

Population History of Guam: Context of Microevolution

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The status of population history studies in the Pacific has advanced materially in recent years, culminating in such significant publications as those by McArthur (1968), Schmitt (1968), Pool (1961 *et seq.*), Voisin (1962), and others. Notably, comparable advances have not been forthcoming from the Micronesian area. Thus, the earlier statement by Taeuber and Han (1950) concerning the state of demographic knowledge of this region is still pertinent, while modern investigations into the historical demography of Micronesia have scarcely begun. This situation represents a serious deficiency in the development of research in the microevolution of Micronesian populations, since physical anthropology has long since accepted the critical need for understanding the population matrix of evolutionary process (Cavalli-Sforza and Bodmer, 1971; Salzano *et al.*, 1967; *inter alia*).

An earlier attempt to summarize existing sources related to the population history and dynamics of Micronesian islands (Hainline, 1964) provided the basis for an initial interpretation of the genetic and biological divergencies observed by various students in this area (Hunt, 1950a, 1950b; Hasebe, 1938), but the subject has barely been tapped. Additional materials have come to light,² requiring a more intensive review and evaluation of the population history of each of the major areas within the Micronesian region as a background to the reinterpretation of the evolutionary history of these populations. Only in the light of such greater knowledge can the accuracy of generalized interpretations of the evolution of these groups be tested (Gajdusek, 1964) or problems in the interpretation of evolutionary processes operating in such small-scale populations be resolved (Giles *et al.*, 1966; Cadien, 1971; Morton *et al.*, 1971a, 1971b).

I. BACKGROUND

Micronesia includes the northwestern portion of the Pacific Ocean, lying north of the equator and west of 180° longitude. Contained within this expanse are over 2000 land forms, of which about 120 identified islands and atolls are recognized

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(Bryan, 1946, 1971). Four major island groups and two independent islands are located in this territory: the Mariana Islands, the Caroline Islands, the Marshall Islands, and the Gilbert Islands, as well as Ocean Island and Nauru Island. Of these, the Mariana Islands, consisting of some 15 volcanic land forms, have been the subject of more intensive, prolonged concern by foreigners, dating from their discovery by European explorers, beginning with Ferdinand Magellan in 1521. The Mariana Islands group includes the more southerly islands—Guam, Rota, Tinian and Saipan—as well as the smaller, less well-known, islands of Aguijan, Agrigan, Alamagan, Anatahan, Asuncion, Farallon de Medinilla, Guguan, Maug, Pagan, Sariguan, and Uracas.

The history of these islands has been more recently described at length by Carano and Sanchez (1964), Beardsley (1964), Reed (1952), Safford (1903), Bowers (1950, 1951), Gallahue (1947), *et al.*, while the ethnography of the native populations has been variously described by Thompson (1945, 1947), Spoehr (1954), Fritz (1904), *inter alia*. Archeological investigations have been conducted by Hornbostel (n.d.), Osborne (n.d., 1947), Spoehr (1957), Pellet and Spoehr (1961) and Reinman (1967, 1968a, 1968b).

The population history of the Mariana Islands may be divided conveniently here into four periods: (1) period of population stability, spanning the years of early contact exposure (1521–1668); (2) period of population decline and contraction (1669–1786); (3) period of population recovery and integration (1787–1898); and (4) period of population growth and expansion (1899–1950). Additionally, a fifth, or “modern” period, covering the last two decades, can be recognized, but is not treated here, although data from this period are included for comparative purposes.

II. POPULATION HISTORY OF THE MARIANA ISLANDS

1. Period of Population Stability (1521–1668)

Following the initial contact between the natives of the Mariana Islands (later termed “Chamorros”) and Europeans, commencing with the discovery of Guam by Magellan, traditionally assigned the date of March 6, 1521, a period of repeated, sporadic, and somewhat casual contact between natives and foreigners ensued. Although the tempo of contact increased as Guam became a regular stopping point for the Spanish fleets sailing from the New World to the Spanish possessions west of Guam, interactions between aliens and natives remained superficial and transient on the whole until the arrival of the Jesuit mission, under the venerable Padre Sanvitores, in 1668.

Among the recorded visitors to the islands were a number of Spanish ships, as well as English, Dutch and French sailors and ships (cf. Safford, 1901, 1903; Reed, 1952), while, doubtless, other visitors whose arrival has not been preserved in records also touched these islands. Some indications of the demographic consequences of these visits can be gleaned from sporadic reports of the removal of a small number of natives on board departing ships, as well as occasions for the

introduction of foreign elements and ideas, along with the possibility for the movement of alien genes into the native population during this period. Finally, some loss of life occurred among the native population as a result of occasional forays and punitive raids, but no evidence exists that any extensive decline took place among the Chamorros, either as a result of the introduction of diseases or in armed conflict, until a later period of history.

Prior to the departure of Magellan's fleet, three days after its arrival at Guam, the Spanish sent a punitive expedition ashore: "After punishing the Indians by killing some of them and ransacking and setting on fire one of their small villages . . ." (Corte, 1870a), the fleet departed after collecting additional provisions. Again, in 1565, the expedition under Andres Miguel Lopez de Legaspi departed after sending a raiding party ashore to avenge the killing of a seaman by killing and wounding some natives as well as taking some prisoners (Safford, 1901). No record remains of the results of Cavendish's orders to fire upon canoes following his ships when he departed Guam in 1588. It seems likely that deaths so inflicted could have been relatively random in respect to age and sex of the victims, or alternatively, may have been differentially effective against women, children and the aged segment of the population which would have been more readily available to attacks directed against villages.

In contrast, removal of segments of the native population on board departing ships seems to have affected males, and, probably, would have resulted in the removal of active, young adult males. Safford (1901) records that the Loaysa expedition lured eleven natives on board to man ship pumps during the rest of the expedition. Oliver van Noort, anchored at Guam in 1600, noted that about 200 canoes, each containing some 3 to 6 men, came out to his ships to engage in trade, but that only a few females came on board during this time.

Among the influx of European and other aliens who took up residence for various periods of time among the Chamorros, several reports remain. One of these visitors, Gonzalo de Vigo, was probably one of three deserters from a ship of the Magellan fleet, *La Trinidad*, under Espinosa, which, having failed to sail to the New World, passed one of the northern Mariana Islands en route to the Molucas. De Vigo's companions were both killed prior to 1526 when de Vigo was picked up by the Loaysa expedition during its stay at Guam (Safford, 1901; cf. Reed, 1952). Thompson (1945), quoting a letter by Governor Don Francisco Tello, reported that a Franciscan priest and several soldier-companions disembarked from the *San Pablo* in 1596 and resided in the Marianas until the arrival of the galleon under Don Lope de Ulloa in the following year.

A shipwreck off Rota in 1600 resulted in the introduction of a fairly large number of survivors into the native population. When the galleon *Santo Tomas* stopped in Guam in 1601, 26 survivors were reported as living in the islands, and were joined by a friar who swam ashore from the Spanish vessel. About 1648, a Chinese ship sailing out of Ternate wrecked on the shores of Guam and the Chinese captain, Choco, settled among the natives, living near Merizo village (Corte, 1870a; Ibanez,

1886). Somewhat earlier, in 1638, the shipwreck of the Spanish ship *Concepcion*, off Tinian, left a number of crewmen resident in the Marianas for varying periods of time, as some sailed later to the Philippine Islands, although one, named Pedro, was found by the members of the Jesuit mission in 1668 living in Guam (Corte, 1870a).

It is clear that the arrival of aliens was a relatively common phenomenon, although few such residents were European until the 17th century, judging from the following quotation from Murillo Velarde, reported by Safford (1901): "Also it is true that there arrived in these islands some Japanese which had been lost, and also some from Liso, Ternate, and Tidore, as we see happen every day." Most, if not all, of such visitors were probably males. In the light of later historical events, it is interesting here to note that no record refers to the arrival of visitors from the Caroline Islands or other parts of Micronesia during this period.

Estimates of native population size during this period could only have been based on unfounded speculation prior to the arrival of the Sanvitores mission in 1668, while, by this latter date, the results of over a century and a half of contact experience may have influenced the size and distribution of the native population, as well as its composition. The energetic activities of the Mission resulted in the delineation of the distribution of the native population of Guam shortly after the Mission began operating, and preliminary reports on the population of other islands were soon made available as initial explorations visited the various other islands of the Marianas archipelago. Most of the estimates of population size of the natives of the Mariana Islands are based on these early Mission reports, but it is problematical if these are appropriately descriptive of "pre-Contact" conditions. A list of some of these estimates, citing earlier sources, where indicated, is presented in Table 1.

Perhaps the most reliable of these estimates is that provided by Fritz (1904), based on house count estimates. Based on the Mission reports of the number and distribution of settlements and houses on Guam (Agana with 53 main houses and 150 smaller houses nearby; 50-150 on the coast; 20 in the mountains; or a total of 180 places with more than 20 houses each), Fritz applied a conservative figure of 5 persons per house to obtain a figure of 18,000 dwellers, plus a figure of 12,000 for settlements of less than 20 houses, residents of bachelors' houses, etc., to arrive at a conservative estimate of 30,000 total for Guam. Thompson (1945), cautions: "Concentration of the population around the seaport, however, probably occurred after the discovery of the island, as in the Philippines, Samoa, and other parts of the Pacific." More recently, this pattern of population concentration around Pacific "Port Towns" has been confirmed in many Pacific Islands (Spoehr, 1963). Certainly, at this point in time, it is impossible to resolve the differences in population estimates for this period, nor is it reasonable to rely on the reports of Mission activities without qualification. Early mission reports claimed to have baptized 13,000 souls, while more than 20,000 catechumens were recorded by the end of 1668 (Anon., 1674). Unless mass instruction and baptismal ceremonies were

Table 1. Period of population stability (1521-1668).

