Island is particularly noteworthy in this regard, with nearly 29 percent of its Pacific Islander population aged 15-24 years (compared to about 18 percent for the state as a whole). The age composition of many other municipalities varied widely, with the greatest variability once again evident in places with relatively small populations.

Data helping to explain the population change between 1930 and 1935 once again are scanty. Both fertility and mortality apparently remained low, with crude birth rate (30.1) slightly exceeding crude death rate (27.8) in 1935 (Yanaihara 1940:46; note that the 1935 crude birth rate calculated from fertility data [Japan 1936] yields a value of 30.4). Data on mobility comparable with those presented for 1930 unfortunately are unavailable.

TABLE 6. **Pacific Islander Population by Municipality, according to Place of Registration: 1930**

Area	Total Persons	Place of Registration (Percentage)			
		Same Locality	Same District[a]	Other District[a]	Other Location[b]
Chuuk State	15,200	89.0	10.3	0.5	0.1
Chuuk Lagoon	10,162	86.6	12.7	0.5	0.2
Eot	120	82.5	17.5	-	-
Fanapanges	186	93.0	7.0	-	-
Fefen	1,221	79.0	19.1	1.1	0.7
Parem	135	83.0	16.3	0.7	-
Ramanum	289	96.5	3.5	-	-
Siis	143	91.6	8.4	-	-
Tol	2,508	95.1	4.9	-	-
Tonoas	1,443	65.8	33.1	0.5	0.6
Udot	535	80.6	18.9	0.6	-
Uman	969	92.8	7.1	0.1	-
Weno	2,613	91.1	8.2	0.8	-
Outer Islands	5,038	93.8	5.5	0.7	-
Fananu	132	83.3	15.9	-	0.8
Murillo	118	90.7	9.3	-	-
Nomwin	106	91.5	7.5	0.9	-
Ruo	107	94.4	5.6	-	-
Ettal	283	95.8	3.9	0.4	-
Kuttu	357	95.8	4.2	-	-
Lukunoch	496	97.8	2.2	-	-
Moch	278	96.8	3.2	-	-
Namoluk	322	92.9	7.1	-	-
Oneop	333	96.1	1.8	2.1	-
Satawan	264	91.7	7.6	0.4	0.4
Ta	142	73.9	26.1	-	-
Losap	311	98.7	1.3	-	-
Nama	389	98.5	1.5	-	-
Piis-Emmwar	225	98.2	1.8	-	-
Onanu	64	87.5	10.9	1.6	-
Onou	58	70.7	29.3	-	-
Onoun[c]	131	64.9	32.1	3.1	-
Piherarh	52	63.5	34.6	1.9	-
Houk	226	95.6	-	4.4	-
Pollap	159	99.4	0.6	-	-
Polowat	364	98.1	-	1.9	-
Tamatam	121	98.3	1.7	-	-

Source: Nan'yo-cho 1931.

[a] Refers to major island districts within the Mandated Territory (e.g., Truk District).

[b] Refers to locations outside the Mandated Territory.

[c] Included Makur in 1930.

TABLE 7. **Pacific Islander Population by Age and Municipality: 1935**

Area	Total Persons	Age Group (Percentage) <15	15-24	25-59	60+
Chuuk State	15,129	37.8	18.4	41.0	2.8
Chuuk Lagoon	10,180	36.9	18.9	41.3	2.9
Eot	102	40.2	13.7	42.2	3.9
Fanapanges	173	39.9	16.2	42.2	1.7
Fefen	1,236	38.3	18.0	40.2	3.4
Parem	134	30.6	14.9	53.0	1.5
Ramanum	229	31.0	14.4	52.0	2.6
Siis	112	36.6	18.8	42.0	2.7
Tol	2,367	40.1	16.3	41.0	2.6
Tonoas	1,923	31.6	28.5	38.9	1.0
Udot	517	33.3	17.4	45.8	3.5
Uman	974	41.5	16.0	38.5	4.0
Weno	2,413	36.6	16.9	42.4	4.0
Outer Islands	4,949	39.7	17.2	40.5	2.6
Fananu	114	29.8	20.2	47.4	2.6
Murillo	118	39.0	10.2	47.5	3.4
Nomwin	101	40.6	10.9	47.5	1.0
Ruo	105	35.2	12.4	50.5	1.9
Ettal	238	39.5	15.1	42.9	2.5
Kuttu	330	41.5	21.5	34.5	2.4
Lukunoch	476	44.5	18.9	33.6	2.9
Moch	270	41.5	14.8	42.2	1.5
Namoluk	287	40.1	16.0	41.8	2.1
Oneop	405	47.7	18.0	31.6	2.7
Satawan	280	37.9	17.5	40.7	3.9
Ta	149	38.3	16.1	41.6	4.0
Losap	326	41.7	16.0	39.3	3.1
Nama	405	41.5	18.0	39.0	1.5
Piis-Emmwar	235	45.1	19.1	33.2	2.6
Onanu	72	37.5	23.6	36.1	2.8
Onou	55	32.7	16.4	49.1	1.8
Onoun[a]	122	36.9	21.3	41.0	0.8
Piherarh	49	34.7	18.4	46.9	
Houk	222	32.9	18.0	45.0	4.1
Pollap	153	38.6	12.4	47.1	2.0
Polowat	335	26.0	17.3	52.5	4.2
Tamatam	102	43.1	15.7	40.2	1.0

Source: Nan'yo-cho 1937.

[a] Included Makur in 1935.

Regional Demography in 1958

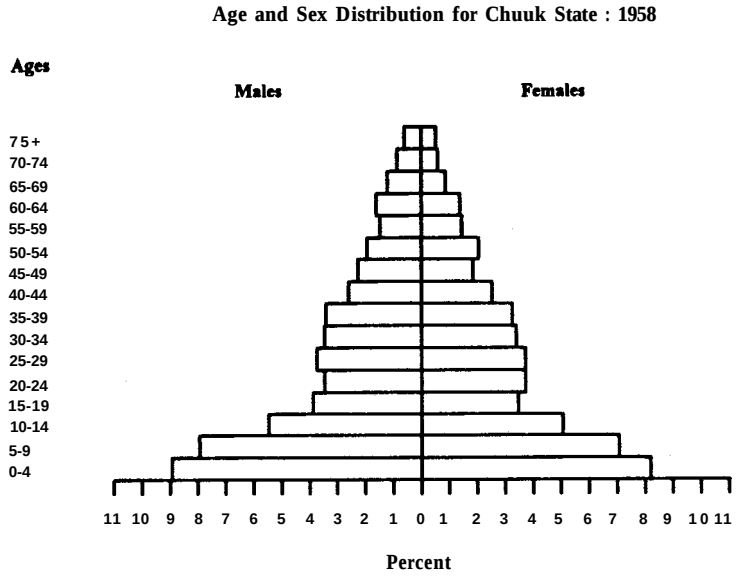
It was not until 1958 that another census of Chuuk State occurred, conducted by the TTPI administration (Office of the High Commissioner 1959). Resulting data indicate that the population increased by nearly 5,000 individuals over the total recorded by the previous census twenty-three years earlier, at an average annual rate of 1.2 percent (see Table 2). Of course, the period between 1935 and 1958 includes World War II and the likely depopulation that occurred then. If the 1946 population estimate mentioned earlier of nearly 13,900 is accurate, the average annual rate of population growth between that year and 1958 increases to 3.2 percent.

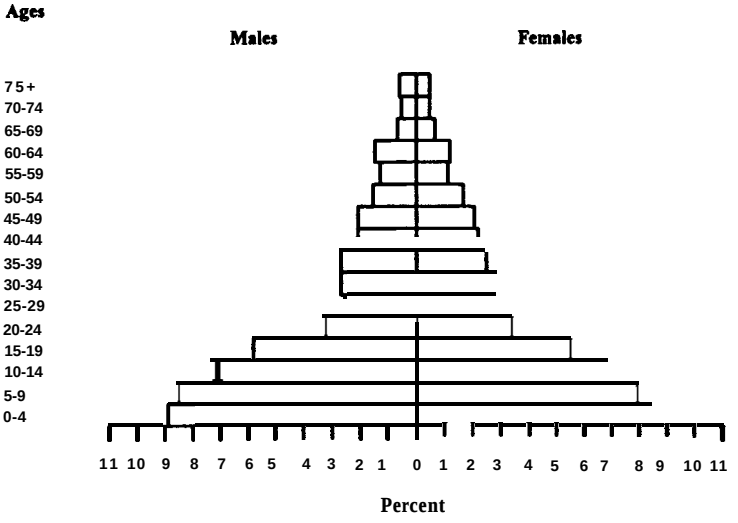
Although the population of both Chuuk Lagoon and the outer islands increased between 1935 and 1958, most growth occurred in the lagoon (see Table 3). In 1958 the lagoon contained 70 percent of the state population, a slight increase from prewar levels. Weno and Tol municipalities continued to dominate state demography, together accounting for nearly 40 percent of the total; the population of Tonoas Island, in contrast, declined by nearly 400 persons between 1935 and 1958. The outer-island population grew more slowly between 1935 and 1958 than that of the lagoon, though most municipalities witnessed an increase. Males continued to outnumber females slightly and the median age declined to 20.3 years (Figure 4). This increasingly youthful population suggests that natural growth (births minus deaths) played an important role in the demographic increase that occurred between 1935 and 1958. Unfortunately, reliable data on fertility, mortality, and migration all are lacking for 1958.

Regional Demography in 1967

The 1967 census indicates that the population of Chuuk State continued its post-World War II growth, the addition of nearly 5,000 more people representing a 2.5 percent average annual increase since 1958 (see Table 2; School of Public Health n.d.). The lagoon experienced the greatest demographic growth, accounting for more than 72 percent of the total state population (see Table 3). The populations of all lagoon municipalities increased between 1958 and 1967, with the combined populations of Weno and Tol totaling nearly 42 percent of all Chuuk State inhabitants. The population of all but four outer-island municipalities also grew over this nine-year period.

