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► **To cite this version:**

Jean-Louis Rallu. Rarotonga Population from Contact to the 1880s. Pacific Populations, Fertility, Mortality and Movement in Colonial Oceania, UNSW, Jun 2023, Sydney (AUSTRALIA), Australia. hal-04354860

HAL Id: hal-04354860

<https://hal.science/hal-04354860v1>

Submitted on 20 Dec 2023

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Rarotonga population from contact to the 1880s

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ABSTRACT

A rapid conversion of Rarotonga's population allows using missionary data on baptisms and deaths of converts as civil registration data on births and deaths, from the late 1830s. In 1830, a year affected by a dysentery, the population declined by about 25 per cent. There was a severe mortality crisis in 1838-1843, due to tuberculous cervical lymphadenitis, a disease that also affected Tahiti, the Marquesas and Maui. The good quality of data enables us to assess population trends during the crisis, which is a unique case in Pacific islands in the first half of the 19th century. Decline rates reached 10 per cent yearly during the crisis and were still 2.7 per cent in 1844-1848, resulting nearly in a halving of the population. Decline continued at about 3 per cent until 1854 and deaths still exceeded births in the 1870s, and probably later, due to minor epidemics and lingering endemic diseases. But in- and out-migration do not allow to assess later decline from censuses. We retrodicted population from the 1854 census, based on missionary reports on dysentery, a war, famines and widespread endemic diseases reported from their arrival in 1823, and estimate the population at about 12,000 in 1820 and there are estimates of 13,000 in the contact-era. Decline is 87.5 per cent to 1880. Thus, constant decline is well assessed for most of the 19th century. A similar situation occurred in Hawai'i, based on census data from 1831, and for Tahiti from the late 18th century based on missionary reports and estimates, and official censuses from 1848 to 1881. Population density was 194 persons per sq/km at contact.

INTRODUCTION

First contact in Rarotonga is unclear, but traders visits are well assessed from 1814 (Coppell, 1973). Arrivals of LMS teachers in 1823 and missionaries in 1827 provide, if not complete, rather detailed information on events that affected Rarotonga population: epidemics, a war and sanitary situation as regards prevalence of introduced endemic diseases. Thanks to a rapid conversion, nearly completed in the late 1830s, biases associated with missionary records of baptisms and deaths of converts only, are absent and can be used as births and deaths data. Thus, Rarotonga is a unique case, providing information on birth and death rates in an Eastern Polynesian island from the 1830s. We use missionary data quoted in *Island Populations of the*

Pacific (McArthur, 1967) and epidemics and the sanitary situation reported in *Plagues and Pestilence in Polynesia* (Lange, 1984) to assess trends from 1838 to the 1860s, retrodict Rarotonga population to 1820 and hint at an estimate at contact in 1814. We shall analyse the severe mortality crisis that affected Rarotonga in 1838-1843, and subsequent decline in relation with the sanitary situation and medical informations, improving our understanding of the long steady decline of Pacific island populations that is usually obliterated by the short and dramatic impact of epidemics, but was, however, a major factor of overall decline (Rallu, 2022). After 1860, migration from other Cook Islands and emigration to Tahiti and New Zealand do not allow to assess original Rarotongan population development.

Historical context

Rarotonga was first visited by Bounty mutineers in 1789, without landing, and first known contacts were by Goodenough, the Seringapatam and Richard Siddoms, in 1814 (Coppell, 1973: 43). However, although whaling was not frequent before the 1810s, increasing mostly from 1820, whalers may have been the first contacts in Rarotonga. There may also have been earlier indirect introduction of new diseases, most likely venereal diseases, as landings occurred in 1777 in Mangaia and Atiu, by Cook; in 1789, by Bounty mutineers; in 1803 by Turnbull; 1808 by Reiley; and also in Aitutaki in 1789, 1791 and 1792, by Bounty mountineers and Edwards searching them (Coppell, 1973). The position of the island was reported to Cook by Tahitians and there were ancient contacts with Leeward Islands.

There is no estimate of Rarotonga population at first known contacts in 1814 and we have little information on what happened before the arrival of LMS mission. Missionary John Williams arrived in 1823, after the end of a war that started after Goodenough's departure in 1814 and killed about 730 people (McArthur, 1967: 162-164)¹, and the first letters sent to LMS in London report widespread endemic diseases (164-165). He left teachers and returned with missionaries in 1827, resulting in a severe flu epidemic (Lange, 1984: 334); however, there may have been unrecorded epidemics before.