Estimate—Total Number	Source (Where Given)	Reference
MARIANA ISLANDS, ALL		
40,000	Kotzebue, 1821	Bowers, 1950
40,000-50,000		Spoehr, 1954
40,000-90,000		Bowers, 1951
50,000 min.	Nurillo	Cox, 1917
50,000 min.	Anson	Roth, 1891
(Guam, Rota & Tinian)		
50,000 min.		Reed, 1952
60,000	Crozet	Roth, 1891
73,000	Freycinet, 1829	Thompson, 1947
70,000-100,000		Joseph & Murray, 1951
100,000	Jesuit estimates	Olive, 1887
100,000		Thompson, 1945; Corte, 1870a
MARIANA ISLANDS, EXCLUDING GUAM		
40,000 more or less	Recalculated by Garcia, 1936-39	Thompson, 1947
NORTHERN MARIANA ISLANDS (EXCLUDING GUAM, ROTA, TINIAN AND SAIPAN)		
12,000	Freycinet, 1829	Thompson, 1947
GUAM		
300,000		Fritz, 1904 (see text)
35,000	Reconstruction from Tobias Kotzebue, 1821	Thompson, 1947
40,000	Reconstruction, Kotzebue, 1821 from Juan de la Concepcion	Thompson, 1947
40,000 potential		Thompson, 1947
44,000	Reconstruction, Kotzebue, 1821 from Murillo Velarde	Thompson, 1947
50,000	Reconstruction by Garcia, 1936-39, from Sanvitores	Thompson, 1947
60,000	Reconstruction, Kotzebue, 1821, based on Marion	Thompson, 1947
60,000	Crozet	Roth, 1891
ROTA		
8,000	Reconstruction, Freycinet 1829, based on Tobias	Thompson, 1947
TINIAN		
7,000	Reconstruction by Freycinet, based on Tobias	Thompson, 1947
SAIPAN		
11,000	Reconstruction by Freycinet, based on Tobias	Thompson, 1947

performed, it seems unlikely that a handful of dedicated priests and brothers could have effected such wonders in the brief period of eight months.³

In any event, conflict arose between segments of the native population of the Mariana Islands and the Mission priests and soldiers attached to the Mission within a few months of the arrival of the Mission, culminating in the extensive conflict and population movements which took place in the second period of the population history of the Mariana Islands, 1669–1786. Spanish reports from this initial period, however, fail to provide any detailed information as to the composition of the native population, thus precluding any estimates of the sex ratio, age distribution, or other basic demographic characteristics of this group. A final note suggests that the Mission may have supported a policy of population exchange, for one reference is made, in a latter by the Queen to De Mancera, dated November 16, 1671, quoted from an earlier report by Father Sanvitores (MARC Documents, Mexico): “. . . and that in exchange for them (Pampango Indians requested to be sent to Guam), they will send back there an equal number of native Indians from the said Mariana Islands who would go willingly as they had begun to go last year, one thousand six hundred and sixty-eight. . . .”

2. Period of Population Decline and Contraction (1669–1786)

Native resistance to the missionizing activities of the Spanish quickly led to open hostility, not merely in Guam, but also in many of the Mariana Islands. Beginning with the murder in 1669 of one Lorenzo, a survivor of the *Concepcion* shipwreck in 1638, who was then acting as interpreter for the Jesuits on Anatahan Island (Ibanez, 1886), a number of the religious and secular members of the Mission were killed, Father Sanvitores being slain in 1672. The response of the Spanish government to these events was to send in additional religious and military personnel and to provide additional monies and supplies for their support. According to one of the earliest reports from this period, a rebel force of 2,000 natives was met successfully by a Spanish force consisting of 10 priests, 12 Spaniards and 17 Filipinos in Guam in 1670 (Anon., 1674) or 1671 (Corte, 1870a).

As Spanish military forces were strengthened, the Spanish began attacking native villages, at first confining their assaults to Guam. Captain Juan de Santiago burned down the village of *Eunhon*, or *Tumhon*, while seeking to capture Matapang, the alleged murderer of Father Sanvitores (Ibanez, 1886; Corte, 1870a). Captain Dami n de Esplana, named Sergeant-Major by the superior of the Mission in 1674, carried out punitive expeditions against the villages of *Chochogo*, *Chechego* (?) and *Mapas*, according to Corte (1870a), although Ibanez (1886) claims that the villages of *Chuchugu*, *Pepuro*, *Sidia-Aty*, *Sagua*, *Nagan* and *Ninca* were attacked during this period. Many of the natives of these villages were reported to have fled, either into the hills of Guam, or to other of the Mariana Islands. These

³ If we allow 6 priests, working 12 hours a day, 30 days a month, we would have a total of 17,280 working hours accumulated in 8 months for a per capita average conversion expenditure of approximately 34 minutes and 56 seconds.

refugees were joined by some of the natives of *Ectiyan* village who were attacked in the following year (by residents of the village of *Tarranguo* under the leadership of a Visayan native) in retaliation for the murder of two lay brothers in *Ectiyan*. *Upe* Village was burned in 1676, following the murder there of Father Antonio de S. Basillie; while Captain Francisco de Irrisarri y Viner burned down the village of *Talisay* later in the same year (Corte, 1870a).

The policy of destruction of native villages and resettlement of the remaining native population in one of a small number of native villages was effectively carried forth under the governorship of Don Jose Quiroga who arrived in Guam in 1680. Shortly after his arrival, Quiroga attacked and destroyed many remaining native villages and rebel centers, and founded 6 "church-villages" of Pago, Inapsan, Inarahan, Merizo, Umatac and Agat, forcing the natives to move into one or another of these centers (Fritz, 1904; Corte, 1870a). In addition, Quiroga pursued the natives who, after burning the church at the recently established center at Inarajan, had successfully fled to Rota, and forced some 150 fugitives to return to Guam (Corte, 1870a; Ibanez, 1886).

Native uprisings were reported in Guam, Saipan and Tinian in the ensuing years, until, following the death of Governor Damian de Esplana, Jose Quiroga succeeded to the post in 1694. Under his direction, the inhabitants of all the Marianas Islands were removed to Guam or Saipan, excepting a small number of natives who, hiding out on Rota, apparently escaped detection and resettlement. Natives of Tinian Island, temporarily escaping to Agrigan, were finally defeated by Quiroga and removed to Saipan in 1695. A final resettlement took place when Chamorros residing on Saipan were removed to Guam in 1698, leaving only Guam and Rota occupied at the beginning of the 18th century (Safford, 1901, 1903; Corte, 1870a; Fritz, 1904).

It is difficult to estimate the numbers of natives dying in the course of hostilities or in consequence of the disruptions attendant on the series of rebellions which took place in the final decade of the 17th century. Spanish reports, which expectably might emphasize the success of their few numbers against so large a native population, rarely mention the loss of more than a few or "some" natives in various sieges. Destruction of native villages and the dispersal of village residents into unsettled environs, whether in Guam or on other islands, likely entailed some degree of population flux, either through the death of infants, the infirm, or elderly natives, while disturbances in daily living patterns and associations may have had some inhibiting effect on the birth rate. Loss of life at sea while en route to other islands is suggested in Corte's description of the flight of the residents of Inarajan to Rota, and, presumably, might have included the loss of a random sample of all ages and both sexes.

Probably of far more import in this period were the effects of newly-introduced diseases, appearing at epidemic levels. The first of such recorded epidemics was noted as occurring in 1688 by Le Gobien, and was described by Fritz (1904) as a kind of rheum (accompanied by fever and bloody flux from which, reportedly,

none were spared but those who drank Holy Water), while Reed (1952) judges this an influenza epidemic. On Guam, a native population in the throes of resettlement, having suffered a series of damaging typhoons in 1670 (Ibanez, 1886), in 1671 (Corte, 1870a; Thompson, 1946, 1947; Reed, 1952) and in 1693 (Thompson, 1945; Reed, 1952), and engaging in a series of rebellions, would expectably be peculiarly susceptible to disease, whether of introduced or native origins. That population decline had begun well before the date of the first Spanish census in 1710 seems evident, but the decrease had certainly not proceeded to the level of from 100 to 400 indicated by Dampier, after his visit in 1686, and recorded by Haswell (1917), Safford (1901) and Reed (1952).

At the turn of the century, the centralization of the remaining native population of the Mariana Islands on Guam had been accomplished, with the exception of a few hundred refugees remaining on Rota Island. The history of the population decline which took place thereafter is not merely common to a general pattern expressed in many Pacific island peoples (McArthur, 1968), but disturbingly familiar to any who have read the population history of California Indians during the mission period of their history (Cook, 1943a, 1943b).

Native population declined steadily, reaching its lowest point in 1786 for the Mariana Islands as a whole, although the nadir point was reached at an earlier date (1753) in Rota, according to Freycinet (1829). Concurrently, the growth of a "mestizo" population, the progeny of matings between natives and Spanish, Filipino, and other foreigners, paralleled the demise of the native segment during this period. Concentrated in fairly densely-settled villages and the major port town of Agana, altered host conditions for infectious and communicable diseases must have been created, while cultural disruption also must have hindered the establishment of new life patterns conducive to population recovery and growth.

A prevailing view of this time, summarized by Crozet who visited Guam in 1772 (In Roth, 1891: 83), ascribed the decline to abortifacients in an effort to avoid bearing children. Whatever the efficacy of this practice, the simultaneous growth through natural increase of a mestizo population offers an indirect challenge to the notion—unless we assume that the women involved in mixed matings, many of whom were certainly Chamorros, were uniquely ignorant of native pharmacopoeia, were immune to the effects of the abortifacients, or failed to share the motivation of despair.

From 1699 to 1786, at least two epidemics have been recorded, both identified as smallpox. The first of these, appearing in 1699 or 1700, reportedly took many lives (Fritz, 1904), although Father Palomo (in "Continuation . . ." to Corte, 1870a) vehemently denied that any loss of life resulted from the event. Whatever the mortality of the earlier exposure, a highly susceptible population would have been at risk by the time of the appearance of the second epidemic in 1779 (Safford, 1901).

Immigration to the Mariana Islands, accelerated during the final decade of the previous century with repeated reinforcements of the Spanish forces and Mission,

continued to introduce new residents, primarily from Spain, America, and the Philippines, and probably included limited numbers of women and children. A Memorial from the Royal Cedula, dated 1722 (MARC DOC MEX) requests that a previous Cedula, granted to the Duquesa de Abeyro, for passage of some 80 to 90 native families from Manila to settle in the Mariana Islands, be put into effect. However, by 1762, the Governor of Guam could only determine the presence of 100 able-bodied Filipino males in the islands who might be available for military services if needed (Governor Guam Reports and Investigations, 1762). In 1772, Tobias, as reported in Roth (1891: 93), recorded that a native militia of some two hundred men was commanded by four Spanish captains, with the remaining officers described as mostly mestizos and Filipinos. By 1783, census results record the presence of 818 Spanish and their descendants, of 648 Filipinos and their descendants, and of 151 soldiers of unspecified nationality (see Table 2).