Two 1958 characteristics continued into 1967: a slight excess in males over females, and a (particularly) youthful population, with the median age (islanders only) declining to only 16.0 years (see Figure 4). Data from the 1967 census on age composition by municipality highlight the changes in





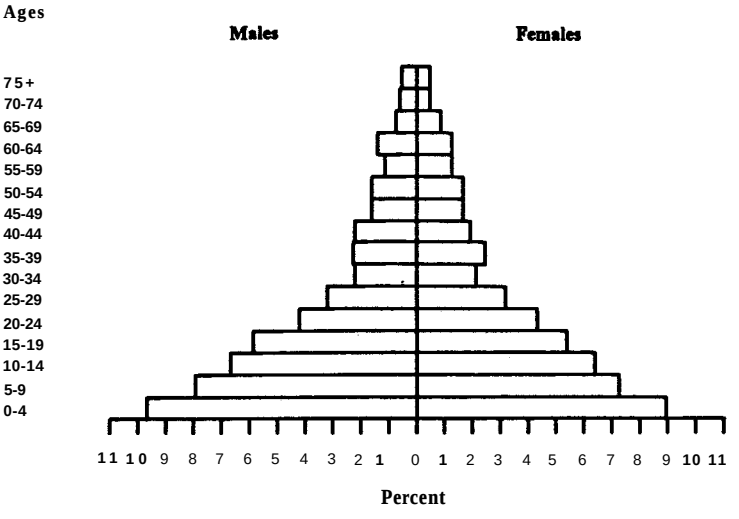


FIGURE 4. **Population pyramids: 1958, 1967, 1973.**

age structure that had occurred throughout the state since the Japanese administration (Table 8). The lagoon age composition generally resembled that of the outer islands--with the latter containing relatively fewer individuals aged 15-24 years and relatively more aged 60 years or greater. The age structure of municipalities varied, with the composition of places with larger populations (Fefen, Tol, Tonoas, Uman, and Weno) broadly similar to one another.

Fertility data in 1967 indicate a crude birth rate only slightly higher than that recorded in 1935 (Table 9). Considered with general and total fertility measures, the crude birth rate indicates moderate-to-high fertility that generally is comparable to other parts of Micronesia (see Levin and Retherford 1986). Fertility measures calculated from a different source than that used for Table 9 indicate a slightly higher level of reproduction for Chuuk State as a whole in 1967, with the highest fertility found in Chuuk Lagoon (Table 10). Three of the five most populated municipalities featured natality in excess of that for the state as a whole. Fertility for smaller populations varied considerably--mainly a function of the small numbers involved and providing only limited insights on reproductive levels. Mortality data indicate that most deaths involved individuals aged 5 years or younger and 70 years or older (Table 11). The low crude death rate compared to the crude birth rate suggests that natural increase played a key role in population growth (Table 12). Unfortunately, mobility data for 1967 are unavailable, although intrastate movement likely played an important role in many municipalities--such as the emigration from Ramanum that helped counter natural population growth on that island (Goodenough 1978:198).

Regional Demography in 1973

The U.S. Bureau of the Census conducted its first census of the TTPI in 1970 (U.S. Bureau of the Census 1972). Unfortunately, recording, editing, and tabulation errors made the resulting data of questionable use for most of the Trust Territory in general and Chuuk State in particular--with populations for several municipalities, as well as the state as a whole, unavailable (and other figures of questionable accuracy) (see Table 3). Because of these problems another census was conducted in 1973 (Office of Census Coordinator 1975).

The 1973 census recorded more than 31,600 residents, an addition of more than 6,500 persons since 1967 as a result of average annual growth reaching 3.9 percent (see Table 2). Much of this growth occurred in Chuuk Lagoon, where the 1973 population had increased to account for nearly 77 percent of the state total (see Table 3). Weno and Tol municipalities contin-

TABLE 8. **Population by Age and Municipality: 1967**

Area	Total Persons	Age Group (Percentage)[a] <15	15-24	25-59	60+
Chuuk State	25,107	45.4	17.0	27.9	5.6
Chuuk Lagoon	18,141	45.4	17.2	27.6	5.3
Eot	217	44.7	16.6	22.6	4.6
Fanapanges	306	41.8	18.6	22.9	4.6
Fefen	2,042	48.8	15.8	27.6	5.4
Parem	134	46.3	9.0	31.3	12.7
Ramanum	283	43.5	19.1	32.9	3.2
Siis	244	45.9	16.0	25.8	8.2
Tol	4,486	46.5	16.8	26.8	5.4
Tonoas	2,021	46.3	17.8	27.6	6.5
Udot	874	45.4	15.3	28.6	7.2
Uman	1,621	47.3	17.8	26.4	5.1
Weno	5,913	42.9	17.9	28.6	4.5
Outer Islands	6,966	45.4	16.5	28.6	6.2
Fananu	155	50.3	18.7	24.5	4.5
Murillo	235	48.5	21.3	24.3	5.5
Nomwin	279	46.2	22.9	24.4	5.4
Ruo	184	51.6	16.8	24.5	5.4
Ettal	298	41.9	19.8	29.9	7.4
Kuttu	496	46.0	19.2	28.4	5.6
Lukunoch	549	46.6	14.6	28.4	6.9
Moch	515	39.0	21.0	31.3	6.6
Namoluk	306	44.8	21.2	26.1	6.9
Oneop	427	43.1	16.6	23.0	7.0
Satawan	508	43.7	20.7	28.0	6.3
Ta	249	45.8	15.3	29.3	2.4
Losap	452	48.9	17.3	26.5	6.6
Nama	534	49.3	14.2	27.0	8.6
Piis-Emmwar	213	48.4	18.3	23.9	8.0
Makur	50	50.0	18.0	30.0	2.0
Onanu	37	40.5	10.8	10.8	-
Onou	38	42.1	18.4	18.4	-
Onoun	242	44.2	11.2	36.8	6.2
Piherarh	67	43.3	10.4	10.4	-
Houk	290	46.2	10.7	38.3	2.8
Pollap	304	52.3	9.9	32.9	4.3
Polowat	410	35.9	6.8	39.0	9.0
Tamatam	128	50.0	12.5	28.1	8.6

Source: School of Public Health n.d.

[a] Percentages may not sum precisely to 100.0 due to exclusion of 749 individuals whose ages were "not specified" and 286 individuals who were "foreign born" (whose ages similarly were not specified).

TABLE 9. **Measures of Fertility for Chuuk State: Select Census Years**

Year	Total Persons	Total Births	Crude Birth Rate	General Fertility Rate	Total Fertility Rate
1967[a]	25,107	803	32.0	161.3	5,633
1973	31,609	855	27.0	131.0	4,383
1980[a]	37,488	1,167	31.1	145.5	4,751
1989[b]	47,871	1,596	33.3	157.8	5,312

Sources: School of Public Health n.d.; U.S. Bureau of the Census 1972, 1983a; U.S. Dept. of State 1981, 1982; Office of Planning and Statistics 1992a.

[a] Measures for 1967 and 1980 differ from those presented in Table 10, due to conflicting data. The data here are reported births in all of Chuuk State for each year and thus should be comparable across years. Unfortunately, these same data are not available for each municipality, requiring the use of different data sources for Table 10.

[b] General fertility rate and total fertility rate calculations for 1989 excluded 9 births to women of unknown age. Measures for 1989 based on data reported in the 1989 census, as the number of *reported* births (used for the other three years) was 471 less than the number recorded in the census.

ued to dominate lagoon demography, together accounting for nearly 48 percent of the total. The changes in the outer islands varied, some gaming and others losing population since 1967.

The age-sex composition of the 1973 Chuuk State population generally resembled that reported in 1967, featuring slightly more males than females, a relatively large proportion of individuals aged 25 years or less, and a median age of 16.5 years (see Figure 4). The age structure of individual municipalities once again varied widely (Table 13), though in some cases key differences provide clues to the causes of population growth that occurred after 1967. For example, the outer islands contained relatively more individuals aged 15 years or younger and 60 years or older, and relatively fewer individuals aged 15-24 years, than did Chuuk Lagoon--suggesting that many persons aged 15-24 years may have moved to the lagoon. Age composition discrepancies are particularly obvious for Weno, the municipality that experienced the greatest population growth between 1967 and 1973--with relatively large percentages of residents in the two central age groups suggesting immigration from other parts of the state to capitalize on the educational or employment opportunities in the emerging population center.

TABLE 10. **Fertility Measures by Municipality: 1967 and 1980**

Area	1967					1980				
	Total Persons	Total Births[a]	Crude Birth Rate	General Fertility Rate	Total Fertility Rate	Total Persons	Total Births	Crude Birth Rate	General Fertility Rate	Total Fertility Rate
Chuuk State	25,107	931	37.1	159.1	5,706.	37,488	1,302	34.7	162.3	5,675
Chuuk Lagoon	18,141	701	38.6	167.9	6,040	28,328	970	34.2	160.4	5,529
Eot	217	8	36.9	166.7	8,667	181	11	60.8	268.3	6,435
Fanapanges	306	7	22.9	109.1	3,569	401	4	10.0	47.1	2,390
Fefen	2,042	66	32.3	157.9	5,663	3,076	118	38.4	178.8	6,692
Parem	134	4	29.9	181.8	5,833	225	17	75.6	386.4	13,931
Ramanum	283	15	53.0	190.5	5,500	462	12	26.0	139.5	4,207
Siis	244	8	32.8	153.8	5,446	324	36	111.1	461.5	22,192
Tol	4,486	176	39.2	167.6	5,903	6,705	228	34.0	168.0	5,820
Tonoas	2,021	76	37.6	170.8	6,733	3,223	118	36.6	183.5	6.384
Udot	874	40	45.8	215.2	7,280	1,082	46	42.5	212.0	6,815
Uman	1,621	59	36.4	158.5	5,994	2,298	106	46.1	212.4	7,004
Weno	5,913	242	40.9	168.5	6,020	10,351	274	26.5	117.3	3,853
Outer Islands	6,966	230	33.0	136.8	4,863	9,160	332	36.2	168.0	6,106
Fananu	155	6	38.7	206.9	7,500	235	7	29.8	142.9	5,256
Murillo	235	5	21.3	111.1	2,265	325	19	58.5	339.3	12,016
Nomwin	279	7	25.1	90.9	4.190	322	12	37.3	179.1	5.494

Ta	249	7	28.1	87.0	2,986	295	9	30.5	142.9	4,520
Losap	452	16	35.4	150.5	5,872	587	9	15.3	75.0	2,536
Nama	534	29	54.3	226.1	7,797	1,027	32	31.3	162.4	5,359
Piis-Emmwar	217	12	56.3	238.1	7,917	240	6	25.0	133.3	3,778
Makur	50	2	40.0	NA	NA	97	7	72.2	333.3	18,833
Onanu	37					75	3	40.0	214.3	6,667
Onou	38	4	105.3	333.3	4,167	59	2	33.9	166.7	3,750
Onoun	242	15	62.0	269.2	9,683	434	29	66.8	276.2	14,374
Piherarh	67	3	44.8	NA	NA	118	5	42.4	227.3	7,083
Houk	290	6	20.7	67.8	1,955	205	14	68.3	285.7	9,718
Pollap	304	14	46.1	218.2	6,667	427	5	11.7	46.3	2,371
Polowat	410	12	29.3	116.3	4,004	441	21	47.6	218.8	8,769
Tamatam	128	8	62.5	280.0	6,833	188	9	47.9	243.2	10,750

Sources: School of Public Health n.d.; U.S. Bureau of the Census 1983b.