Rarotonga was a case of rapid conversion. Teachers left by Williams in 1823, already made good progress when he returned in 1827, with between 2,000 and 3,000 people attending a church service. However, the wide range of this estimate shows that teachers had no precise knowledge of the number of converts. Nevertheless, missionaries claimed that the rest of the population was converted within four or five years, i. e. in 1831-1832, but this is doubtful (see below).

There was a famine toward the end of 1829, following a season of heavy rains; in 1830, a dysentery killed about 1,600 people; and in 1831, a famine again (McArthur, 1967: 165). In March 1837, there was an epidemic of influenza and « *a virulent scrofulous disease which has affected the islanders of late [...] was causing many deaths (Buzacott, 1838a).* » (166). This disease, introduced in the mid-1830s from Society Islands, resulted in a severe mortality crisis in 1838-1843 – the latter year being also affected by a dysentery – if not later, as Buzacott wrote in *Mission Life*, published in 1866, that « *'the nondescript disease, resembling scrofula' caused*

1 Note that war was not a constant conflict, but alternate attacks and counter-attacks, and in some cases those who had no time to flee were massacred.

‘upward of five thousand’ deaths in ‘a little over sixteen years’ while ‘not more than 500 births’ had occurred » (175); however, these numbers are very approximative. According to missionary reports, mortality declined rapidly, by 30 deaths yearly (169), in 1849-1853, which is more than dubious (see below).

The 1854 measles that affected Tahiti reached the Cook Islands, first Mangaia and Aitutaki, and Rarotonga would have been affected after December 5. However, missionary data became scarce from 1854, and its impact is difficult to assess (170). Introduced new diseases were occasionally reported, for instance in 1863, without details on their impact (171). Then, inter-islands migration and emigration to Tahiti makes it difficult to assess trends in original Rarotonga population. It is important to note that most of decline occurred prior to 1860 when, except missionaries, there was no European settlers, traders or planters on any of the Cook Islands. A British Protectorate was established after chiefs sued for outside support in 1888, but the arrangement being unworkable, the Cook Islands were annexed by New Zealand in 1901 (164).

Methodology

Data come from missionary reports quoted in *Island Populations of the Pacific* (McArthur, 1967). First, we check the quality of missionary data on baptisms and deaths of converts (see box) to assess their relevance to be used as reliable, if not totally complete, records of births and deaths, which is done by calculating birth and death rates and considering if they are plausible or not in comparison with data of other countries at that time and information on the health situation, and mostly by checking consistency of births and deaths reports with population counts.

Mission data on baptisms and deaths

Missions recorded baptisms and deaths of converts. They had little contacts with heathens and did not know the number of heathens and what happened among them as regards vital events. In the early days of Christianisation, baptisms mostly consist of adults who eventually also baptized their children, and it is impossible to know the number of infants/new-born who were baptized from Pitman's returns on baptisms and deaths (see below). – Assuming that only one new-born per woman can be baptized in a year, the number of infant is, at the most, equal to the number of women baptized: 35, representing 14 per cent of baptisms; a similar proportion was observed in Havannah, Efate (Vanuatu), with about 10 per cent of baptisms in 1875-1882 being infants (based on data communicated by Ballard – pers. comm.). – Older people are usually more reluctant to abandon tradition and remain distant from missions. They are eventually baptized a few hours before passing away, mostly if their children are Christians, and are recorded as baptism and death on the same date. However, most of deaths of heathens are not recorded.

Thus, data on baptisms and deaths of converts are irrelevant to assess population trends, until the whole population is converted, and records of births and deaths are complete. However, still births and infants dying before baptism are still unrecorded.

London Missionary Society 41th report – 1835, p. 17.