Involuntary immigrants to Guam during this period include two Negro boys, provided by the pirate Woodes-Rogers as a gift to the Governor during his visit in 1710, and an elderly Spaniard, Gomes Figuero, taken from a Spanish prize by Woodes-Rogers during his voyage to Guam, and left behind in Guam when the English ship departed (Leslie, 1899; Safford, 1901). Also during this period, two accidental voyages led to the brief sojourn of natives from the Caroline Islands in Guam—one group of 30 arriving in 1721 (Safford, 1901; Reed, 1952; Lopinot, 1964) and an unspecified number arriving from the Yap Islands in the 1760's (Reed, 1952).

Doubtless many European ships entering the area during this period went unnoticed in the historical records, and particularly so when such voyagers avoided landing at Guam. However, Anson's visit to Tinian (1742) and La Perouse's visit to the Northern Marianas in 1786 have been recorded, as also the visit of Dampier and of Funnell to Rota in 1705 (Anson, 1748; Safford, 1901, 1903; Reed, 1952). Visitors to Guam during this period included such familiar names as Dampier and Swan, Eaton, Cowley, and Woodes-Rogers; Captain de Pages, Crozet; Dudesmeur; Clipperton, Byron, Wallis and Portlock. With the exception of reported atrocities against the natives committed by Eaton and Cowley, no evidence remains that visitors during this period engaged in the removal of natives or in hostile acts against the native population. According to Fritz (1904) a delegation of Chamorros sailed for Manila and Mexico in 1671, but the return of this group has not been documented.

Some suggestive evidence indicates that the native population existed in conditions of severe economic hardship. Fritz (1904), basing his claim on a report by a Father Brown, stated that many died of hunger in 1706. In addition, a Royal Cedula, dated March 30, 1772, concerns the complaints of the natives of the Mariana Islands (and of Mindanao) as to their "miserable state, caused by the extreme greed of the person who governs them" (MARC DOC MEX).

In summary this period, opening with a decade of turmoil and strife, and leading to the forcible resettlement of the native population into concentrated settlements on Guam (with a few hundred refugees remaining on Rota), witnessed

Table 2. Period of population decline and contraction (1669-1786).

Year	Total	Mariana Islands			Total	Guam & Rota			Total	Native
		Native	Mestizo	Other		Native	Mestizo	Other		
1672	50,000									
	(Baptized)									
1686										300-400
1694										
1698										100
1710	3,197									
	3,539									
	3,672									
	3,678									
	3,760									
		3,678								
					3,539					
					3,678					
						3,197		417		
1726										
	4,200 to				4,200 to				ca.	
	4,300				4,300				4,000	
1742										
1753										
1756		1,652								
1760		1,654								
						1,654				
										1,654
1764		1,654								
1768									ca.	
									10,000	
1772		ca. 800								ca.
		to 900								1,500
1783									3,231	
									3,231	
1784		1,583								
1786		1,318							3,169	
										1,318

the steady, continuing decline of a "native" population, the rapid growth of a mestizo population, and a steady increase in the number of emigrants from Spain, America, and the Philippine Islands. Living conditions for the native population, at least, were probably extremely impoverished, and, in combination with the effects of several epidemics, retarded population recovery for nearly a century. Unfortunately, Spanish records fail to provide any information as to the age or

Table 2. (Continued)

Guam Mestizo	Other	Northern Mariana Islands Total	Rota Total	Tinian Total	Saipan Total	Source	Reference
		0				Dampier	Anonymous, 1674; Fritz, 1904. Reed, 1952; Haswell, 1917. Joseph and Murray, 1951; Bowers, 1951.
			Few Hun- dred		0	Marche, 1891	Joseph and Murray, 1951; Bowers, 1951; Joseph and Murray, 1950.
						Freycinet, 1829	Spoehr, 1954.
						Corte, 1876	Spoehr, 1954; Cox, 1917; Joseph and Murray, 1951.
							Spoehr, 1954; Olive, 1887 Fritz, 1904. Bowers, 1951. Thompson, 1945.
						Freycinet, 1829	Thompson, 1947.
						Corte, 1875	Thompson, 1947; Fritz, 1904; Olive, 1887.
95						Corte, 1875	Safford, 1904; Thompson, 1947; Reed, 1952.
			200 to 300 234	0		Anson, 1742	Roth, 1891.
						Freycinet, 1829	Thompson, 1947; Reed, 1952; Joseph and Murray, 1951. Fritz, 1904. Olive, 1887; Corte, 1870a.
						Freycinet, 1829	Thompson, 1947; Olive, 1887. Bowers, 1951.
						Depages	Safford, 1901.
						Crozet	Roth, 1891.
						Raynal, 1798	Safford, 1901; Reed, 1952.
						Freycinet, 1829	Thompson, 1947; Reed, 1952.
						Kotzebue, 1821	Safford, 1901; Bowers, 1950.
						Freycinet, 1829	Thompson, 1947. Bowers, 1950.
						Freycinet, 1829	Spoehr, 1954.
						Freycinet, 1829	Thompson, 1947.
1,614	1,617						

sex composition of the population, with one singular and exceptional report concerning the alleged great longevity (ca. 120 years) of a number of Chamorros then residing in Guam. Changes in the settlement pattern and population distribution after the *reduccion* had taken place are indicated in a report by Crozet, dating to 1772 (In Roth, 1891: 85) and found also in Raynal (1798): Besides Agana, there are "... 21 small Indian settlements round the islands, all on the sea-coast, and

composed of five or six families each. . . .”

3. Period of Population Recovery and Integration (1787–1898)

The salient features of the population history of the Mariana Islands during this period may be briefly summarized as follows:

During the first 70 years of this era, total population size nearly tripled, reaching a figure of over 9,000 persons before the devastating smallpox epidemic of 1856 reduced this number nearly in half. In the remaining 40-odd years, from 1857–1898, population size more than doubled, reaching some 9,000 (cf. Table 3). A sizable portion of this latter increment was contributed by the migration of large numbers of Carolinian Islanders (at least 1,000) brought to the islands as part of a policy of repopulation of the Mariana Islands, and through the influx of perhaps as many deportees from Manila. By the end of this period, permanent settlements were maintained on Saipan, Tinian, and Rota, as well as Guam. Finally, the development of a “neo-Chamorro” people has been signalled at this time, as census distinctions seem to have adapted to the blurring of former categories no longer appropriate to the appearance and integration of a new, multi-hybrid population.

The rate of natural population growth prior to 1856 was undoubtedly very high, for immigration prior to this date seemed at least no more common than previously, while the population was exposed to repeated epidemics which expectably operated against any existing trends toward increase. According to Safford, an epidemic (influenza?) caused the deaths of 194 persons in Guam and 36 in Rota between January 7 and January 31, 1849, although affecting very few children. An epidemic of whooping cough reportedly resulted in the deaths of at least 200 children in 1855 (Fritz, 1904). Two epidemics swept through the survivors of the smallpox epidemic in 1856—a measles epidemic in which at least 50 died in 1861, while another epidemic of whooping cough caused the deaths of 100 children in Agana, alone, in 1898 (Fritz, 1904).

In addition, general living conditions and the prevailing economic situation seem not to have advanced greatly over the levels of the preceding period. Food shortages and scarcity were so great that supplies of rice and dry fish had to be sent to Guam from the Philippine Islands in 1802 (Safford, 1901), while the natives were forced to rely on *federico* as an emergency supply during the period of food shortage resulting from the effects of three hurricanes in 1847 and a major “inundation” which swept the islands in 1848. Recovery from this episode was further delayed by the typhoon and severe earthquake which affected Guam in 1849 and by the weakened state of many residents who were affected by the influenza epidemic of that same year. Economic growth was probably stimulated briefly during the period (ca. 1820–1850) when Guam, Saipan, and Tinian were major whaling port areas of the Northern Pacific, but most of the capital available from such sources seems to have been drained into the coffers of a very few individuals, the government or church (Carano and Sanchez, 1964). By 1815, the last more or less regular galleon stopover at Guam was recorded (Safford, 1901).

Foreign interest in the area led to several abortive attempts to develop ranches on some of the more remote islands or trading companies on the island of Guam. Kotzebue reported the attempt by a Captain Brown to settle some 38 Hawaiians on Saipan and Tinian around 1810, but the colony was forcibly removed about 1815. In 1865, Johnson and his son attempted to develop a ranch on Tinian, using 250 Carolinians for labor, but this effort was abandoned in 1878 (Bowers, 1950). By 1831, a group of expatriates had settled on Guam, marrying into native families, and some of these individuals were to assume important roles in the embryonic development of commerce and trade. Among those listed by Safford were the following:

John Anderson (arrived in Guam with the Freycinet expedition)

Juan Roberto (arrived in Guam ca. 1825)

William Atkins (arrived in Guam ca. 1826)

Eden Casey (arrived Guam ca. 1825)

John Sherwood (time of arrival not mentioned)

In 1832, James Wilson and Joseph Peter Watkins, both English, requested permission to reside in Guam permanently. By 1851, the list of foreign residents compiled by Safford included: J. Anderson, J. Roberto, J. Sherwood, S. Wilson, G. George, R. Milinchan and H. Milinchan. Somewhat later, Samuel J. Masters and his secretary, J. S. Van Ingen, arrived in Guam and requested permission to establish a merchantile enterprise on the island. By 1855, Captain Masters, a former police magistrate at Lahaina, Hawaii, had begun to act as the United States Consul at Guam, while a Dr. Beals served as medical officer on Guam, and a ship chandlery, that of Messrs. Thomas Spencer and Company, had been established (Reed, 1952; Safford, 1901, 1903).

Prior to the time of the decimating smallpox epidemic in 1856, immigration to the Mariana Islands had been minimal, especially in contrast to the rate of population movement into the area which took place after that date. A small Carolinian colony was established on Guam in 1816, and, by 1830, 55 Carolinians were noted as residing on Saipan. This nucleus of Carolinian settlement was augmented somewhat following the great earthquake and tidal wave which apparently hit many Carolinian islands, as well as Guam, in 1849, leading survivors of the calamity to flee their ravaged atoll homes and seek refuge elsewhere in Micronesia. The only clear evidence of an enforced migration from the Philippine Islands to the Mariana Islands at this time concerns the deportation of 65 convicted Filipinos to Guam in August 1851. Fifty-one of these men were distributed among residents on the island to assist in agricultural activities, but, as a result of the discovery of their plans to lead an uprising on the island, 63 of the group were returned to Manila in November of the same year. At about the same time, a Filipino deportee was sent to Saipan in 1849 as catechist to the residents there. This and other occasional references to individuals sent from Manila to Guam as deportees suggest that the Marianas Islands were not used extensively as a penal colony prior to the 1870's.