Note: Includes infants born to mothers aged < 15, >49, and of unknown age; the "unknown" group is used for crude birth rate but not general or total fertility rates.

[a] 1967 natality based on infants aged 1 year and younger and thus excludes those who were born alive but died during the first year of life before the survey date.

TABLE 11. **Registered Deaths in Chuuk State by Age Group: 1967, 1973, and 1980**

Age Group	1967[a]	1973	1980
	Number		
Total Deaths	189	83	184
	Percentage		
All Ages	100.0	100.0	100.0
< 1	16.9	16.9	26.6
1-4	13.8	9.6	13.6
5-9	2.6	1.2	2.2
10-14	1.1	1.2	1.1
15-19	-	-	2.2
20-24	1.6	3.6	2.2
25-29	0.5	1.2	3.3
30-34	1.6	4.8	3.3
35-39	5.8	4.8	1.1
40-44	1.6	2.4	4.3
45-49	3.7	7.2	3.8
50-54	5.3	1.2	4.3
55-59	3.7	8.4	7.1
60-64	7.9	10.8	5.4
65-69	3.2	7.2	5.4
70-74	11.1	8.4	4.3
75+	10.6	10.8	9.8

Sources: 1967 calculation based on deaths in the 11.5 months preceding the 1967 census, as presented in School of Public Health n.d.; 1973 and 1980 calculations based on deaths in calendar year, presented in U.S. Dept. of State 1982.

[a] Does not include 17 persons whose age at death was "not specified" and thus may not sum precisely to 100.0%.

Despite the growth and the youthful 1973 population, available data indicate a *decline* in fertility between 1967 and 1973 for all three measures considered (see Table 9). Although the age-specific distribution of mortality in 1973 generally resembled that reported for 1967 (see Table 11), mortality rates were lower in 1973 for all but one age group presented and the crude death rate decreased considerably (see Table 12)--preserving an excess of births over deaths and yielding similar crude rates of natural increase (crude birth rate minus crude death rate) for both census years. Mobility data for the TTPI-born population of Chuuk State in 1973 support the proposition

TABLE 12. **Age-Specific Death Rates in Chuuk State: 1967, 1973, and 1980**

Age Group	1967[a]	1973[a]	1980
Total	7.53	2.63	4.91
<1	34.33	10.61	34.85
1-4	8.10	1.77	4.69
5-9	1.28	0.21	0.70
10-14	0.60	0.25	0.41
15-19	-	-	0.99
20-24	1.92	1.14	1.22
25-29	0.78	0.52	2.10
30-34	2.29	3.03	2.72
35-39	9.25	2.74	1.52
40-44	3.06	1.61	6.46
45-49	7.24	5.85	5.79
50-54	13.21	0.96	8.21
55-59	13.26	9.87	14.08
60-64	26.36	11.21	12.85
65-69	18.52	12.40	17.15
70-74	80.77	20.23	22.60
75+	81.30	29.13	55.73

Sources: See Table 11.

[a] Includes individuals whose age group was "not stated"; 1967 total also includes 17 deaths where age was "not specified."

presented above concerning population change in different areas: Chuuk Lagoon contained markedly higher percentages of individuals who considered another portion of Chuuk State or the TTPI home (Table 14). Much of this tendency is due to the heavy movement to Weno Island. Relatively large percentages of individuals living in Onoun and Satawan municipalities in 1973 also considered another part of Chuuk State home--having grown considerably since 1967 as both assumed the role of subdistrict centers, each featuring (among other things) one of the state's two outer-island junior high schools. In contrast, most outer islands both received and contributed relatively few migrants, the greatest emigration coming from the Mortlocks (Connell 1983:25).

Regional Demography in 1980

The U.S. Bureau of the Census conducted its second census of Chuuk State in 1980, recording a population that had grown by 5,879 persons over the preceding seven years at an annual average of 2.5 percent (see Table 2; U.S.

TABLE 13. **Population by Age and Municipality: 1973**

Area	Total Persons	Age Group (Percentage)[a] <15	15-24	25-59	60+
Chuuk State	31,609[b]	46.3	19.5	27.6	6.1
Chuuk Lagoon	24,216	45.4	20.6	27.6	5.9
Eot	192	43.8	23.4	27.1	5.7
Fanapanges	341	45.7	18.8	30.5	4.7
Fefen	2,478	50.1	16.4	27.3	6.0
Parem	203	43.8	20.2	26.1	9.4
Ramanum	375	52.5	11.2	28.8	6.9
Siis	241	50.6	14.9	25.7	7.5
Tol	5,439	49.1	18.0	25.9	6.5
Tonoas	2,558	49.1	17.2	26.6	6.0
Udot	930	49.2	15.1	26.3	9.2
Uman	1,891	49.8	16.7	25.9	6.3
Weno	9,568	39.5	25.8	29.2	5.0
Outer Islands	7,350	49.6	15.8	27.5	7.0
Fananu	179	50.3	15.6	28.5	4.5
Murillo	203	58.6	14.3	20.7	6.0
Nomwin	293	53.6	13.7	30.0	2.7
Ruo	180	53.3	16.7	26.1	3.9
Ettal	266	48.1	12.0	32.0	7.9
Kuttu	383	47.5	11.5	31.9	8.9
Lukunoch	505	48.7	13.3	30.7	7.3
Moch	443	46.0	14.7	31.8	7.2
Namoluk	263	56.3	5.3	31.2	7.2
Oneop	404	49.8	11.9	29.7	8.4
Satawan	826	36.7	38.4	21.2	3.8
Ta	229	43.7	14.4	33.2	8.7
Losap	438	55.9	9.1	25.8	8.7
Nama	702	57.5	9.1	23.9	9.3
Piis-Emmwar	226	55.8	11.9	22.1	10.2
Makur	66	57.6	10.6	24.2	6.1
Onanu	47	44.7	6.4	42.6	6.4
Onou	41	58.5	-	36.6	4.9
Onoun	375	37.3	37.6	19.5	5.3
Piherarh	111	53.2	13.5	27.9	4.5
Houk	265	53.2	9.1	33.2	4.2
Pollap	316	54.4	13.3	26.3	6.0
Polowat	435	48.7	9.7	30.6	11.0
Tamatam	154	59.1	3.9	29.9	7.1

Source: Office of Census Coordinator 1975.

[a] Percentages do not sum to precisely 100.0 due to exclusion of 151 individuals whose ages were "not specified."

[b] Includes 43 individuals whose place of residence was "not specified."

TABLE 14. **TTPI-born Population by Municipality of Usual Residence, According to Home District: 1973**

Usual Residence	Total Persons	Home District (Percentage)			
		Same Municipality	Elsewhere in Chuuk	Elsewhere in TTPI	Outside TTPI
Chuuk State	31,218	83.3	16.1	0.6	-
Chuuk Lagoon	23,889	80.7	18.5	0.8	-
Eot	192	90.6	9.4	-	-
Fanapanges	341	95.9	4.1	-	-
Fefen	2,474	94.3	5.6	0.1	-
Parem	203	94.6	5.4	-	-
Ramanum	375	93.6	6.4	-	-
Siis	241	88.4	11.2	0.4	-
Tol	5,415	97.0	2.9	0.1	-
Tonoas	2,539	92.2	7.4	0.3	-
Udot	929	91.1	8.9	-	-
Uman	1,890	97.7	2.2	0.1	-
Weno	9,290	58.1	40.0	1.9	-
Outer Islands	7,329	91.7	8.3	0.1	-
Fananu	179	98.9	1.1	-	-
Murillo	203	98.0	2.0	-	-
Nomwin	289	98.3	1.7	-	-
Ruo	180	98.3	1.1	0.6	-
Ettal	266	95.1	4.9	-	-
Kuttu	383	100.0	-	-	-
Lukunoch	504	97.8	2.2	-	-
Moch	443	98.0	2.0	-	-
Namoluk	263	97.3	2.3	0.4	-
Oneop	404	95.0	5.0	-	-
Satawan	816	62.9	37.1	-	-
Ta	228	93.4	5.7	0.9	-
Losap	438	98.4	1.6	-	-
Nama	702	99.1	0.9	-	-
Piis-Emmwar	225	99.6	-	0.4	-
Makur	66	83.3	16.7	-	-
Onanu	47	91.5	8.5	-	-
Onou	41	100.0	-	-	-
Onoun	371	63.1	36.9	-	-
Piherarh	111	79.3	19.8	0.9	-
Houk	265	95.5	4.5	-	-
Pollap	316	100.0	-	-	-
Polowat	435	99.3	0.7	-	-
Tamatam	154	90.3	9.7	-	-

Source: Office of Census Coordinator 1975.

Note: Calculations do not include 391 individuals whose usual residence or home district was "not stated."

Bureau of the Census 1983a). Most growth once again occurred in Chuuk Lagoon, though that area's share of the state population declined slightly from the 1973 level (see Table 3). Weno and Tol municipalities continued to contain the greatest percentages of lagoon inhabitants, together accounting for almost 46 percent of the state total--the slight decline in lagoon demographic dominance accounted for by the decrease in Weno's share of the state population.