Pitman's returns on baptisms for Gatangia (Cook Islands).

year	men	women	children	(my totals)
1827	10	6	24	40
1829	8	7	51	66
1830	8	6	37	51
1831	15	12	26	53
1832	-	-	7	7
1833	5	4	19	28
(my totals)	46	35	164	245
Per cent	19	14	67	100

Whereas missionary reports appear to be irrelevant to be used as births and deaths data in 1834-1836 (see below), the levels of birth and death rates based on baptisms and deaths returns become plausible from 1838-1839 and they are consistent with population counts in 1840 and 1843. Hence, we use missionary data from 1838 to assess the extent of the 1838-1843 crisis, and retrodict population to 1830, and then estimate trends in 1820-1830 based on corrected 1834-1836 data and informations on epidemics and a general context of widespread endemic diseases as reported by missionaries soon after their arrival.

Data enable us to assess trends until 1854, when a missionary count was conducted. But, from 1854, missionary reports become occasional and do not cover all stations. Moreover, from the 1850s, and mostly the 1860s, migrations make it difficult to assess trends in Rarotangan population. However, the 1867 'census' and occasional reports on vital events still show decline until at least 1880, and in 1887, the number of deaths exceeded largely the number of births due to a whooping cough epidemic that killed many children (Spoehr, 1973: 4).

Assessing and dating Williams' estimate

Williams estimated Rarotonga population at between 6,000 and 7,000, from several visits to Cook Islands from 1823 to 1833 (164). The many epidemics that occurred during the long period when Williams gathered information make his undated estimate, in round thousands, extremely unprecise. McArthur affects it to before 1830 (167), which is dubious.

Our bases to retrodict the population from 1838 are the 1840 'enumeration' of 4,350 people at the end of 1840, raised to 4,500 by McArthur, and Gill's count of 3,300 at the end of 1843 (167), that are consistent with numbers of births and deaths in 1841-1843, showing that data quality is good then.

In a first step, we retrodict² Rarotonga population from 4,500 at the end of 1840 with birth and

2 We carried a year by year retrodiction using births and deaths quoted in McArthur (1967) and

death rates in 1838-1840 (see below), yielding a population of 6,070 at the end of 1837³. As mortality was already high in 1837, due to flu and the scrofulous disease (see above) and as this number is already above Williams' lowest estimate, 6,000, we retain his highest estimate of 7,000 that we assign to the end of 1830 (see below). Hence, the yearly decline between 1830 and 1837 is 2.0 per cent, which appears very plausible from 1834-1836 data (see below) and rather moderate, given missionaries' reports of widespread endemic diseases after their first visits to the island in 1823 and 1827, and several epidemics after 1830. This rate yields, by retrodiction from 1837, a population of 6,350 at the end of 1835, but it could be higher if we had reliable data for 1834-1836 (see below). Thus, our assumption of a population of 7,000 in 1830 appears conservative.

McArthur's decision to attribute Williams' estimate to the late 1820s (174) is inconsistent with her support of Maretu's estimate of 1,600 dysentery deaths in 1830 (165). With epidemic deaths, famine in 1829 and our estimate of an average 2 per cent yearly decline in 1830-1837, the population at the end of 1829 could be about 2,000 above its number at the end of 1830, thus 9,000 people. Then, based on mid-year population of 8,000 in 1830, the dysentery death rate, 20 per cent, is in line with McArthur's lower estimate of « *between 20 and 25 per cent* » (174) and, adding 'normal' yearly and other deaths, it is close to her higher estimate, 25 per cent, a tremendously high level. Thus, Williams' higher number appears good if it relates to after the 1830 epidemic, or it is a gross underestimate, which is no surprise given the way it was done.

Trends from missionary reports, 1834-1854

First data, 1834-June 1836

Births and deaths reports for 1834-June 1836 are only available for Takitumu, showing a moderate excess of births over deaths, 248 against 198 (166) and, assuming they relate to January 1st 1834-June 30 1836, the birth rate is 32 p. 1,000 and the death rate 25 p. 1,000⁴. Birth rate is rather high, given probably widespread venereal diseases, being one third higher than in 1838-1839, 24 p. 1,000 (see below), which could still be due to adult being included in baptisms. Death rate is improbably low, being about the same as in England, 23 p. 1000 and lower than in France at the same time, while endemic diseases were widespread and the scrofulous disease had recently been introduced (Lange, 1984: 335-336). More generally, given the health context reported by missionaries since their arrival and Polynesians' low immunity following centuries of isolation, mortality could not be equal or lower than in

calculated rates on mid-year population, interpolating trends when data are lacking.