On the other side of the migration ledger, it is probably during this period when

the practice of using Chamorro men as sailors on foreign vessels became common practice. Safford notes for 1855 that the captain of a whaling vessel, Captain George Laurance, shipped a number of Guam natives on board, agreeing to return them at the end of a limited enlistment period, but actually discharging them in Honolulu. This report is confirmed by Olive's comments (1887:15-16):

Segun noticias que me dió el capitán de un bergantin de las Islas Sandwich, en Honolulu habrá unos 800 chamorros, muy apreciados como buenos trabajadores. Hace años, ofreció a estos trasporte gratis Doña Bartola, la residente en Yap, en un bergantin de su propiedad, y ninguno quiso regresar: esto se me ha dicho.

The latter quotation also makes reference to the movement of Chamorros to other islands in Micronesia, a phenomenon amply confirmed in subsequent documents, including the 1897 household census. Finally, it appears that small numbers of Chamorro males may have served aboard Spanish vessels for brief periods, for Olive writes (1887: 16): "Tambien he oido hablar bien de los chamorros que fueran voluntarios para servir en neustros buques de guerra el año 1884."

Subsequent to 1856, however, immigration increased radically, not merely in number, but in the variety of national origins represented in migrants. Sixty-three Chinese laborers arrived from Manila aboard the Spanish vessel *Denia* in 1858 in response to the Governor's earlier request (Safford, 1901); and an additional 39 Chinese may have arrived during the 1860's (Fritz, 1904). Olive also reports the arrival of 35 Japanese laborers brought to the Mariana Islands in 1867 to help develop the projects of the "Sociedad Agricola de la Concepcion," while two Japanese zoologists arrived at Guam from Yokahama in 1894 to make zoological collections for Dr. Walter Rothschild (Safford, 1901).

Between 1865 and 1869, over one thousand Carolinians were brought into the Mariana Islands, in part to develop the copra industry in the area. Beers (1954) suggests that an earlier complement of some 600 Carolinians was brought to Guam on labor contract about 1861, and by 1868, when an additional 95 Carolinians were brought to Guam in April of that year, a total of 430 Carolinians were listed as resident in the community around what is now the area of Tamuning (Ibanez, 1886). The rate of natural increase among this group seems to have been minimal, for Olive records the following total figures for Carolinians on all Mariana Islands in the years indicated below and gave much attention to some of the possible factors which might have been responsible for this trend:

1884—1058

1885—1068

1886—1069

Perhaps as many Filipinos were deported to the Mariana Islands between the years of 1874-1877, when three ship-loads of deportees were brought into Guam aboard the *Mercante*, *Panay*, and *Patino*. Although the records show some discrepancies, as many as 926 seem to have been sent, although not all survived the voyage (MARC DOC). An unspecified number may have arrived even earlier,

for Palomo (in "Continuation" to Corte 1870a) notes that a good many Filipinos were sent as a consequence of the Cavite insurrection of 1872. More than 20 years later, an additional group of Filipinos was sent to Guam in 1896, but these (98 Tagalogs) were killed during an insurrection at the Presidio at Guam in December of that year (MARC DOC, VITAL STATISTICS FOR AGANA).

Various records and census data are available from this period in the population history of the Mariana Islands which permit the reconstruction of some of the demographic attributes of the population for the first time (Table 3). As most writers on the subject have pointed out, the preciseness of the data are questionable, but general patterns probably can be reliably derived from such materials. These include a number of censuses, by village, allowing the reader to detect trends in population distribution patterns. In addition, the household census of Guam for 1897 has been made available and the results help to illuminate some of the demographic and genetic consequences of earlier population history.⁴ Finally, the vital statistics records for 1896 are now also available and provide a base line for comparison with more carefully recorded vital statistics records of subsequent dates.

The pattern of village settlement and population change by village for this period are indicated in Table 4. Although interpretations are made somewhat more difficult by the different municipal units for which population figures are reported at different times, I have attempted to indicate the major trends by grouping reported data into more inclusive categories to allow gross patterns to become evident. Clearly, the tendency toward greater concentration of population into Agana and its environs (Anigua, Asan, Tepungan, Sinajana, Maria Cristina, and Mungmung), beginning shortly after contact, did not continue in a steady manner, nor can the temporary decline be traced to any immediate results of the 1856 epidemic. Rather, a peak period of concentration seems to have taken place in 1871 when nearly 84 percent of the total population of Guam was living in this center, but a decline began in the following year and was not reversed until the fourth period in the population history of Guam. In addition, shifting patterns of village occupancy seem indicated by these data, indicating that at least two villages, Mungmung ("Mongmong" on current maps) and Pago appear to have been abandoned as named, administrative units. By the time of the 1897 census (cf. Table 5), the following administrative units were utilized: Agana and its immediate environs, consisting of 15 "Cabeceras"; Anigua; Asan; Tepungan; Sinajana; Maria Cristina; Agat; Merizo; and Inarajan. The port area of Agat, along with the associated community of Sumay, shows a steady increase in population concentration during

⁴ Analyses of these data, collected in 1969, were made possible through a generous grant for this purpose by the Graduate College Faculty Research Support Committee, University of Arizona, Tucson, Arizona. I would like to take this opportunity to express my appreciation for this assistance. The materials were made available through the facilities of the Micronesian Area Research Center in Guam and I am deeply indebted to the entire staff of that Center for invaluable assistance in locating, translating, and analyzing these data.

Table 3. Population distribution of Guam and Rota Islands, 1897,
by age, sex, and residence.

Age Group	Agana		Agana-Adjacent		Agat		Merizo		Inarajan		Guam, All		Rota, All	
	Sex ^a Ratio	Age ^b Dist. %	Sex Ratio	Age Dist. %	Sex Ratio	Age Dist. %	Sex Ratio	Age Dist. %	Sex Ratio	Age Dist. %	Sex Ratio	Age Dist. %	Sex Ratio	Age Dist. %
0	129.7	2.83	145.5	2.40	95.5	3.09	103.3	3.17	66.7	3.83	119.3	2.87	100.0	3.23
0-4	108.9	13.66	108.2	13.50	90.9	17.43	80.0	18.27	84.6	18.39	100.8	14.77	95.0	15.76
5-9	111.9	12.72	112.7	11.90	110.9	14.49	109.5	11.17	111.8	13.79	111.6	12.77	97.0	13.13
10-14	108.0	10.04	61.8	10.92	78.9	10.26	111.4	11.80	109.1	8.81	95.9	10.31	75.5	14.14
(0-14)	109.6	36.42	92.9	36.32	94.1	41.19	95.8	41.24	98.1	41.00	102.9	37.86	90.2	43.03
15-19	91.5	9.91	96.4	9.59	89.4	9.43	56.7	11.93	118.2	9.20	87.9	9.96	84.0	9.29
20-24	75.3	10.79	86.4	10.92	96.9	9.81	115.9	12.06	81.3	11.11	83.2	10.78	72.7	7.68
25-29	78.0	9.04	90.0	10.12	101.3	11.40	70.5	9.52	12.50	10.34	84.0	9.62	104.3	9.49
30-34	86.2	7.81	73.5	7.55	63.5	7.77	168.4	6.47	183.3	6.51	86.5	7.61	59.1	7.07
35-39	103.1	5.01	114.3	5.33	96.7	4.45	80.0	4.57	83.3	4.21	100.9	4.90	100.0	5.66
40-44	97.0	3.75	59.1	3.11	57.1	2.49	100.0	2.99	—	3.07	84.3	3.37	35.3	4.65
(15-44)	85.4	46.31	87.5	46.62	87.2	45.36	88.4	47.34	103.5	44.44	86.7	46.24	76.4	43.84
45-49	63.3	4.02	65.5	4.26	113.3	2.41	100.0	1.27	66.7	3.83	68.9	3.55	50.0	2.42
50-54	64.8	3.87	51.4	4.97	42.3	2.79	90.0	2.41	—	1.53	60.1	3.64	140.0	2.42
55-59	63.7	3.21	64.3	2.04	100.0	2.72	61.5	2.66	62.5	4.98	67.7	2.99	33.3	3.23
60-64	105.5	2.89	93.8	2.75	92.9	2.04	50.0	3.81	—	1.15	94.4	2.77	30.0	2.63
65-69	107.3	1.63	66.7	2.22	112.5	1.28	—	0.76	—	1.77	104.5	1.55	—	2.63
70-74	96.4	1.06	—	0.36	266.7	0.83	—	0.25	—	0.38	108.6	0.84	—	0.40
75+	80.0	0.52	—	0.36	—	0.38	—	0.13	—	0.77	116.7	0.45	—	0.61
(45-75+)	75.6	17.20	67.5	16.96	94.1	12.45	78.0	11.29	66.7	13.41	76.4	15.80	51.2	13.13
Unk	—	0.07	—	0.10	—	—	—	0.13	—	1.15	—	0.10	—	—
Totals	91.6	100.00	85.8	100.00	90.9	90.0	89.9	100.00	96.2	100.00	90.7	100.00	78.1	100.00

^a Sex ratio = $100 \left(\frac{N \text{ males}}{N \text{ females}} \right)$ not calculated for cohorts numbering fewer than 10.

^b Age distributions per major residential region shown in percent of total for each such region.

Table 4: Population distribution, Guam, period III (1787-1898), by city and village units, showing number enumerated and percent of total population of each unit.