The 1980 population remained youthful, with a median age of 16.5 years

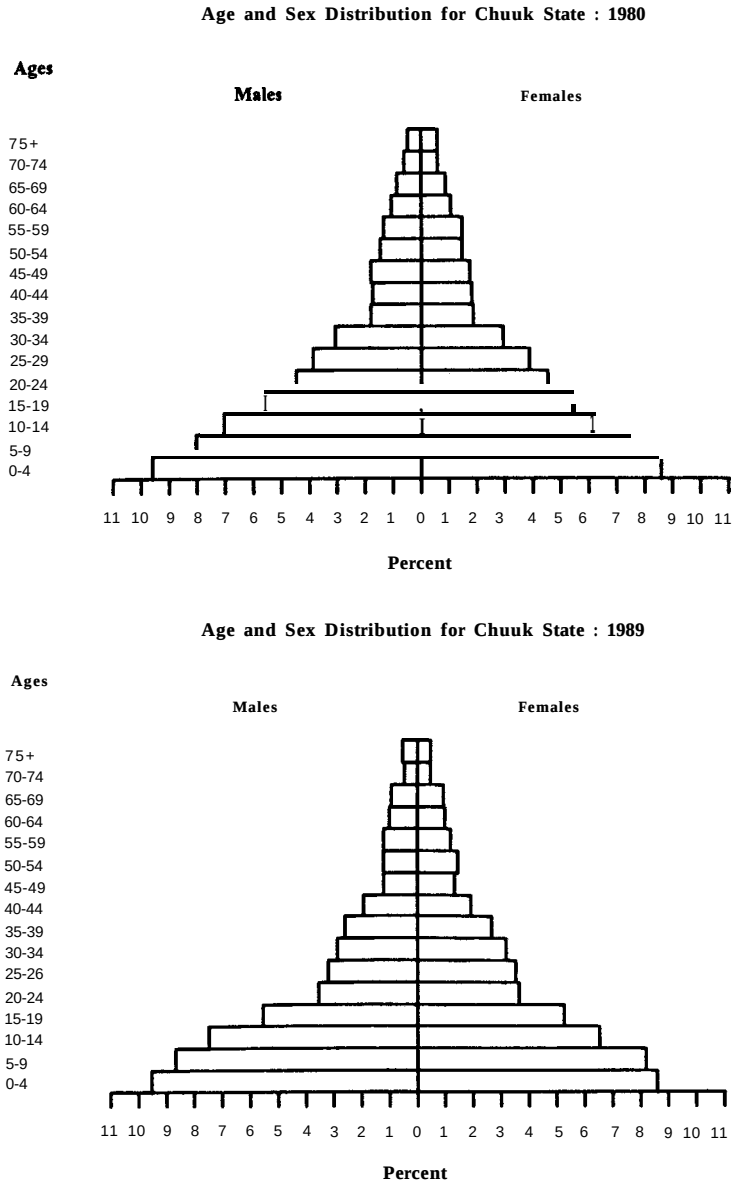


FIGURE 5. **Population pyramids: 1980, 1989.**

(U.S. Bureau of the Census 1983a:14), and contained slightly more males than females (Figure 5). But the age structure of different portions of Chuuk State changed between 1973 and 1980, with Chuuk Lagoon containing a greater percentage of individuals younger than 15 years and a smaller percentage of individuals aged 15-24 years than the outer islands (Table 15). Weno Municipality once again featured proportionally more individuals aged 15-59 years than the state as a whole, suggesting that its attraction for education- and working-age persons persisted. Nama Island, which experienced a demographic increase of more than 45 percent between 1973 and 1980, featured a particularly young population in the latter year--nearly 52 percent were aged 15 years or younger.

Fertility data for Chuuk State as a whole indicate a resurgence of reproduction levels towards those recorded in 1967, with all three measures considered in this study higher than 1973 levels (see Table 9). Municipality-specific fertility, once again measured with different data than those used for the entire state, supports the general picture of resurging fertility--though with considerable geographic variability as natality generally was higher on the outer islands than in the lagoon (see Table 10). One point worth noting is the relatively low fertility for Weno Island, with values for all three measures calculated well below state levels. Statewide mortality also increased beyond 1973 levels, with growth particularly evident in infant mortality and mortality of individuals aged 75 years or older (see Tables 11 and 12).

Mobility within the state continued to play an important role in shaping the geographic distribution of population. Somewhat surprisingly, outer-island municipalities received more migrants than their lagoon counterparts, at least over the short term (Table 16). As usual, specific emigration patterns are more difficult to trace with available data--such as the surge in movement from Namoluk Atoll to Chuuk Lagoon during the mid-1970s in response to emerging educational opportunities in the lagoon (Marshall 1979a:3-5). The relatively large influx to outer-island municipalities by 1980 may represent return migration of outer islanders from Chuuk Lagoon in response to depressed employment opportunities in the lagoon during the late 1970s (Hezel and Levin 1990:53-56; see also Connell 1983:39-41).

Regional Demography in 1989

In 1989 the FSM Office of Planning and Statistics conducted the most recent census of Chuuk State (Office of Planning and Statistics 1992a). Average annual demographic growth of 2.8 percent since 1980 added nearly 10,400 more persons as the state population approached 47,900 (see Table 2). Most of the demographic increase during the 1980s occurred in Chuuk

TABLE 15. **Population by Age and Municipality: 1980**

Area	Total Persons	Age Group (Percentage) <15	15-24	25-59	60+
Chuuk State	37,488	46.4	19.5	28.6	5.4
Chuuk Lagoon	28,328	46.9	19.2	28.9	5.0
Eot	181	42.0	21.5	29.3	7.2
Fanapanges	401	47.4	21.9	25.2	5.5
Fefen	3,076	46.5	20.4	27.8	5.4
Parem	225	43.6	19.6	28.4	8.4
Ramanum	462	53.9	17.5	26.2	2.4
Siis	324	46.9	17.6	26.5	9.0
Tol	6,705	49.6	18.4	26.7	5.3
Tonoas	3,223	49.3	18.4	27.2	5.1
Udot	1,082	48.9	18.9	26.2	6.0
Uman	2,298	46.6	19.0	28.9	5.5
Weno	10,351	44.2	19.7	31.7	4.4
Outer Islands	9,160	45.0	20.5	27.7	6.7
Fananu	235	50.2	22.6	23.4	3.8
Murillo	325	51.4	18.2	24.9	5.5
Nomwin	322	49.7	13.0	31.7	5.6
Ruo	293	46.4	19.8	29.0	4.8
Ettal	446	35.2	26.7	31.6	6.5
Kuttu	483	47.4	13.3	30.4	8.9
Lukunoch	666	42.2	20.6	32.0	5.3
Moch	632	43.8	18.8	29.1	8.2
Namoluk	324	44.1	21.0	26.9	8.0
Oneop	480	42.1	17.5	31.3	9.2
Satawan	767	44.5	20.6	29.9	5.1
Ta	295	43.1	21.4	29.8	5.8
Losap	587	45.0	21.8	27.6	5.6
Nama	1,021	51.9	18.2	22.2	7.6
Piis-Emmwar	240	42.5	23.3	28.3	5.8
Makur	97	49.5	22.7	19.6	8.2
Onanu	75	46.7	18.7	26.7	8.0
Onou	59	54.2	6.8	33.9	5.1
Onoun	434	37.8	37.3	20.0	4.8
Piherarh	118	48.3	13.6	28.0	10.2
Houk	205	42.9	17.1	32.2	7.8
Pollap	427	44.7	25.3	24.4	5.6
Polowat	441	40.1	20.0	28.3	11.6
Tamatam	188	51.6	19.7	24.5	4.3

Source: U.S. Bureau of the Census 1983a.

TABLE 16. **Population by Municipality, According to Place of Residence in 1975: 1980**

Area	Total Persons[a]	Place of Residence in 1975 (Percentage)			
		Same Municipality	Elsewhere in Chuuk	Elsewhere in TTPI	Outside TTPI
Chuuk State	28,914	92.2	6.8	0.4	0.6
Chuuk Lagoon	22,189	93.7	5.4	0.4	0.6
Eot	148	98.6	0.7	0.7	-
Fanapanges	288	97.9	2.1	-	-
Fefen	2,506	94.6	4.6	0.3	0.4
Parem	185	99.5	0.5	-	-
Ramanum	362	98.9	1.1	-	-
Siis	255	97.3	2.4	-	0.4
Tol	5,202	97.4	2.2	0.2	0.2
Tonoas	2,516	98.6	1.0	0.2	0.2
Udot	841	95.2	4.4	0.4	-
Uman	1,783	79.6	19.6	0.1	0.6
Weno	8,103	91.6	6.6	0.6	1.2
Outer Islands	6,725	87.3	11.5	0.6	0.6
Fananu	190	97.9	2.1	-	-
Murillo	259	99.6	0.4	-	-
Nomwin	238	99.6	0.4	-	-
Ruo	228	96.9	1.3	-	1.8
Ettal	339	85.8	11.5	1.8	0.9
Kuttu	373	34.0	63.8	1.3	0.8
Lukunoch	379	100.0	-	-	-
Moch	504	85.1	14.1	0.4	0.4
Namoluk	260	85.4	10.8	1.5	2.3
Oneop	397	68.5	29.5	1.8	0.3
Satawan	622	96.6	1.4	0.6	1.3
Ta	231	76.6	19.0	3.0	1.3
Losap	345	99.7	0.3	-	-
Nama	807	85.3	13.5	0.5	0.7
Piis-Emmwar	193	78.8	20.2	0.5	0.5
Makur	76	92.1	7.9	-	-
Onanu	61	85.2	14.8	-	-
Onou	44	100.0	-	-	-
Onoun	305	91.1	8.5	0.3	-
Piherarh	101	93.1	5.9	1.0	-
Houk	143	88.8	11.2	-	-
Pollap	359	98.9	1.1	-	-
Polowat	119	100.0	-	-	-
Tamatam	152	99.3	-	-	0.7

Source: U.S. Bureau of the Census 1983b.

[a] Includes only those individuals older than 5 years of age; excludes 7 individuals whose place of residence in 1975 was not given.

Lagoon; all component municipalities of that island group witnessed population growth since 1980, the lagoon total accounting for more than 80 percent of 1989 Chuuk State residents (see Table 3). Together Weno and Tol municipalities contained 50 percent of the state population, Weno accounting for nearly one-third of the total. Several outer-island municipalities, in contrast, experienced depopulation during the 1980s.

The 1989 population of Chuuk State was the youngest ever recorded, with the median age dropping to 15.8 years; males once again slightly exceeded females (see Figure 5). The age composition of the major geographic regions was similar to that recorded in 1973, with the lagoon containing proportionally fewer individuals younger than 15 years and proportionally more aged 15-59 years (Table 17). These tendencies were particularly evident in Weno Municipality--likely another indication of people moving to Weno Island for employment and education. Age composition once again varied greatly between individual municipalities both within the lagoon and in the outer islands.

Natality increased over 1980 levels for all three fertility measures employed (see Table 9). Limited mortality data are available for Chuuk State in 1989, with estimates of the crude death rate ranging between 6.5 and 8.7 (Office of Planning and Statistics 1992a).[7] Much of the population growth between 1980 and 1989 thus apparently occurred as a consequence of fertility exceeding mortality, continuing the trend seen following World War II. Mobility once more affected the geographic distribution of population: most of this mobility occurred in Chuuk Lagoon, led again by Weno Island (Table 18)--further evidence that much of the population growth there during the 1980s resulted from in-migration. Although mobility data for certain outer-island municipalities indicated considerable in-migration a well, all tended to involve small populations that would limit the absolute number of persons relocating.