3 As 1840 and 1843 counts are at end of year (167), we follow on estimating population at end of year. Rates are calculated with mid-year population, as usually. Note that the 1854 enumeration that is supposed to relate to end of year was sent to LMS in London on December 5, 1854. (169), showing that mission census dates were approximative.

4 According to our retrodiction (see above), and missionary information that Takitumu district represents about half of the island's population, the population was 6,350 at the end of 1835. McArthur also hypothesizes that data could relate to 1 or 2 years. In the former case, birth rate would be 51 p. 1,000, which is exceptionally high – and in the latter, it would be 38 p. 1,000, being still incompatible with widespread venereal diseases; and the death rates would be respectively 41 p. 1,000 or 31 p. 1,000, both rates being quite low given reports of frequent endemic diseases.

European countries at the same time, and close to a level that the Cook Islands did not reach before the 1940s, with 21 p. 1,000 in 1944-1946 (McArthur, 1967: 215). Thus, there was certainly no increase in 1834-1836 and Rarotonga population was declining. Given the health situation, we assume an average yearly decline by 2 per cent in 1830-1837, with a birth rate of 24 p. 1,000, like in 1838-1839 and a death rate of 44 p. 1,000 (rather conservative comparatively with 55 p. 1,000 in 1844-1848), that is consistent with a population of 7,000 at the end of 1830 (see above). These rates also show that all the population was certainly not yet converted in the mid 1830s, 'births' including baptisms of adults, and deaths of heathens not being recorded.

The 1838-1843 mortality crisis

In 1838, 58 births and 264 deaths were registered in Avarua and Arorangi districts, and « *similar numbers* » in the third district from July 1838 to July 1839 (166); average birth, death and increase rates from these data are respectively 24 p. 1000, 109 p. 1000 and -8.5 per cent. Thus, the whole island was about equally affected, with extremely high mortality. Then, the only data given by McArthur is a yearly excess of 200 deaths over births in Takitumu for 1839-1843, (169), resulting in decline at an average rate of 9.9 per cent – assuming that it was the same in the two other districts, which seems likely from 1838-1839 data –, showing that mortality increased to about 120 p. 1000 (based on stable fertility of 22 p. 1000). McArthur quotes more precisely missionary reports for 1843 « *The total number of deaths in Rarotonga during 1843 was 443, and there were only 100 births. W. Gill (1856, p. 72) gives the figure of 3,300 for the population at the close of 1843.* » (167). As population declined much more than the number of births (if this round number is accurate), the birth rate increased from 24 p. 1,000 in 1838 to 29 p. 1,000 – which is surprising; however, mortality remained high (127 p. 1000) and decline was still 9.9 per cent. As 130 deaths were due to dysentery, with a rate of 37 p. 1,000, the scrofulous disease was abating; however, the non-dysentery death rate still reached an impressive 90 p. 1,000⁵. – Note that, although dysentery deaths may be underestimated, it was much less severe than in 1830, or it was limited to part of the island. – From 6,070 persons at the end of 1837, according to our retrodiction, to Gill's estimate of 3,300 at the end of 1843, decline is by 45 per cent. The 1840 and 1843 counts are consistent with data on births and deaths as quoted by McArthur, adjusted at island level. Thus, whenever vital events data are not always available for all districts, all appear to have been similarly affected.

With our estimate of yearly decline (2.0 per cent) in 1830-1837, the 1838-1843 mortality crisis in Rarotonga – that Lange (1984: 339) considers to be due to tuberculous cervical lymphadenitis – follows the same pattern as in Hiva Oa that was affected by a similarly crisis due to the same disease, in 1912-1923, after the opening of schools in Atuona, with death rates increasing from 39 p. 1000 in the 1890s to 48 p. 1000 in 1901-1910 before reaching 70 p.1000 and above 80 p. 1,000 in some valleys, with population declining at rates of 6 per cent or above in 1912-1923 (Rallu, 1990: 158; 171). In both islands, the population was about halved, declining within 6 years by 45 per cent in Rarotonga, and by 52 per cent over 12 years in Hiva Oa. The same disease affected Maui between 1831-1832 and 1835-1836⁶, extending

5 A death rate of 45 p. 1,000 was considered as very high mortality for normal years in African countries in the 1960s.

6 The next data by counties for Maui are for 1853, therefore we cannot assess the duration of the crisis.

to the whole island, with decline rates of 9.7 per cent and 11.2 per cent respectively in Makawao and Lahaina – where a school opened in 1830 – and above 7 per cent in other districts (Schmitt, 1977: 12). Similar rapid decline was also mentioned by Wilson (McArthur, 1967: 248) in the 1820s in Tairapu (Tahiti), without data or cause, but it was due to a consumptive disease (Lange, 1984: 337-338).