Date	Agana	Anigua	Asan	Tepun- gan	Sina- jana	Maria Cristina	Mong- mong	Agat	Sumay	Umatac	Merizo	Inara- jan	Pago	Totals	Source
	N %														
1831 (Nov. 14)	4,137 (68.4)	234 (3.9)	158 (2.6)	56 (0.9)	172 (2.9)		74 (1.2)	/...222..... / (3.7)	206 (3.4)	295 (4.9)	246 (4.1)	249 (4.1)	6,049 (100.1)	(a)	
	/.....4,831..... / (79.9)														
1832 (Dec. 31)	4,362 (69.1)	246 (3.9)	155 (2.5)	57 (0.9)	177 (2.8)		68 (1.1)	/...218..... / (3.5)	220 (3.5)	319 (5.1)	244 (3.9)	244 (3.9)	6,310 (100.2)	(a)	
	/.....5,065..... / (80.3)														
1849	5,620 (70.8)	217 (2.7)	190 (2.4)	73 (0.9)	250 (3.1)		102 (3.6)	/...287..... / (3.6)	224 (2.8)	358 (4.5)	346 (4.4)	273 (3.4)	7,940 (99.9)	(b)	
	/.....6,452..... / (81.3)														
1871				5,251 (83.7)				/...553..... / (8.8)		127 (2.0)	189 (3.0)	156 (2.5)	6,276 (100.0)		(c)
1872				4,972 (79.6)				/...641..... / (10.3)		/...379..... / (6.1)		256 (4.1)	6,248 (100.1)		(d)
1886	4,949 (60.5)	169 (2.1)	259 (3.2)	259 (2.9)	234 (1.8)	145 (2.4)	193	712 (8.7)	471 (5.8)	225 (2.7)	439 (5.4)	390 (4.8)	8,186 (100.3)	(e)	
	/.....5,949..... / (72.7)														
	4,959 (60.9)	169 (2.1)	252 (3.1)	234 (2.9)	142 (1.7)	193 (2.4)		712 (8.7)	429 (5.3)	225 (2.8)	439 (5.4)	390 (4.8)	8,144 (100.1)	(f)	
	/.....5,929..... / (72.8)														
1891				6,153 (73.3)				/...1,151..... / (13.7)		/...679..... / (8.1)		413 (4.9)	8,396 (100.0)		(g)
1897	5,198 (59.8)			1,126 (12.9)				/...1,325..... / (15.2)		/...788..... / (9.1)		261 (3.0)	8,698 (100.0)		(h)
	/.....6,323..... / (72.7)														

Abbreviations and explanations: (a) Villalobos, *In Safford*, 1901; (b) Cox, 1917; (c) Corte, 1875; (d) Ibanez, 1886; (e) Olive, 1887; (f) Noticias, 1886; (g) Resumen, 1891; (h) 1897 Household Census, corrected by Underwood, 1972.
 Note: Minor variations in total percent figures are a result of rounding off individual percent figures.

Table 5. Population structure and distribution, Guam, 1897
(After 1897 Census).

Age Group	Σ (Agana 101-114)			Σ (Agana-Adjacent 115-120)			Σ (Agat 201-205)			Σ (Merizo 301-303)			Σ Inarajan			Summary All Guam		
	♂	♀	Σ	♂	♀	Σ	♂	♀	Σ	♂	♀	Σ	♂	♀	Σ	♂	♀	Σ
0	83	64	147	16	11	27	20	21	41	13	12	25	4	6	10	136	114	250
	83	63	147	16	11	27	20	21	41	13	12	25	4	6	10	136	114	250
0-4	370	340	710	79	73	152	110	121	231	64	80	144	22	26	48	645	640	1285
5-9	349	312	661	71	63	134	101	91	192	46	42	88	19	17	36	586	525	1111
10-14	271	251	522	47	76	123	60	76	136	49	44	93	12	11	23	439	458	897
(0-14)	990	903	1893	197	212	409	271	288	559	159	166	325	53	54	107	1670	1623	3293
15-19	246	269	515	53	55	108	59	66	125	34	60	94	13	11	24	405	461	866
20-24	241	320	561	57	66	123	64	66	130	51	44	95	13	16	29	426	512	938
25-29	206	264	470	54	60	114	76	75	151	31	44	75	15	12	27	382	455	837
30-34	188	218	406	36	49	85	40	63	103	32	19	51	11	6	17	307	355	662
35-39	132	128	260	32	28	60	29	30	59	16	20	36	5	6	11	214	212	426
40-44	96	99	195	13	22	35	12	21	33	11	11	22	2	6	8	134	159	293
(15-44)	1109	1298	2407	245	280	525	280	321	601	175	198	373	59	57	116	1868	2154	4022
45-49	81	128	209	19	29	48	17	15	32	5	5	10	4	6	10	126	183	309
50-54	79	122	201	19	37	56	11	26	37	9	10	19	1	3	4	119	198	317
55-59	65	102	167	9	14	23	18	18	36	8	13	21	5	8	13	105	155	260
60-64	77	73	150	15	16	31	13	14	27	10	20	30	2	1	3	117	124	241
65-69	44	41	85	10	15	25	9	8	17	5	1	6	1	1	2	69	66	135
70-75	27	28	55	2	2	2	8	3	11	1	1	2	0	1	1	38	35	73
75+	12	15	27	3	1	4	4	1	5	1	0	1	1	1	2	21	18	39
(45-75+)	385	509	894	77	114	191	80	85	165	39	50	89	14	21	35	595	779	1374
Unk	1	3	4	1	0	1	0	0	0	0	0	0	2	1	3	4	4	8
Totals	2485	2713	5198	520	606	1126	631	694	1325	373	415	788	128	133	261	4137	4561	8698

this period, so that 1.52 percent of the entire population of Guam lived in this neighborhood by 1897. Finally, it should be noted that while the proportion of the population living in Agana and its surrounding communities had increased after the 1856 population decimation, the numbers, as well as percentages, of those remaining in the more distant communities of Umatac, Merizo and Inarajan are scarcely more than half of the comparably figures for 1849, some seven years prior to the smallpox epidemic. Since there is no evidence of differential survivorship in the Agana area during this island-wide epidemic, nor of intra-island movement tending toward urbanization following the events of 1856, I am inclined to judge that immigration differentials can best be evoked as an explanatory device here, by assuming that most immigrants from abroad were brought into the Agana area and resided there, at least temporarily.

In the other islands, only Saipan supported more than one village during this period. The resettlement of this island, which began around 1815 when some 200 Carolinians from the Truk Islands area settled in Saipan, proceeded haltingly at first. Although Chamorro immigrants began to move to the island a few years after the Carolinian settlement was established, the number of residents actually decreased until around 1850. By 1830, only 55 Carolinians were reported as living in Saipan (Olive, 1887), while the total population of the island was listed as 128 in 1835 (*Islas Marianas Informe, 1885*, quoted by Spoehr, 1954). An additional 41 Carolinians, from *Lamuseg* (=Lamotrek?), sought refuge in Saipan after the disastrous tidal wave and earthquake of 1849 (Safford, 1901), so that the total population of Saipan had reached 267 by 1851 (*Diccionario historico, 1851*, cited by Spoehr, 1954). In the ensuing four years, additional Carolinian immigration took place so that the total number of Carolinians on Saipan was 266 in 1855 (Olive, 1887). By 1863, only seven years after the smallpox epidemic which ravaged Guam and Rota, the total population of Saipan had increased to 420 (*Islas Marianas Informe, 1885, In Spoehr, 1954*), but most of this growth was probably derived from immigration, as in the ensuing two years the total population numbered only 433 (Sanchez, 1867, In Spoehr, 1954) or 435 (Wheeler, 1900). By 1870, some 686 persons lived in the single village of San Ysidro de Garapan, in one of three wards, of which two were occupied by Carolinians and one by Chamorros. Following the resettlement of some 200 Carolinians resident on Tinian to Saipan about 1886, an additional village, Tanapag, was established on Saipan. Thus, the total population of Saipan in 1886 numbered some 1023, with 819 living in Garapan village and 204 resident in Tanapag village (Olive, 1887).

In comparison, the population history of Rota more closely paralleled that of Guam. A slow, but steady, increase in population number appears in the figures during the early half of this period, increasing from some 300 people in the 1790's to 438 residents as of 31 December 1832. Following the epidemic of 1849, and the climatic disturbances of that time, the population declined to 349 by 1855. The smallpox epidemic of 1856 exerted a further depressing effect so that, despite the influx of Carolinian immigrants, the total population of Rota numbered only 335

in 1864 (Handbook, 1948) or 1865 (Wheeler, 1900). Probably as a result of the influx of immigrants, the population grew rather rapidly thereafter, numbering 442 in 1866, again decreasing, at least to 326 in 1872 (Ibanez, 1886). Filipino deportees were sent to Rota in 1877, and a brief period of population growth is noted, probably culminating about 1896 when 504 persons were listed as resident in Rota (1897 Census). Olive (1887) noted a disproportionate number of females, particularly among the Carolinians, in the Rota population in 1885, as well as the differential mortality of males in at least one recorded shipwreck off Rota in this period, but no specific data on age or sex composition of the Rota population is available prior to the 1897 census (Table 6).

Tinian was resettled during this same period, beginning about 1816, and several colonies of Carolinians were established on the island for varying periods. During the latter half of this century, a single village, San Luis de Medina, was maintained, and, by 1886, the total population of Tinian consisted of 235 Carolinians, some 18 inmates of the leper colony, and the Chamorro administrator (Teniente Alcalde) and his family (Olive, 1887).

4. Period of Population Growth and Expansion (1899–1950)

Following the surrender of the Spanish authorities on Guam to American naval officers on June 20, 1898, and the later transfer of Spanish interests in the rest of the Mariana Islands to the German government, the native population of this region entered a period of gradually increasing involvement in world affairs. While Guam remained under the administration of the United States, except for a three-year period under direct Japanese control from 1941–1944, the remainder of the Mariana Islands were to pass from German hands to those of the Japanese after World War I. The termination of hostilities between the United States and Japan in 1945 witnessed the passage of the Japanese administration in favor of a Trust Territory status under the United States for the entire Mariana Islands area, except Guam. Expectably, the population histories of these sub-regions, as well as the population data, differ greatly and necessitate separate treatment. Census data from the 1897 Spanish household census is considered here to provide a baseline for considering the population trends of this period since equally detailed materials are not available for Guam prior to the 1920 census (Table 7).

The most striking characteristic of the population history of Guam for this period is that of growth, particularly since the time of the 1940 census. The total population of Guam increased nearly seven-fold between 1897 and 1950, but had increased less than three-fold between 1897 and 1940. Much of this growth is directly related to immigration, for the proportion of the total population identified as "native" or "Chamorro" decreased from 99.5 per cent in 1901 to 45.6 per cent in 1950. By far the greater contribution of the non-Chamorro proportion of the total population was "White" (38.5 per cent in 1950) or Filipino (12.2 per cent in 1950). However, an indirect measure of the contribution of natural increase in the Chamorro segment is indicated by the increasing value of the child-woman

Table 6. Population composition, Rota Island, 1897.