Evolving Regional Demography in Chuuk State: Causes, Results, and Repercussions

The Mechanisms of Population Change in Chuuk State

Available evidence indicates that Chuuk State population declined during the late nineteenth and early twentieth centuries, though the particulars of this depopulation are scanty. During the period covered by systematic censuses, the demography of the area went through two phases: a period when population remained relatively constant, during the Japanese period of administration, and a period of sustained, often rapid population growth fol-

TABLE 17. **Population by Age and Municipality: 1989**

Area	Total Persons	Age Group (Percentage)[a] <15	15-24	25-59	60+
Chuuk State	47,871	48.2	17.7	28.2	5.3
Chuuk Lagoon	38,341	47.7	18.6	28.3	4.9
Eot	279	54.1	14.0	24.7	7.2
Fanapanges	447	47.7	16.8	32.4	3.1
Fefen	3,902	50.1	16.6	27.8	5.4
Parem	350	50.3	12.9	32.6	4.3
Ramanum	679	48.5	20.6	26.5	4.3
Siis	438	53.0	14.2	26.3	5.7
Tol	8,346	51.1	17.6	26.0	4.9
Tonoas	3,870	48.8	17.9	27.6	5.4
Udot	1,513	51.4	16.8	26.5	5.0
Uman	2,895	50.4	15.4	28.0	5.9
Weno	15,622	43.8	20.8	30.0	4.4
Outer Islands	9,530	50.2	14.3	28.1	7.0
Fananu	238	54.2	13.9	26.5	5.0
Murillo	296	54.1	10.5	28.4	5.4
Nomwin	386	50.3	11.9	30.8	6.7
Ruo	398	50.5	15.8	28.9	4.0
Ettal	420	39.5	14.0	36.2	9.8
Kuttu	423	47.5	11.3	29.8	11.1
Lukunoch	745	47.2	16.0	30.6	5.9
Moch	604	52.0	11.9	28.1	7.9
Namoluk	310	51.3	11.9	29.0	7.7
Oneop	534	50.4	9.9	30.7	8.1
Satawan	885	45.3	20.8	28.7	5.2
Ta	291	48.8	16.5	26.1	7.2
Losap	475	49.5	14.1	26.7	9.1
Nama	897	55.0	11.6	24.9	7.8
Piis-Emmwar	320	57.2	9.4	28.1	5.3
Makur	121	58.7	12.4	24.0	5.0
Onanu	80	57.5	13.8	22.5	6.3
Onou	91	57.1	11.0	25.3	5.5
Onoun	513	42.5	31.6	21.8	3.9
Piherarh	139	55.4	12.9	23.0	7.9
Houk	346	52.9	9.2	32.1	5.8
Pollap	315	59.0	8.9	25.1	7.0
Polowat	477	48.4	13.0	26.8	11.1
Tamatam	226	54.9	11.9	27.4	5.8

Source: Office of Planning and Statistics 1992a.

[a] Percentages may not sum precisely to 100.0 due to exclusion of 255 individuals whose ages were "not stated."

TABLE 18. **Population by Municipality, According to Place of Legal Residence: 1989**

Area	Total Enumerated[a]	Legal Residence (Percentage)	
		Same Municipality	Other Municipality
Chuuk State	47,306	86.4	13.6
Chuuk Lagoon	37,813	83.9	16.1
Eot	278	80.9	19.1
Fanapanges	447	99.1	0.9
Fefen	3,891	97.5	2.5
Parem	350	88.0	12.0
Ramanum	677	99.4	0.6
Siis	436	97.5	2.5
Tol[b]	NA	NA	NA
Patta	1,294	97.3	2.7
Polle	1,323	96.1	3.9
Tol	4,822	98.3	1.7
Wonei	873	98.7	1.3
Tonoas	3,858	96.5	3.5
Udot	1,502	96.1	3.9
Uman	2,891	98.7	1.3
Weno[c]	NA	NA	NA
Fono	368	99.2	0.8
Weno	14,803	63.2	36.8
Outer Islands	9,493	96.1	3.9
Fananu	237	98.3	1.7
Murillo	295	96.3	3.7
Nomwin	384	99.2	0.8
Ruo	397	99.2	0.8
Ettal	415	93.5	6.5
Kuttu	421	98.8	1.2
Lukunoch	742	98.5	1.5
Moch	602	99.2	0.8
Namoluk	310	100.0	-
Oneop	534	99.3	0.7
Satawan	883	90.7	9.3
Ta	290	99.3	0.7
Losap	473	99.2	0.8
Nama	895	99.6	0.4
Piis-Emmwar	319	100.0	-
Makur	121	68.6	31.4
Onanu	80	80.0	20.0
Onou	89	78.7	21.3

(continued)

TABLE 18. Continued

Area	Total Enumerated[a]	Legal Residence (Percentage)	
		Same Municipality	Other Municipality
Onoun	513	77.6	22.4
Piherarh	138	97.1	2.9
Houk	343	100.0	-
Pollap	312	99.4	0.6
Polowat	474	99.8	0.2
Tamatam	226	94.2	5.8

Source: Office of Planning and Statistics 1992a.

[a] Does not include individuals whose legal residence was not stated.

[b] The 1989 census treated Patta, Polle, Tol, and Wonei separately when collecting data on legal residence; because residence referred specifically to these particular places, unlike population data we cannot present a combined figure for "Tol Municipality" that would preserve geographic comparability with other census years.

[c] The 1989 census treated Fono and Weno separately when collecting data on legal residence; because residence referred specifically to these particular places, unlike population data we cannot present a combined figure for "Weno Municipality" that would preserve geographic comparability with other census years.

lowing World War II. In the process of discussing available demographic data and vital statistics, I briefly noted possible reasons for population change. I now examine the mechanisms underlying the evolution of Chuuk State regional demography more closely, focusing both on total population and the geographic arrangement of this population.

Although depopulation apparently began in Chuuk State during the second half of the 1800s, available evidence indicates that with few exceptions the dramatic declines witnessed elsewhere in Micronesia never occurred." As discussed earlier, due largely to its extended isolation from sustained contact with people from outside Micronesia, for much of the nineteenth century Chuuk State largely avoided many of the diseases that decimated population in other places. Eventually foreign diseases did come, with Chuuk Lagoon and certain outer islands suffering from their effects by the 1870s. Smallpox, measles, tuberculosis, intestinal diseases, typhoid, and respiratory disorders all caused what appear to be considerable deaths from the late nineteenth century into the 1920s. Tuberculosis persisted through World War II, particularly on the outer islands (Pelzer and Hall 1946:12). In addition to increasing mortality, such diseases indirectly reduce fertility by

removing persons of reproductive age. Certain diseases also reduce fertility without causing death (see, for example, Hunt, Kidder, and Schneider 1954:40). The precise impact of these factors are uncertain due to insufficient information. Venereal diseases that decrease fertility, particularly gonorrhea (Pirie 1971), no doubt also occurred in Chuuk State, though there is little indication that they were widespread in any part of the state (probably due to limited interaction with the whalers who largely were responsible for introducing such maladies). Although population decline in part was attributable to decreased fertility resulting from introduced illnesses, most of the depopulation resulting from diseases was a consequence of increased mortality.

Other factors also contributed to depopulation in Chuuk State during the late nineteenth and early twentieth centuries. One was natural disasters, most notably typhoons that occasionally struck portions of the state--causing untold numbers of deaths directly and often leading to subsequent problems such as famine by destroying subsistence resources. In certain parts of the state, mortality due to other causes paled in comparison to the number of deaths caused by typhoons (e.g., Tolerton and Rauch n.d.:7). Another factor was warfare (See Fischer and Fischer 1957:81), apparently occurring occasionally on outer islands and incessant throughout much of the lagoon prior to German suppression of native disputes in the early 1900s (Krämer 1932:17). Data are lacking on the exact effect of warfare, though probably it was not great given the types of conflicts that characterized precontact Micronesia. Typhoons and warfare similarly acted to increase mortality, thus augmenting the main effect of diseases, but their impacts varied geographically: the effects of typhoons tended to be more pronounced in the outer islands while warfare was more prevalent in Chuuk Lagoon.

Sometime between 1900 and 1920, depopulation in Chuuk State ceased and the total Pacific Islander population leveled off at about 15,000 persons. Although relevant data once again are scanty, this generally constant population apparently was due to a rough balance between birth and death rates coupled with minimal immigration from outside the state. The slight changes documented in total population, including both the small increase between 1920 and 1930 and the small decrease between 1930 and 1935, all likely occurred due to slight shifts in fertility, mortality, and mobility patterns. The demographic changes among Pacific Islanders in Chuuk during the Japanese administration resemble those documented in the Marshall Islands during the same period (Gorenflo and Levin 1994). Overall, Chuuk State experienced neither the sustained population decline witnessed in Yap State nor the sustained population growth experienced in Kosrae and Pohnpei states (see Gorenflo 1993b; Gorenflo and Levin 1991, 1992)--although in

recent years Chuuk has witnessed the most rapid natural growth of any state in the FSM (Office of Planning and Statistics 1992b:98). As in other parts of Micronesia, one of the most important changes that occurred during the Japanese period was improved health care, helping to minimize the impact of introduced diseases.

Mobility caused relatively little demographic change throughout most of the German and Japanese administrations. Some movement within and beyond Chuuk State occurred during the German tenure, primarily to provide labor or disaster relief; a colony of people whose ancestors originally came as evacuees from the Mortlock Islands remains on Pohnpei Island, providing a continuing attraction to migrants from that Chuuk State outer-island group (Marshall 1976:39; Marshall 1979b:266). If the data on lifetime migration in 1930 are representative of the Japanese period prior to the late 1930s military preparations, few islanders from other parts of the Pacific moved to Chuuk State. Emigration also likely was minimal, apart from the (usually) temporary recruitment of laborers to work elsewhere in the Mandated Territory. By 1930 only about 10 percent of the Pacific Islanders in Chuuk State lived in a municipality different from where registered. The greatest examples of this relocation occurred in Chuuk Lagoon--led by Tonoas Island, where nearly one-third of the 1930 population came from elsewhere in the state to this growing commercial and administrative center--providing a basic preview of future mobility patterns dominated by movement to certain lagoon destinations. As the Japanese war effort increased during the late 1930s, administrators relocated increasing numbers of people within the state and brought in other islanders from outside Chuuk, though specifics on these patterns are uncertain. Although repatriation occurred following the war, the experiences and social connections developed during this period of relatively high mobility no doubt helped shape more recent migration patterns.

The U.S. Navy estimated the population of Chuuk State at slightly fewer than 13,900 in August 1946, a loss of more than 1,200 islanders since the 1935 census. This was probably largely the effect of World War II, resulting from American aerial attacks as well as starvation and disease late in the war. Following the war, the population began a period of prolonged growth, increasing at average annual rates ranging from 1.2 to 3.9 percent between census years (see Table 2). The reason for this growth appears to be a shift in the balance between mortality and fertility. Although an absence of reliable data continues to hinder a precise study of vital statistics, available evidence indicates that fertility increased slightly from prewar levels while mortality decreased substantially (see Marshall 1975:176-178; Nason 1975b:132-133; see also Tables 9, 10, and 12). The introduction of modem medicine and

health care largely eradicated the diseases that had continued to take a demographic toll well into the Japanese period while improving the chances for survival (particularly) during the early and later years of life. The result was rapid population growth largely due to natural increase.

Mobility played a varying role in Chuuk State demography following World War II. Available evidence from 1973, 1980, and 1989 indicates that immigration contributed little to the growing population, with relatively few individuals coming from elsewhere in the TTPI or beyond. The role of emigration, in contrast, became increasingly important over time. As of 1980, only 542 individuals born in Chuuk State resided in the United States (Barringer, Gardiner, and Levin 1993:286). But with the adoption of the Compact of Free Association in 1986, and its provision enabling FSM citizens to migrate to the United States or any U.S. territory, mobility began to siphon off Chuuk State residents to other places. The main destinations appear to be other parts of the Pacific--primarily Guam and the Commonwealth of the Northern Mariana Islands (CNMI)--as well as the United States. Researchers estimated the number of migrants to the former two destinations in 1988 at about 1,100 and 700 persons, respectively (Hezel and McGrath 1989:50-57). By 1990 the number of Chuuk-born residents of Guam had reached 1,843, with another 969 CNMI residents born in Chuuk State (U.S. Bureau of the Census 1992a:16; U.S. Bureau of the Census 1992b:15). Preliminary analyses of unpublished data from special censuses conducted by the U.S. Department of Interior Office of Territorial and International Affairs in 1992 and 1993 indicate that nearly 3,600 individuals born in Chuuk State resided in Guam with nearly 1,100 Chuuk State-born persons living in the CNMI. The reasons usually given for recent emigration from the FSM in general and Chuuk State in particular are the search for economic and (secondarily) educational opportunities (Hezel 1978; Marshall 1979a; Hezel and McGrath 1989:51-57; Flinn 1982:57-58; Rubinstein and Levin 1992:351, 380-381).

In contrast to relocation to and from Chuuk State, mobility has had a more extended influence on the arrangement of population within the state. Certain islands within Chuuk Lagoon have emerged as the main destinations of migrants, following a basic pattern established by Tonoas Island during the Japanese administration. As discussed above, population growth in particular lagoon municipalities exceeded the considerable growth experienced in the state as a whole following World War II--accounting for much of the increase in relative demographic importance witnessed by Chuuk Lagoon over the past four decades. The main migrant destination has been Weno Island, which emerged as a center of political and economic activity after the war. By 1973, more than 40 percent of the TTPI-born residents of

Weno Municipality called some other place home (see Table 14). This tendency continued: in 1989 nearly 37 percent of the residents of Weno Island were legal residents of another municipality in Chuuk State or beyond (see Table 18). The origins of most of these migrants were rural parts of Chuuk State, both within the lagoon and in the outer islands. As described for one of the outer islands in Yap State (Levin and Gorenflo 1994:126-127, 132-137), such mobility patterns can have severe cultural and economic impacts on the places of origin of migrants (see also Gorenflo and Levin 1995). Migration to the lagoon by young adults led one researcher to predict that Namoluk Atoll would eventually become a combination day-care center and old folks home (Marshall 1979a:3), although surprisingly some return migration to certain outer islands in Chuuk State has occurred recently (M. Marshall, pers. com., 1992). Onoun and Satawan atolls also have attracted migrants from other outer islands, emerging as subdistrict centers that provide certain important services, primarily education (Connell 1983:25).

Although mobility within and beyond Chuuk State requires further study, two features seem to characterize recent patterns. One is *channelized migration,* where migrants from certain places tend to move to certain destinations where people they know (primarily kin) already have relocated--such as Iras village, the settlement on Weno established by people from Pollap Atoll (see Flinn 1982; Reafsnyder 1984). A second feature is *step migration,* where individuals from rural areas migrate for a time to the main population center in Weno Municipality prior to (and in a sense in preparation for) a subsequent move to some destination beyond Chuuk State. The emergence of migration as the main force shaping the geographic distribution of the rapidly growing state population demands that more attention be focused on this important demographic process.

Statistical Measures of Changing Regional Demography in Chuuk State

Having discussed demographic change in Chuuk State and its potential causes, I now explore the nature of change in the regional distribution of population. Consistent with two other studies of regional demographic change in multiisland states in the FSM, this inquiry employs three different spatial statistics. Two of the measures, *point-to-point temporal association* and *spatiotemporal association,* provide complementary means of assessing shifts in the geographical arrangement of population over time. The third, *spatial autocorrelation,* provides a means of evaluating the nature of a spatial configuration of population at a particular point in time. For the sake of brevity, I present only brief discussions of these analytical tools below. Addi-

tional technical details appear elsewhere, focusing both on the statistical underpinnings of spatial autocorrelation (Cliff and Ord 1973, 1981) and the two temporal measures of spatial change (Gorenflo 1990:305-307) and on the application of all three techniques to regional demographic data (Gorenflo and Levin 1991, 1992).

Point-to-point temporal association assesses local change in the geographical arrangement of a region's population, focusing on the degree to which the populations of particular places at some time *t'* corresponded to the populations of those same places at an earlier time *t*--conceptually, for all municipalities *i*,

$$p_{i,t'} = f(p_{i,t}),$$

where $p_{i,t'}$ and $p_{i,t}$ denote the population of place *i* at times *t'* and *t*, respectively. The assessment of point-to-point temporal association typically uses statistical measures of correlation defined originally in a nonspatial context; here I employ Pearson's product-moment correlation coefficient and Spearman's rank-order correlation coefficient. Values for both measures range from 1.0 (perfect positive correlation) to -1.0 (perfect negative correlation).

Measures of point-to-point temporal association for patterns of regional demographic arrangement in Chuuk State indicate strong, statistically significant ($p < .01$) positive correspondence between successive census years (Table 19). Remarkably high correlation values persisted even when comparing population distributions from 1935 and 1958, two censuses separated by twenty-three years that included World War II and considerable depopulation. The results of measuring point-to-point temporal association indicate limited local change in the arrangement of Chuuk State population. Despite a population that shifted from constant size to sustained growth increasingly concentrated on certain islands in Chuuk Lagoon, the spatial configuration of people among individual places in one census year was highly correlated statistically with the spatial configuration of population among those same places in the following census year. Even when one compares configurations of population separated by longer periods of time, there is little evidence for much local change over time. The comparison between 1925 and 1989 data produced point-to-point temporal association measures of .94 and .84 for the Pearson and Spearman measures, respectively. Changes in the regional arrangement of the populations of individual places at different points in time thus occurred in small increments throughout most of the twentieth century, with the accumulated magnitude of local change still minimal after more than six decades.

Spatiotemporal association measures shifts in the spatial arrangement of

TABLE 19. **Statistical Comparisons for Chuuk State Regional Population: Between Select Census Years**

Years Compared	Point-to-Point Temporal		Spatiotemporal
	Pearson	Spearman	Quadratic Assignment
1925 & 1930	.998	.980	-.176[a]
1930 & 1935	.988	.984	-.185
1935 & 1958	.956	.940	-.192
1958 & 1967	.997	.987	-.181
1967 & 1973	.988	.971	-.184
1973 & 1980	.997	.969	-.187
1980 & 1989	.995	.933	-.187[a]
1925 & 1989	.936	.841	-.207[a]

Note: Levels of significance, unless otherwise noted, are $p < .01$.

[a] $.01 < p < .05$.

a variable over time. Through considering the population of places *and* the distance separating them, this statistic evaluates the degree to which the population of places at some time *t'* corresponded to the populations of all other places at an earlier time *t,* in an attempt to identify any trends in the geographic arrangement of people. Strong positive spatiotemporal association indicates that places at time *t'* were located close to places with similar numbers of people and far from places with dissimilar numbers of people at time *t;* strong negative spatiotemporal association, in contrast, indicates the opposite situation. I employed a quadratic assignment method of matrix comparison to calculate spatiotemporal association statistics, developed from a technique used to compare the spatial arrangement of two variables at one point in time (Hubert, Golledge, Costanzo, and Gale 1985; see Hubert and Schultz 1976; Gorenflo 1990:305-306). Here I focus on two matrices: **D,** a 35 x 35 matrix of Euclidian distances between Chuuk State municipalities, where each entry $d_{i,j}$ represents the distance separating place *i* from place *j;* and **C,** a 35 x 35 matrix containing information on the population of municipalities in Chuuk State recorded in two census years. For matrix **C,** I calculated each entry $c_{i,j}$ via the following function:

$$c_{i,j} = [\,|p_{i,t} - p_{j,t'}| + |p_{j,t} - p_{i,t'}|\,] / 2,$$

with all variables defined as above.

Comparisons of demographic data between successive census years yielded statistically significant ($p < .01$ for all comparisons but two, which were $.01 < p < .05$) negative spatiotemporal association values ranging from -0.176 to -0.192 (see Table 19). These results indicate a tendency for places at time *t'* to be close to places with different populations at time *t.* Such a situation would arise in the spatial intermingling of places with contrasting populations, such as occurs when demographic centers emerge amidst hinterlands of smaller populations. But no dramatic shifts appear in any of the comparisons between contiguous census years, the weak tendency towards similar regional arrangements of population persisting throughout the seven comparisons between sequential census years. Spatiotemporal association between 1925 and 1989 census data confirms the lack of substantial regional shifts in demographic organization, with the associated negative results only slightly greater than any comparisons of successive censuses.

To augment the statistics that explore changing population distribution over time, I also calculated spatial autocorrelation values for population distributions in each census year. Spatial autocorrelation measures the interdependence of a variable over space at one point in time. In the present research setting, strong positivespatial autocorrelation indicates a geographic distribution of population where places with similar numbers of people were proximal and places with dissimilar numbers of people were distant. In the interest of consistency, I calculated spatial autocorrelation measures with a quadratic assignment approach similar to that used to calculate spatiotemporal association (see Hubert, Golledge, and Costanzo 1981). As was the case with the spatiotemporal association calculations, resulting spatial autocorrelation values indicate weak, statistically significant negative correlations in the arrangement of population (Table 20). These results support

TABLE 20. **Spatial Autocorrelation Calculations for Chuuk State Regional Population: Select Census Years**

Year	Spatial Autocorrelation	Significance
1925	-.170	.05
1930	-.182	.01
1935	-.186	.01
1958	-.175	.05
1967	-.182	.01
1973	-.183	.01
1980	-.187	.01
1989	-.185	.01

the conclusion of a persisting weak interdigitation of settlement size over time, with no evidence of a substantial shift in the regional arrangement of population.