Age Group	Rota-CB 1			Rota-CB 2			Rota-CB 3			All Rota		
0	6	3	9	2	4	6	0	1	1	8	8	16
	6	3	9	2	4	6	0	1	1	8	8	16
0-4	19	22	41	17	17	34	2	1	3	38	40	78
5-9	10	13	23	21	16	37	1	4	5	32	32	65
10-14	13	11	24	13	25	38	5	3	8	31	39	70
(0-14)	42	46	88	51	58	109	8	8	16	101	112	213
15-19	13	7	20	6	16	22	2	2	4	21	25	46
20-24	10	15	25	5	5	10	1	2	3	16	22	38
25-29	14	11	25	8	9	17	2	3	5	24	23	47
30-34	5	9	14	6	11	17	2	2	4	13	22	35
35-39	6	3	9	6	9	15	2	2	4	14	14	28
40-44	2	7	9	4	5	9	0	5	5	6	17	23
(15-44)	50	52	102	35	55	90	9	16	25	94	123	217
45-49	3	1	4	0	5	5	1	2	3	4	8	12
50-54	3	3	6	2	1	3	2	1	3	7	5	12
55-59	4	5	9	0	5	5	0	2	2	4	12	16
60-64	1	5	6	2	4	6	0	1	1	3	10	13
65-69	0	3	3	2	2	4	0	0	0	2	5	7
70-74	0	1	1	1	0	1	0	0	0	1	1	2
75+	1	2	3	0	0	0	0	0	0	1	2	3
(45-75+)	12	20	32	7	17	24	3	6	9	22	43	65
Unk	—	—	—	—	—	—	—	—	—	—	—	—
Totals	104	118	222	93	130	223	20	30	50	217	278	495

ratio which compares favorably to the same index for various other native island populations (Table 8). Another measure of native population growth is provided by the median age characteristic of the population at the several census dates (Table 9). This index reveals a steady trend toward increasing youthfulness of the native population, a characteristic of growing populations. Also revealed in this index is the differential life expectancy of females among the Chamorros, a feature shared with most Western societies, and evident as early as 1897 in Guam. This factor is certainly important in the differential in the percentage of "widowed" (or, at later dates, "widowed or divorced") segment of the Chamorro population at various dates in this period (Table 10).

The native population of this distant island shares several other features of the general population patterns and trends of the United States during the first half of this century (Taeuber, 1972), including a decline in annual growth rate and changes in nuptial patterns during the 1930's. The average annual growth rate for Guam, which had reached the figure of 2.94 for the period 1920-1930, declined to 2.07 for the period 1930-1940. The proportion of persons currently married, which had shown a steady increase for females on Guam from 41.3 per cent in 1897 to 52.8 per cent in 1930, declined to 47.8 per cent in 1940. The failure to marry or

Table 7. Period of rapid population growth and expansion: Guam, 1899-1950.

Year	Total Number	Natives-Chamorro	Carolinians	Others	U. S. Naval Establishment	Source	Citation
1899			50				Thompson, 1947
				ca. 20			Beers, 1944
1900	ca. 9,000						Wheeler, 1900
1901	ca. 10,000						Haswell, 1917
	9,676	9,630	0	46			Beers, 1944; Thompson, 1947; Gallahue, 1946; Bowers, 1951.
	9,675						Cox, 1917
1902	10,000						Fritz, 1904
1908	11,490	11,159		159	172	Gov. Guam Annual Report	Carano and Sanchez, 1964; San Agustin, 1965
1910	11,806						U.S. 15th Census (1930)
	11,953	11,624		212	117	Gov. Guam Annual Report	Gallahue, 1946 Thompson, 1947
1915	13,689	12,968			721		Cox, 1917 Thompson, 1947
1916		13,285		206			Cox, 1917, 1926
1920	13,698					Gov. Guam Annual Report	Thompson, 1947
	13,275						Gallahue, 1946
	13,584	12,216		1059	309		15th U.S. Census (1930)
1923		14,912					Cox, 1926

(Continued from Table 7.)

Year	Total Number	Natives-Chamorro	Carolinians	Others	U. S. Naval Establishment	Source	Citation
1924		15,160		550	814		Cox, 1926
1925	16,648	15,246		543	859	Gov. Guam	Thompson, 1947
1930	18,509	16,402		989	1,118	Annual Report	
1935	20,899	19,455		754	690	15th U. S. Census (1930)	Gallahue, 1946
1940	22,290	20,177		2,113		Gov. Guam	Thompson, 1947
	23,067	21,502 (includes 617 half-Chamorro)		787	778	Annual Report	16th U.S. Census (1940) Gallahue, 1946; San Agustin, 1965.
1944		21,730		30,000 to 40,000 transients		Gov. Guam	Thompson, 1947
		22,476				Japanese Census	Thompson, 1947
Apr. 1946	23,846	22,783		6	456		Thompson, 1947 Gallahue, 1946
Mar. 1946	23,136	22,698		6	incl. 405	OPNAV P-22-100	Carano and Sanchez, 1946.
1947	24,139						Bowers, 1950; 1951.
1950	59,498	27,124		32,374			17th U. S. Census (1950)
	58,754	28,000					Reed, 1952.

Table 8. Child-woman ratio for Chamorro population of Guam, 1897-1960, and for various Pacific island populations (comparative date from McArthur, 1968).

CHAMORRO (GUAM)		VARIOUS PACIFIC ISLANDS		
Year	Ratio	Year	Island-Population	Ratio
1897	597	ca. 1889	Marquesas Islands	400
1930	857			
		1936	Fijians, Fiji Islands	671
			Indians, Fiji Islands	959
			Cook Islands	804
		1939	Tonga Islands	790
1940	798	1945	Cook Islands	837
		1946	Fijians, Fiji Islands	698
			Indians, Fiji Islands	1,105
			Tahiti and Dependencies	511
			Leeward Islands	782
			Marquesas Islands	894
1950	974		Austral Islands	972
			Tuamotu and Gambier Islands	542
		1951	Cook Islands	881
			Tahiti and Dependencies	603
			Leeward Islands	832
			Marquesas Islands	971
			Austral Islands	907
			Tuamotu and Gambier Islands	542
		1956	Fijians, Fiji Islands	771
1960	1,004		Indians, Fiji Islands	1,024
			Tonga Islands	843
			Western Samoa	969
			American Samoa	909
			Cook Islands	940

Table 9. Median age of Chamorro population at various census dates, 1897-1960.

Date	Total Chamorro Population	Males	Females
1897	21.0	19.9	21.9
1930	18.1	17.3	18.8
1940	17.5	16.3	18.6
1950	16.6	15.7	17.6
1960	14.4	13.5	15.4

Table 10. Marital status of population: Guam, 1897-1950.

Year	MALES (15 YEARS OLD AND OVER)					FEMALES (15 YEARS OLD AND OVER)				
	Total	Single	Married	Widowed	Divorced	Total	Single	Married	Widowed	Divorced
1897	N 2,467	(1,085)	1,212	170	—	2,938	(1,360)	1,212	366	—
	%	44.0	49.1	6.9			46.3	41.3	12.4	
1920	N 3,572	1,491	1,852	218	10	3,978	1,580	1,865	516	14
	%	41.7	51.8	6.1	0.3		39.7	46.9	13.0	0.4
1930	N 4,465	1,845	2,365	243	12	4,754	1,691	2,510	533	20
	%	41.3	53.0	5.4	0.3		35.6	52.8	11.2	0.4
1940	N 5,480	2,397	2,754		329	6,114	2,548	2,925	641	
	%	43.7	50.3		6.0		41.7	47.8		10.5
1950	N 7,253	3,277	3,607		369	7,903	2,979	4,023		901
	%	45.2	49.7		5.1		37.7	50.9		11.4

Table 11. Period of rapid population growth and expansion.

Year	ROTA NATIVES			TINIAN NATIVES			Total	SAIPAN Chamorro	
	Total	Chamorro	Carolinian	Other	Total	Chamorro			Carolinian
1899					14,917		59	23,685	
1900	491							1,237	
1901	497							1,407	
1902	490	440	49	1	95	36	59	1,631	967
1903	481							1,798	
1904	490							1,951	
1905	428							1,880	
1907	453							2,112	
1908	433								
1909									
1912				2					
				Japanese					
1914		(ca) 500			5 or 6				
1916								2,752	
1920	700				"few"			3,000	
1925								3,492	
1930	646				43				
1935	764				25			3,282	
1936			791				26		
1937			773				22	23,819	2,339
1938	7,621		736		14,917			23,685	
1939			770				17		
					14,900	25	13		
1940			827				2	23,682	
1943								30,000 (ca)	
1944				<10,000				(ca) 10,000	
					17,900			17,874	13,289
1945	9,156		790	8,366				17,974	2,426
1946			862					11,827	19,356
		(ca) 800							
1947	655				15	216		4,796	3,754
1948	655							4,945	
					292				
					216				
1949	681				364			4,962	3,890
	665				352			4,898	
1950								4,771	
								4,925	
								(ca) 4,700	(ca) 3,800

Table 11. (Continued)

NATIVES		NORTHERN MARIANA ISS. NATIVES				SOURCE	CITATION
Carolinian	Other	Total	Chamorro	Carolinian	Other		
621						German Census, 1902	Bowers, 1950 Hermann, 1910
621	43	138		62	123	German Census	Hermann, 1910 Hermann, 1910; Fritz, 1904 Hermann, 1910 Hermann, 1910 Guerrero, 1968 Hermann, 1910 Guerrero, 1968 Hermann, 1910 Guerrero, 1968 Laufofo Meti, 1969
	200 Immigrants >780 Immigrants +200 Samoans 72 Samoans 15 Japanese	215					Lopinot, 1964 Lopinot, 1964 Bowers, 1950 Matsamura, 1918 Handbook, 1948 Handbook, 1948 Handbook, 1948; Handbook, 1948; Bowers, 1950 Gallahue, 1946 USNATT, 1957 Gallahue, 1946 Bowers, 1950; 1951 Gallahue, 1946 Gallahue, 1946 Bowers, 1950; 1951 Gallahue, 1946 USN-ATT, 1957
		175 to 190					
		204					
		274 to 372					
3,222		168					Bowers, 1950 Gallahue, 1946
893	20,587	168				Japanese Reports	USNATT, 1957 Gallahue, 1946 Bowers, 1950; 1951 Gallahue, 1946 Gallahue, 1946
2,796		168					Bowers, 1950; 1951 Gallahue, 1946 Gallahue, 1946
3,194		382					Bowers, 1950; 1951 Gallahue, 1946 USN-ATT, 1957
3,179		225					
3,052	(ca) 25,000						
2,258	782	10,249 29,600					Bowers, 1950 USN-ATT, 1957 Spoehr, 1954 Guerrero, 1968 Bowers, 1950 USN-ATT, 1957 Bowers, 1950 Gallahue, 1946 Bowers, 1951 Guerrero, 1968 Handbook, 1948 Joseph & Murray, 1951 Handbook, 1948 Bowers, 1950 USN-Ann Reports Bowers, 1951 Bowers, 1950 USN-Ann Reports Spoehr, 1954 Taylor, 1951 Bowers, 1951
2,426	810	14,738			146		
2,966	1,025 4,387	15,365					
		136					
3,754	1,042					USN-Military Gov. Report	Handbook, 1948 Bowers, 1950 USN-Ann Reports Bowers, 1951 Bowers, 1950 USN-Ann Reports Spoehr, 1954 Taylor, 1951 Bowers, 1951
3,890	1,072	277 285 282					
(ca)3,800 (ca) 900		255 255					

postponement of marriage in the potentially fertile component of the population, as well as the effects of the war years, may have contributed to the second decline in average annual growth rate observed for the period 1950 to 1960, which decreased from a value of 2.96 for the period of 1940–1950 to 2.48 for the period 1950–1960.