Repercussions of Changing Regional Demography in Chuuk State

This article so far has focused primarily on documenting and measuring the demographic changes that have occurred in Chuuk State since the beginning of contact with non-Micronesians. As usually is the case, the population changes identified are not an end in and of themselves; such developments have broader implications that include effects on other aspects of culture and society. One of the most potentially important impacts of demographic change in a setting such as Chuuk State is its effects on the organization and adaptation of a sociocultural system, with decreases and increases in population, and shifts in the regional distribution of population, embodying different challenges to adaptive success. Unfortunately, the general absence of detailed information on early sociocultural systems in Chuuk prior to the imposition of a new order by the German administration limits our understanding of these impacts--a deficiency countered, at least in part, by extremely good anthropological studies of portions of the area immediately following World War II.

The island units contained within modem Chuuk State featured societies led by hereditary rulers that anthropologists would call matrilineal chiefdoms (see Service 1971:145-169). In Chuuk Lagoon, ninety-eight such polities existed in the late 1940s, each associated with a particular piece of land (district) and comprising 64 to 127 people (Goodenough 1978:129-137). Administrative levels above the chiefdom largely were lacking, apart from temporary confederations forged between two or more districts for the purpose of waging war on other chiefdoms (Pelzer and Hall 1946:21). Variations on this theme existed on most outer islands as well, with each island unit containing one or more district chiefs (see Tolerton and Rauch n.d.:43-46; Marshall 1972:55-62; Nason 1975a:11-12; Flinn 1985:97; J. Thomas 1978: 37-38, 53; Reafsnyder 1984:117-126; Flinn 1992:48-58). Both lagoon and outer-island polities tended to be independent. Nevertheless, in a few instances interchiefdom or even inter-island (or intraisland) hierarchies emerged, such as the dominance of the Western Islands by Polowat Atoll during the nineteenth century (Damm and Sarfert 1935:171-174) and the traditional alliances formed among individual islets in the Lower Mortlocks (Nason 1970:50).

Independence in general extended to economic organization. Each household fished and collected other marine animals in addition to growing

several foods, including breadfruit, taro *(Colocasia* and *Cyrtosperma),* banana, sweet potato, and coconut (Office of the Chief of Naval Operations 1944:125; Pelzer and Hall 1946:32-48; Pelzer 1947; Gladwin and Sarason 1953:52-58; Nason 1975a:7-9; Hunter-Anderson 1991:40-42; Flinn 1992: 17-19). Limited economic exchange occurred within chiefdoms in accordance with administrative structure, with the district chief receiving first fruits. Interaction also occurred between chiefdoms, largely organized around the five island groupings composing Chuuk State and occurring in two different spheres. The most basic sphere was interaction within the separate island groupings, feasible because of the proximity of individual island units and desirable to maintain social and economic relations (e.g., Nason 1975b:122). The second sphere of interaction consisted of links between the lagoon and the outer islands--once again desirable for both social and economic reasons (Office of the Chief of Naval Operations 1944:3, 29, 49; Pelzer and Hall 1946:21-22; Gladwin and Sarason 1953:34-38; Gladwin 1970:61-63; Nason 1975b:121; Severance 1976:27-28; Goodenough 1978: 56; Oliver 1989, 1:577-580, 969-970; Flinn 1990:117). Evidence suggests that frequent travel occurred between the lagoon and the Hall and Mortlock islands, indicated by kinship ties and certain linguistic and cultural similarities (Gladwin and Sarason 1953:37-38). Interaction with the Western Islands was much less frequent, in part because ocean currents made canoe travel from these groups to the lagoon difficult at certain times of the year and in part because polities in the Western Islands were components of the Yap Empire (Lessa 1950:39). Polities in Namonuito Atoll, also part of the Yap Empire, similarly interacted less with Chuuk Lagoon than did certain other outer islands. Nevertheless, geographical and political realities made the maintenance of connections between outer islands and Chuuk Lagoon highly desirable. For outer islanders, the lagoon provided resources unavailable on their small coralline homes as well as potential refuge in times of trouble (such as typhoon devastation). The advantages realized by lagoon polities from interacting with the outer islanders are more elusive--although among groups facing persisting warfare any relationship that meant obligations and potential allegiance in times of conflict presumably was useful.

The picture of regional organization that emerges is thus one of decentralization based on separate chiefdoms, with districts forming the corresponding geographic building blocks. Unfortunately, most of the research upon which much of this scenario rests occurred at least half a century after German administrators imposed a new order--in effect combining certain districts to facilitate interaction with the new rulers and prohibiting the warfare that played such an important role in supradistrict affiliation. Neverthe-

less, although the pre-twentieth-century situation is not clearly known it probably resembled the decentralized setting described above. Available evidence suggests that pre-European districts were even smaller than those documented in the 1940s, in all likelihood producing greater sociopolitical fragmentation than described after the war. Settlement patterns similarly were more dispersed, consisting of scattered houselots that did not form communities in any sense and situated well away from the shoreline, thereby providing protection from surprise attacks over water as well as easy access to upland gardens (Pelzer and Hall 1946:20; Stark et al. 1958:7; Goodenough 1978:129). Although settlement patterns had evolved since the early days of German administration, this probably was not due to population change as much as to the forced reduction in warfare coupled with the imposed combination of native polities. Interaction patterns, in contrast, show some consistency with aboriginal patterns as links within island groupings and between the outer islands and Chuuk Lagoon persist to this day--in part a consequence of the arrangement of island units throughout the state, though current interaction patterns indicate an emphasis on Weno Municipality as its relative political and economic importance grows.

Limited information certainly restricts what one can say about the impact of depopulation on Chuuk State. Such effects have been dramatic in other parts of Micronesia. The removal of entire hereditary lines of authority on Kosrae due to massive depopulation, for example, helped produce considerable social and administrative reorganization of that society (see Gorenflo 1993b:108-109). Moreover, at about the same time that depopulation was occurring in Chuuk Lagoon and on certain outer islands the German administration began to impose a new organizational structure. Although the ultimate reason for combining certain districts might have been a reaction to depopulation, it more likely resulted from the directions of new colonial rulers. Ultimately, it is the imposition of fundamental organizational changes, first through combining aboriginal polities at the insistence of German and Japanese administrators and then through complying with the democratic guidelines introduced by the U.S.-TTPI administration, that clouds our understanding of demography-related changes in Chuuk State throughout most of the twentieth century. Nevertheless, two things are certain: population has grown markedly and become increasingly centralized since 1935, and these demographic trends have introduced both adaptive limitations as well as development potential to this multiisland polity.

High demands on the current economic system and limited resources paint a gloomy picture for Chuuk State in the 1990s--even in comparison to other parts of the FSM (see Office of Planning and Statistics 1992b:99-100). Wages are markedly lower than elsewhere in the federation, exacer-

bated by 23 percent unemployment in the early 1990s and an increased need for cash income resulting from low household subsistence production. Moreover, with a state debt incurred during the first year of the Compact of Free Association and a 10:1 annual trade deficit, the state government faces growing pressure to increase productivity and devise various means of raising revenue. To provide increased earnings, the Chuuk State government will focus on commercial fishing, tourism, and agriculture, the three sectors identified as having the greatest potential to provide economic growth during the 1990s (Office of Planning and Statistics 1992b:107-108).

Although the three sectors show certain promise, their development would place additional pressure on a fragile natural environment. In addition to the obvious need to establish adequate markets and the means to supply them in a timely manner, commercial fishing can strain marine resources--although an emphasis on pelagic species in the 180,000 square miles of water within the state could provide rich, sustainable opportunities if used wisely (see Office of Planning and Statistics 1992b:97). Tourism generates what would appear to be much less pressure on the natural environment. However, much tourism development would focus on sport diving among the wrecks sunk during World War II in Chuuk Lagoon. Developing a diving industry capable of generating increased revenues of the magnitude required would require a major increase in volume, which in turn would require significant development of supporting tourism infrastructure (hotels, restaurants, transportation facilities, and so forth)--once again potentially introducing substantial pressure on the natural (as well as sociocultural) environment. The third focus of development attention is agriculture. The main goal in developing this sector is to reduce the reliance on imported food, which is the highest in the FSM. Unfortunately, in addition to the obvious limitations of agricultural development on the coralline outer islands there also are constraints on increasing the agricultural production on high islands in Chuuk Lagoon (Pelzer and Hall 1946:2). Most of the high islands in the lagoon consist of steep, rugged uplands surrounded by a narrow band of coastal lowlands--the former better suited for subsistence agriculture and woodlands but prone to erosion, the latter largely mangrove swamp, fresh-water marshes, beaches, and raised beach deposits less desirable for growing many types of food (Stark et al. 1958:43-47; Soil Conservation Service 1983:1). In all, only about 25 percent of the land area of the main high islands are well suited for agriculture, with that land of limited fertility and susceptible to considerable erosion (Soil Conservation Service 1983:17).

Development plans with few exceptions have focused on Chuuk Lagoon, particularly Weno Island (Office of Planning and Statistics 1985, 1992b).

For example, of the ten development sectors in the current five-year plan only one (tourism) explicitly includes the outer islands (Office of Planning and Statistics 1992b:108). Onoun and Satawan municipalities officially became subdistrict centers in 1973. The most noteworthy characteristic of these two places is the presence of an outer-island junior high school in each (M. Thomas 1978:31; Connell 1983:25; Flinn 1990:116; Flinn 1992:41-42). Both have attracted population; to a lesser extent, both also have attracted other types of development that at least one researcher likens to urbanization (Connell 1983:133-134). Unfortunately, apart from decentralized development focused on these two municipalities beginning in the early 1970s, the outer islands receive limited attention in planning for the state's future.

Given the development emphasis on Weno Island, the continuing flow of people there is understandable. But such rapid growth can have many shortcomings. In addition to the obvious pressures on the environment, economy, and government (particularly public services), several social problems recently documented (primarily) on Weno Island, including alcohol abuse, violence, and a dramatic increase in teen suicides, may well be a consequence of rapid demographic growth and the sociocultural changes that have accompanied it (see Marshall 1979c; Hezel 1984, 1987). Rural-urban migration also can affect the places migrants leave behind, particularly if it mainly involves one sector of a population. In the case of relatively small, relatively traditional outer islands, emigration of young adults tends to remove an important economic and social component of the societies (see Levin and Gorenflo 1994:132-138). Economic survival of such places may be a problem, although increased remittances often compensate for the loss of traditional productivity. But the sociocultural systems themselves cannot be so easily compensated, ultimately threatening the very existence of traditional outer-island ways of life.

Demographic change during the past five decades has resulted in a series of major adaptive challenges to the citizens and government of Chuuk State. An increasing number of people, many living in Weno Municipality, concentrate demands and productivity potential in places that can neither support major increases in production nor afford increased imports. Outer islands and rural portions of Chuuk Lagoon face different challenges, with many losing segments of their populations through emigration--undermining traditional economies as well as social systems. The lengths to which migrants go to maintain connections with their outer-island homes, retaining land rights (Nason 1970:39) and even organizing their residential patterns in the lagoon to mimic those found on the original islands (Flinn 1982:167, 186-193; Reafsnyder 1984:213-218), mitigate the effects of their absence only partially. Emigration beyond Chuuk State has had impacts similar to those

experienced on the outer islands, providing a means of relieving demographic pressure that at the same time removes productivity potential. In principle, reducing the trade deficit in food should be within the abilities of an island group that until relatively recently featured a subsistence economy. But ultimately, successful development will require control of population growth and movement, accommodating modern opportunities as they become available while acknowledging the limitations of development options.

Concluding Remarks

To anyone familiar with the general demographic history of Micronesia, the above story will seem like a variation on a common theme. As with most of the region, Chuuk State experienced depopulation following the onset of sustained contact with non-Micronesians. But the disease-related declines that decimated much of Micronesia occurred later in Chuuk State than elsewhere in this part of Oceania, its effects generally much less severe. The lessened impact of diseases was compensated for, at least in part, by typhoons, labor recruitment, and warfare. Population decline eventually ceased, with numbers generally leveling off during most of the Japanese administration and beginning a period of sustained growth following World War II. Demographic growth has been substantial, eventually reaching levels comparable to or exceeding those experienced in most other parts of Micronesia. Perhaps the most dramatic aspect of population increase in Chuuk State has been the absolute magnitude, continuing despite many residents emigrating to the CNMI, Guam, and probably the United States.

Demographic growth in Chuuk State has been accompanied by a change in the geographic distribution of population. The dominant characteristic of this change has been migration to certain places in Chuuk Lagoon (primarily Weno) from rural parts of the lagoon and several outer islands. But the evolution of this geographic arrangement has been incremental. The statistical measures used to assess local change in the regional distribution of population identified relatively little such change: a population configuration in one census year shared a strong statistical correlation with the configuration in a subsequent year, even when separated by more than two decades and a major war. By 1989, the geographic arrangement of population continued to register a high correlation with the distribution documented sixty-four years earlier. The statistical measure used to assess regional change in the spatial distribution of population indicated a slight negative-correlation as demographic configurations evolved over time. This same negative correlation characterized all comparisons between census years conducted in this study--indicating a consistency in the regional demography of Chuuk State

throughout much of the twentieth century. Evidence of limited local and regional change in the arrangement of population suggests the preservation of demographic subregions, a tendency supported by spatial autocorrelation measures. Although subregions or subdistricts largely are a consequence of geographic reality--the island units in Chuuk State simply are arranged in five fairly distinct spatial groupings--such areas have important regional implications both in the past and in the present (Flinn 1990). With few exceptions, current planning strategies in Chuuk State do little to acknowledge or preserve such an arrangement, opting instead to invest most resources in the emerging center on Weno Island.

Chuuk State presently faces particularly severe adaptive challenges. Although richer in resources than island groups composed entirely of coralline islands and atolls, the development options nevertheless are limited both in the lagoon and throughout the outer islands. Potential development foci, such as the promotion of the tourism and commercial fishing industries, show great promise but face an enormous challenge to support a large and growing population. Despite the persistence of a regional arrangement of population--of the essence of productivity potential and demands with roots in the past--it is unlikely that any of the development options available to Chuuk State will be able to overcome the economic deficits currently faced and meet the demands of a rapidly growing population. Siphoning off population through emigration to other places clearly creates one problem as it solves another, losing some of the most energetic and productive members of society in the process of dampening overall population growth. With an explicit goal in the second five-year national plan of the FSM to make significant strides towards self-sufficiency (Office of Planning and Statistics 1992b:100), reducing the rate of population growth to a level that economic growth can match or exceed, coupled with increased subdistrict development, appears to be the only realistic, sustainable option open to the largest, most complex component of the federation.

NOTES

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1. This article follows modem convention when referring to individual islands or atolls (hereafter called *island units*) and various subregions that form the modem state of Chuuk. I use the term *Chuuk State* to denote the geographic area of the present state--even when discussing the region prior to 1979, the year of the state's official formation. I refer to the eleven inhabited high-island municipalities near the center of the state as *Chuuk Lagoon* and to the remaining inhabited island units beyond the lagoon's surrounding reef as the *outer islands.* Throughout I employ the currently accepted names for the state and its components, including those changed at the Chuuk State Constitutional Conference in 1989: Chuuk (formerly Truk), Fefen (Fefan), Houk (Pulusuk), Lukunoch (Lukunor), Makur (Magur), Namonuito (Namonwito), Onanu (Onary), Onou (Ono), Onoun (Ulul), Paata (Patta), Piherarh (Piseras), Piis-Emmwar (Pis-Losap), Pollap (Pulap), Polowat (Puluwat), Ramanum (Romalum), Siis (Tsis), Tonoas (Dublon), and Weno (Moen) (Office of Planning and Statistics 1992b:110).

2. Reports of large numbers of deaths due to native warfare in Chuuk State are highly suspect, primarily because high mortality is inconsistent with virtually all well-documented instances of such conflict throughout Micronesia (e.g., Gorenflo and Levin 1994:97-98). Sources that report high casualties, such as the Tetens and Girschner references, probably are exaggerations or embellishments (F. Hezel, pers. com., 1994). Ultimately, native warfare likely had relatively little direct impact on the demography of Chuuk State.

3. In addition to the precise methods used to collect demographic data during the German administration, the exact dates of certain population figures are unclear (see *Deutsches Kolonial-Handbuch* 1909:328; Hermann 1909:627-628). Assigning the population figures for 1900-1909 to particular years in Table 1 required comparison between and cross-referencing of several sources; most should be accurate, at least to within one year. Note that Krämer incorrectly implies that the census of Namonuito Atoll island units occurred in 1910 (1935:195), despite a note on the same page of his monograph giving the census date as December 1909 (see also Krämer 1935:219).

4. The 1946 head count recorded 9,185 islanders in Chuuk Lagoon (as well as 1,300 Japanese who remained at the time of data collection in August) and 4,682 inhabitants in the outer islands, the latter not distinguished by ethnicity but probably almost all natives (Pelzer and Hall 1946:tables 1 and 3). The breakdown of outer-island populations in 1946 was as follows: Fananu (89), Murillo (136), Nomwin (158), Ruo (94), Ettal (219), Kuttu (395), Lukunoch (453), Moch (268), Namoluk (238), Oneop (373), Satawan (36), Ta (156), Losap (406), Nama (490), Piis-Emmwar (241), Makur (NA), Onanu (39), Onou (49), Onoun (106), Piherarh (53), Houk (211), Pollap (155), Polowat (209), and Tamatam (108).

5. Because the primary aim of this study is to explore demographic change in a functioning sociocultural system (or systems, acknowledging the many individual island sociocultural systems in Chuuk State), it focuses solely on the Pacific Islanders living in Chuuk State in 1920, 1925, 1930, and 1935. The number of Japanese residing in parts of the Mandated Territory varied dramatically during the three decades that Japan controlled the area. The Japanese government regulated the migration of Japanese nationals to its Micronesian islands, promoting increased immigration to many of these islands for commercial or military purposes during the late 1930s. By December 1945, more than 37,300

Japanese citizens resided in Chuuk Lagoon alone (Pelzer and Hall 1946:table I); considering these *imposed* in-migrants would cloud any understanding of the demographic evolution of Chuuk State.

6. This study employs several measures of fertility and mortality, selected in part because of the insights on vital statistics they provide and in part because they can be calculated (or have been calculated) with the often scanty information available on Chuuk State. Crude birth rate represents the number of births per 1,000 individuals in the total population for a specific year. General fertility rate, in turn, signifies for a given year the total births per 1,000 women in the main reproductive ages (usually 15 through 49 years). Total fertility rate denotes for a particular year the sum of age-specific birth rates (number of births per 1,000 women in a particular age group) for women in the main reproductive years; note that when divided by 1,000, total fertility rate provides an estimate of live births per woman throughout her reproductive period. Crude death rate represents the number of deaths per 1,000 individuals in the total population for a particular year. Finally, age-specific death rate concerns the number of deaths in a particular age group per 1,000 persons in that age group, once again for a specific year.

7. Attempts to acquire reliable mortality data for 1989 were unsuccessful. Although the FSM Department of Health Services compiles this information, citizens of Chuuk State tend to underreport deaths to a degree that recent mortality data are virtually useless for analytical purposes (Amato Elymore, pers. com., 1993). Earlier mortality probably also was substantially underreported, though it is unclear if the magnitude of the problems equaled current levels. In general, I use fertility and mortality measures in this study to provide basic indications of the mechanisms underlying population change in Chuuk State over time; all measures undoubtedly are inaccurate in absolute terms, serving primarily as a rough means of evaluating the relative contributions of births and deaths in population change.

8. The lack of reliable nineteenth-century population figures greatly limits what one can say about early population change in Chuuk State. With the exception of the estimate of 350 inhabitants on Houk Atoll in 1850 provided by Cheyne (1852:135), early figures either have unknown origins or are based on very brief encounters until those provided by Doane for several island units in the Mortlocks in 1874. Based on more reliable estimates, it appears that both Ettal and Houk atolls experienced marked depopulation between the mid-nineteenth century and the first decade of the 1900s (see Table 1). In comparison, depopulation on other outer islands apparently was much less.

Insights on early demographic change in Chuuk Lagoon are even more elusive. The several estimates dating from 1877 to 1900 that place the lagoon population at about 12,000 probably are reasonably accurate (see Table 1), given the difficulty of estimating a large number of people in a complex geographical setting such as the lagoon. Nevertheless, due to the persistence of warfare and natural calamities, augmented by the impact of introduced illnesses, it is likely that the 1903 figure of 13,115 lagoon inhabitants (which probably is quite accurate) resulted from some amount of depopulation over the preceding several decades. The growth in lagoon population between 1903 and 1907 probably is due largely to the influx of people from outer islands devastated by a typhoon in March of 1907--otherwise interrupting a trend of depopulation whose effects appear as late as 1920 (see Table 3).

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