Countering any such effects, however, were the consequences of improved physical and medical conditions, the more radical of such changes being postponed in their effects until the post-war period. Changing patterns of causes of death provide some indication of shifting selective patterns: of 255 deaths reported for the fiscal year 1901, 57 were due to dysentery, 34 as a result of a typhoon in November of 1900, and 21 were ascribed to epidemic catarrh (Beers, 1944). In contrast, of 281 deaths reported for 1947, 60 were ascribed to tuberculosis, 37 to pneumonia and 11 to hookworm infestation (Carano and Sanchez, 1964). Certainly, an elaborate typhoon warning system, appropriate construction programs, and the ready availability of relief supplies have diminished the potential hazards of climatic catastrophes, while public health programs and modern medical facilities have greatly ameliorated the disease hazards and contributed to increased survivorship and life expectancy. Further, less obvious factors probably contributing to increased fertility include the reduction of debilitating, but sub-vital, conditions, such as parasitism, and increased economic opportunities, facilitating early marriage and successful procreation.

Population distribution trends have only recently taken the form of a centrifugal pattern. Although re-drawing of district lines in some cases obscures specific details, it is clear that the immediate result of American control was an intensification of dense settlement patterns in a limited segment of the island up until 1940. Beginning with data from the 1950 census, however, it is evident that the resident population is becoming distributed more widely throughout the island, while Agana, which underwent a major redistricting in 1947, is no longer the single high-density settlement area of the entire island. Additionally, the settlement pattern has failed to result in increased urbanization, since only 34.2 per cent of the 1970 population is classified as urban, compared with 50 per cent so classified in 1950.

Although comparable, detailed census materials are not available for the populations of the remaining Mariana Islands, the available data demonstrate the markedly divergent population histories of these islands. During the period of German administration, only a handful of foreigners were resident on Rota, Tinian or Saipan, but this situation changed radically during the period of Japanese military build-up in the area (ca. 1935–1944). During the height of Japanese activity, Rota supported somewhat less than 10,000 Japanese troops, Tinian supported some 17,000-plus Japanese, Okinawans and Koreans, while Saipan maintained as many as 25,000 Japanese nationals and troops prior to the beginning of World War II. On Rota, native population growth followed an erratic pattern, and native population size did not even double in the period between 1897 and 1950. Smith (1972) has presented convincing evidence that emigration is a major factor in the low rate of population growth for this island. Tinian, however, has expe-

rienced a four-fold increase in population size as a result of re-colonization, partly involving a colony of displaced Chamorros resident on Yap Islands, after World War II (Table 11).

Perhaps the more interesting pattern of population growth has taken place on Saipan where population size has tripled since 1901. However, marked differences characterize the Chamorro and the Carolinian segments of the resident population. While the Chamorro population increased four-fold during the period of 1901-1950, the Carolinian population had not quite doubled in the same period. Since it seems unlikely that any ethnic bias was at work in the estimated 300 native deaths incurred in the hostilities which ravaged Saipan at the end of World War II, no ready explanation of this sort seems able to account for this marked difference. Suggestive evidence of a demographic contrast between the two groups on Saipan is indicated by Military Government data for the early post-war years (Table 12). Pending the availability of more detailed census data, these materials seem to confirm the comments of the Spanish observers of the late 19th century concerning the low fertility of the Carolinians in the Mariana Islands and to hint at a change in the direction of Chamorro patterns among the Carolinians in recent years.

Table 12. Comparison of crude age structure differences of Chamorros and Carolinians on Saipan Island, 1944-1947.

	July 15, 1944	April 11, 1945	July 1, 1947
CHAMORROS			
Males over 15 years of age	576	683	965
Females over 15 years of age	654	724	942
Children, ages 0 to 15 years	1,028	1,019	1,847
Totals	2,258	2,426	3,754
Percent children	45.5	42.0	49.2
CAROLINIANS			
Males over 15 years of age	264	275	302
Females over 15 years of age	247	250	293
Children, ages 0 to 15 years	271	285	448
Totals	782	810	1,042
Percent children	34.7	35.2	42.9

Population distribution in the Mariana Islands outside of Guam underwent radical changes during the period 1899-1950 as natives were displaced to limited areas by the burgeoning demands of the Japanese military and agricultural programs. Saipan became a major sugar growing and refining center, as well as a key airport in the Japan-Saipan-Palau route, providing additional economic opportunities to the native residents. Following the end of hostilities on the island, six villages were established: Chalan Kanoa, numbering 3,845 residents in 1950, while the smaller villages of Susupe (Yaptown), Oleai (Chalan Laulau), San Antonio, Aslito, and (New) Tanapag supported populations of less than 300 each at the same date (Taylor, 1951). No such similar centrifugal pattern of settlement developed on Rota, containing a single village, or Tinian. Finally, several of the Northern

Mariana Islands—Agrihan, Alamagan, Anatahan, Pagan and Sariguan—began to be settled around the turn of the 20th century, briefly supported intensive Japanese development programs, and have remained populated during most of this period, showing moderate population growth.

III. SUMMARY AND CONCLUSIONS

The population history of the Mariana Islands is reviewed, and source materials evaluated in an attempt to reconstruct the population history of this region and to identify some of the demographic attributes of the native populations between 1521 and 1950. Four periods in the population history of the Mariana Islands are recognized: a period of initial contact and intermittent exposure to European influences (1521–1668); a second period of intensive control and domination by Spanish colonial powers, accompanied by a calamitous population decline and contraction onto the islands of Guam and Rota (1668–1786); a period of re-integration of the “Neo-Chamorro” culture and population recovery (1787–1898); and a final colonial period, characterized by rapid population growth and expansion of population into islands and parts of islands which had remained unoccupied for two centuries (1899–1950).

The results of these studies are intended as part of the essential background studies for further research in problems of population genetics and genetical demography among island populations. Discussions of microevolution in Pacific island populations have employed highly simplified models in population genetics which may be misleading in their results and inaccurate in conclusions when based upon ignorance as to the history of these populations. Nor are the conclusions of the present study merely limited to the specific case in question, for similar patterns of population history can be detected in other islands (McArthur, 1968). It is, at the very least, misleading to suggest that genetic drift can account for vast differences in population gene frequencies when the countering force of migration has not been considered, nor to ascribe genetic differences to undetermined, differential selective pressures when the boundaries of actual breeding isolates remain unspecified.

As a first step in the analysis of the population genetics and evolutionary history of the Micronesian island peoples, the study of the history and demography of the populations provides the basis from which to identify the major contours of the breeding populations and to begin to determine the effective size of these populations. As shown by Wright (1939), population effective size is greatly modified by variations in population size and sex ratio (among other factors) over time. Studies now underway demonstrate the severe genetic effects of the bottlenecks in population size which clearly characterize the population history of this region, and of most of the Pacific area.

REFERENCES

- Anonymous.** 1674. Narrative of the martyrdom of the Venerable Father Diego Luis de San Vitores, of the Jesuits, written by a missionary of the island of GOAN (San Juan), also Jesuit. In Spanish. Reprinted, 1698.
- Anson, (Lord) George.** 1748. A voyage round the world in the years 1740, 1741, 1742, 1743, 1744, compiled by Richard Walter. John and Paul Knapton, London.
- Beardsley, C.** 1964. Guam, past and present. Charles E. Tuttle Co., Rutland (Vt.).
- Beers, H. P.** 1944. American naval occupation and government of Guam, 1898-1902. Administrative Reference Service Report No. 6. United States Naval Office of Records Administration, Washington.
- Bowers, N. M.** 1950. Problems of resettlement of Saipan, Tinian, and Rota, Mariana Islands. CIMA Report 31. Pacific Science Board, Washington.
- . 1951. The Mariana, Volcano, and Bonin Islands. In *Geography of the Pacific*, edited by Otis W. Freeman, pp. 205-35. John Wiley and Sons, Inc., New York.
- Bryan, E. H., Jr.** 1946. A geographic summary of Micronesia and notes on the climate of Micronesia. U. S. Commercial Company Economic Survey, Vol. 2-I.
- . 1971. Guide to place names in the Trust Territory of the Pacific Islands (the Marshall, Caroline and Mariana Islands). Pacific Science Information Center, Bernice P. Bishop Museum, Honolulu.
- Cadien, J. D.** 1971. A note on genetic drift in New Guinea. In *Human Biology in Oceania*, Vol. 2., pp. 140-43.
- Carano, P., and P. C. Sanchez.** 1964. A complete history of Guam. Charles E. Tuttle Co., Rutland (Vt.).
- Cavalli-Sforza, L. L., and W. F. Bodmer.** 1971. The genetics of human populations. W. H. Freeman and Co., San Francisco.
- Cook, S. F.** 1943a. Migration and urbanization of the Indians of California. *Human Biology* 15:33-45.
- . 1943b. The conflict between the California Indian and white civilization. *Ibero-American* 21:1-194, 22:1-55, 23:1-115, 24:1-29.
- De la Corte y Ruano Calderon, Lt. Col. Don Felipe.** 1870a. A history of the Mariana Islands, November 1520 to May 1870, with continuation by the Reverend Father Jose Paloma y Torres, translated by Gertrude C. Hornbostel. Bernice P. Bishop Museum, Honolulu.
- . 1870b. A descriptive and historical account of the Marianas and adjoining islands: their present organization, together with an analytical study of their physical, moral, and political factors and proposals for improvements in all areas which would advance them to the state of well-being which they merit, translated by Helen L. Paul. National Printing Office, Madrid.
- . 1875. A descriptive and historical account of the Marianas and adjoining islands: their present organization, together with an analytical study of their physical, moral, and political factors and proposals for improvements in all areas which would advance them to the state of well-being which they merit, translated by A. T. Perez. National Printing Office, Madrid.
- Cox, L. M.** 1917. The island of Guam. Government Printing Office, Washington. Revised Edition.
- . 1926. The island of Guam. Government Printing Office, Washington. Revised Edition.
- Freycinet, Louis de.** 1829. Voyage autour du monde fait par ordre du Roi, sur les corvettes de S. M. L'URANIE et LA PHYSICIENNE, pendant les années 1817, 1818, 1819, et 1820. Atlas Historique, Paris.

- Fritz, G. 1904. Die Chamorro. Eine Geschichte und Ethnographie der Marianen. Ethnologisches Notizblatt, Band III, Heft 3, pp. 25–110. Berlin.
- Gajdusek, C. 1964. Factors governing the genetics of primitive human populations. Cold Spring Harbor Symposia on Quantitative Biology, Vol. XXIX, pp. 121–27.
- Gallahue, E. E. 1946. The economy of the Mariana Islands. U. S. Commercial Company Economic Survey, Vol. V.
- . 1947. Economic and human resources—Mariana Islands. U. S. Commercial Company Economic Survey.
- Garcia, F. 1936–9. Vida y martiro de el venerable Padre Diego Luis de Sanvitores. In Guam Recorder, translated by Margaret Higgins, September 1936–July 1939.
- Giles, E., R. J. Walsh and M. A. Bradley. 1966. Microevolution in New Guinea: The role of genetic drift. Annals of the New York Academy of Sciences 134(2):655–665.
- Giles, E., S. Wyler and R. J. Walsh. 1970. Microevolution in New Guinea. Additional evidence for genetic drift. Archeology and Physical Anthropology in Oceania 5:60–72.
- Governor of Guam. 1762. Reports and Investigations. Agana.
- Guerrero, Vicente D. Leon. 1968. The proceedings in the northern Mariana Islands during the administrations of Germany, the Japanese empire, and the present trusteeship administration of the United States.
- Hainline, J. 1964. Human ecology in Micronesia: Determinants of population size, structure and dynamics. Unpublished Doctoral Dissertation, University of California at Los Angeles.
- Handbook on the Trust Territory of the Pacific Islands. Office of the Chief of Naval Operations, Washington. 1948.
- Hasebe, K. 1938. Natives of the south sea archipelago. Jinruigaku Senshigaku Koza 1:1–35.
- Haswell, W. 1917. Remarks on a voyage to the Mariana Islands (1801) by William Haswell, First Officer of the Barque, *Lydia*. In The Essex Institute Historical Collections, Vol. 53, pp. 193–214. Salem.
- Hermann, R. 1910. Zur Statistik der Eingeborenen der deutschen Sudseegebiete. Zeitschrift fur Kolonialpolitik, Kolonialrecht und Kolonialwissenschaft, pp. 7–8.
- Hornbostel, T. G. n.d. Unpublished field notes on the Mariana Islands.
- Hunt, E. E. Jr. 1950a. Studies of physical anthropology in Micronesia. Unpublished Doctoral Dissertation, Harvard University, Cambridge.
- . 1950b. A view of somatology and serology in Micronesia. American Journal of Physical Anthropology 8:157–84. (n.s.).
- Ibanez, Fr. Aniceto. 1936. History of the Marianas.
- Ibanez y Garcia, Luis. 1886. Historia de las Islas Marianas con su derrotero y de las Carolinas y Palaos, desde el descubrimiento por Magallanes en el ano 1521, hasta neustra dias.
- Joseph, A., and V. F. Murray. 1951. Chamorros and Carolinians of Saipan. Harvard University Press, Cambridge (Mass.).
- Lauofo, Meti. 1969. Letter from Lauofo Meti, Secretary to the Governor, to H. E. Governor M. F. C. (sic) Guerrero, 15 May, 1969.
- Leslie, R. C. 1899. Life aboard a British privateer in the time of Queen Anne, being the journal of Captain Woodes Rogers. Chapman and Hall, Ltd., London.
- Lessa, W. A. 1955. Depopulation on Ulithi. *Human Biology* 27:161–83.
- Lopinot, Rev. Callistus. 1964. The Caroline mission of the Spanish and German Capuchins, 1886–1919. Micronesian Area Research Center Library, Guam. Mimeographed.
- Matsamura, A. 1918. Contributions to the Ethnography of Micronesia. Journal of the College of Science, Tokyo Imperial University 40(7):1–174.
- McArthur, N. 1968. Island populations of the Pacific. Australian National University Press, Canberra.
- Micronesian Area Research Center Documents relating to reports, cedulae and various matters pertaining to the Mariana Islands, 17th–18th Centuries, from Archives of Mexico. n.d.

- Micronesia Area Research Center Documents, Vital Statistics for Guam, 1896-7. n.d.
 Micronesia Area Research Center Documents, 1897 Spanish Household Census of Guam and Rota Islands. n.d.
- Morton, N. E., D. E. Harris, S. Yee, and R. Lew. 1971a. Pingelap and Mokil Atolls: Migration. *American Journal of Human Genetics* 23(4):339-349.
- Morton, N. E., I. Roisenberg, R. Lew, and S. Yee. 1971b. Pingelap and Mokil Atolls: Genealogy. *American Journal of Human Genetics* 23(4):350-360.
- Murrill, R. I. 1950. Vital statistics of Ponape Island, Eastern Carolines. *American Journal of Physical Anthropology* 8:185-194. (n.s.)
- Olive y Garcia, F. 1887. *Islas Marianas*, translated by M. Driver. M. Perez, Manila.
- Osborne, D. 1947. Archeology on Guam: A progress Report. *American Anthropologist* 49:518-524.
- . n.d. Chamorro archaeology. Unpublished manuscript. Micronesia Area Research Center, Guam.
- Pellet, M., and A. Spoehr. 1961. Marianas archeology: Report on an excavation on Tinian. *Journal of the Polynesian Society* 70(3):321-325.
- Pool, I. 1961. Maoris in Auckland: A population study. *Journal of the Polynesian Society* 70(1):43-66.
- Raynal, Abbe. 1798. A philosophical and political history of the settlements and trade of the Europeans in the East and West Indies, edited by J. O. Justamond. A. Strahan, T. Cadell, Jr., W. Davies, and J. Mundell and Co., London.
- Reed, E. K. 1952. General report on archaeology and history of Guam. National Park Service, Department of the Interior, Washington.
- Reinman, F. M. 1967. Notes on an archeological survey of Guam, Mariana Islands, 1965-1966. Preliminary Report: National Science Foundation. Mimeographed.
- . 1968a. Radiocarbon dates from Guam, Mariana Islands: Shorter communications. *Journal of the Polynesian Society* 77(1):80-82.
- . 1968b. Guam Prehistory: A preliminary field report. *In* Prehistoric Culture in Oceania: A Symposium of the Pacific Science Congress, Tokyo, August-September, 1966, edited by I. Yawata and Y. H. Sinto, pp. 41-50. Bishop Museum Press, Honolulu.
- Roth, H. L. 1891. *Crozet's Voyage to Tasmania, New Zealand, the Ladrone Islands, and the Philippines, 1771-1772*. Truslove and Shirley, London.
- Safford, W. E. 1901. *The Mariana Islands: Notes compiled by W. E. Safford, from documents in the archives at Agana, the capitol of Guam, and from early voyages found in the libraries of San Francisco*. Tanglewood, Chillicothe, Ohio.
- . 1903. Guam and its people. Annual Report for 1902, Smithsonian Institute. Washington.
- Salzano, F. M., J. V. Neel, and D. Maybury-Lewis. 1967. Studies on the Xavante-I. Demographic data on two additional villages: Genetic structure of the tribe. *American Journal of Human Genetics* 19:463-489.
- San Agustin, Joe. T. 1965. United States guaranteed municipal obligations for the Territory of Guam. Unpublished M. A. thesis, George Washington University.
- Sanchez y Zayas, E. 1865-66. *The Marianas Islands*. Nautical Magazine, pp. 34-35.
- Schmitt, K. C. 1968. Demographic statistics of Hawaii, 1778-1965. University of Hawaii Press, Honolulu.
- Smith, James J. 1972. Intergenerational land transactions on Rota, Mariana Islands: A study of ethnographic theory. Ph.D. Dissertation, University of Arizona, Tucson.
- Solenberger, R. R. 1953. The social and cultural position of Micronesia minorities on Guam. Noumea.
- . 1961. Contrasting patterns of Carolinian population distribution in the Marianas. *Asian Perspectives*, Vol. 5.

- Spoehr, A.** 1954. Saipan. The ethnology of a war-devastated island. *Fieldiana: Anthropology*, Vol. 41. Chicago.
- . 1957. Marianas prehistory, archaeological survey and excavation on Saipan, Tinian and Rota. *Fieldiana: Anthropology*, Vol. 48. Chicago.
- . 1963. (editor). *Pacific Port Towns and Cities*. Bishop Museum Press, Honolulu.
- Taeuber, C.** 1972. Population trends of the 1960's. *Science* 176:773-777.
- Taeuber, I., and C. C. Han.** 1950. Micronesian islands under United States Trusteeship: Demographic paradox. *Population Index* 16:93-115.
- Taylor, J. L.** 1951. Saipan: A study in land utilization. *Economic Geography* 27(4):340-347.
- Thompson, L.** 1932. Archeology of the Mariana Islands. Bernice P. Bishop Museum Bulletin 100. Honolulu.
- . 1945. The native culture of the Marianas. Bernice P. Bishop Museum Bulletin 185. Honolulu.
- . 1947. Guam and its people. 3rd Edition. Princeton University Press, Princeton.
- U. S. Bureau of the Census.** 1932. Fifteenth census of the United States: 1930. Outlying territories and possessions. Washington.
- . 1943. Sixteenth census of the United States, 1940. Washington.
- . 1953. U. S. Census of population, 1950. Volume II: Characteristics of the population. Washington.
- . 1963. U. S. census of population, 1960. Volume I: Characteristics of the population. Washington.
- . 1972. U. S. census of population, 1970: Characteristics of the population. Washington.
- U. S. Department of Interior.** 1951-53. Report on administration of the Trust Territory of the Pacific Islands. Washington.
- U. S. Department of the Navy.** 1948-50. Annual reports to the United Nations on the administration of the Trust Territory. OPNAV: 22-100 Series. Washington.
- Voisin, D. H.** 1962. Contribution à l'étude de la Démographie des Iles Marquesas. *Bull. de la Société d'Etudes Océaniques*, 141, 12(4):171-186.
- Wheeler, J.** 1900. Report on the island of Guam. *Military Information Bulletin* 21, War Department Document 123. Washington.
- Wright, S.** 1939. Statistical genetics in relation to evolution. *Exposés de Biométrie et de Statistique Biologique*, edited by G. Teissier, Vol. 13, pp. 1-64. Hermann, Paris.