The aftermath of the crisis

Despite mortality decline, increase remained negative in 1844-1848, « *whereas Takitumu's population averaged 38 births and 88 deaths a year between 1844 and 1848, there were 47 births and 81 deaths annually in Avarua and Arorangi.* » (169). Thus, Rarotonga birth and death rates were respectively 28 and 55 per 1,000⁷, the latter being quite high, as 40 p. 1000 is considered as a high rate for a 'normal' year in European historical demography. This shows that introduced endemic diseases, including the scrofulous disease that was still diagnosed in 1893 by Royal Navy surgeon O. W. Andrews (Lange, 1984: 336) caused much higher mortality than normal, based on European situation. Thus, population declined by 2.7 per cent yearly in 1844-1848. Besides the lingering scrofulous disease, there was a dysentery in 1846, flu in 1847 and probably whooping cough in 1848 (340). Thus, over the nine years from end of 1837, Rarotonga population was halved, from about 6,070 to 3,040 at the end of 1846. Let us remind that these trends are in line with McArthur's estimate of 4,500 in 1840 and missionary count of 3,300 in 1843 (McArthur, 1967: 167) and numbers of births and deaths over this period.

After such a disaster, missionary reports became suspect, with a rapid and regular decline of deaths « *Over the next five years [1849-1853], there was little change in average numbers of births, but the deaths decreased by about 30 a year* » (169); this would result – assuming numbers of deaths were similar in 1849 and 1848 – from an average of 169 deaths yearly in 1844-1848 (see above) in 49 deaths in 1853, with death rate falling to 20 p. 1,000 – again well under levels of Western European countries at that time – and a very suspect growth rate of 1.4 per cent, while deaths still exceeded births in the 1860s and 1870s (172). Moreover, such mortality decline is inconsistent with flu epidemics in early 1851 and mid-1852, the latter associated with mumps and ague (Lange, 1984: 340). Mumps is not fatal by itself, but it could have contributed, with the many minor epidemics from 1845, lingering endemic diseases and repeated food shortages following hurricanes, to weaken resistance of people. Lange notes « *respiratory complications and deaths must often have been high* » (341).

Under such conditions, it is no surprise that the population expected at the end of 1854, based on the alleged regular decline in numbers of deaths, and the population enumerated some time before December 5 (see below) are inconsistent. With 2,374 persons, the population in 1854 is almost 400 persons, or 14 per cent, below the number expected, 2,756, with stable numbers of births and a decline by 30 deaths yearly. It is even about 80 persons below the number expected with stable deaths, 2,456. Such discrepancy is consistent with McArthur's estimate of net migration loss. According to McArthur, migration may account for discrepancies of 150 and 100 people between counts in 1840 and 1843 respectively « *derived from the 1854 'census' and recorded births and deaths* » (167), and we agree with her about this. Therefore, she

7 Based on a population of 3,080 in mid-1846.

discarded missionaries' declining trends in deaths and, like we did, she assumed stable deaths, otherwise her net migration estimate would have been about 400 persons. Yearly decline increased to 3.1 per cent, including some emigration. Numbers of departures and returns were unknown before 1853 when 85 young people left the island and 29 returned, a net loss of 56, but returns could occur several years after departure.

Thus, the severe 1838-1843 crisis and its aftermath until 1848, are well assessed and, even with some emigration, natural decline was probably not much different in 1844-1848 and 1849-1853. Finally, it is clear that missionaries' regular decline in numbers of deaths was faked.

Deterioration of data reporting and a surprising conclusion

Following such inaccurate data, missionary reports nearly disappeared. « *After 1854, the population data given by missionaries become very meagre. [...] There is no record of the numbers of births and deaths in Rarotonga in 1854. [...] There were only two more records of births and deaths, one for 1855 and one for 1857.* » (169-170), and they were incomplete. In 1854, the measles that hit Tahiti spread to Aitutaki and Rarotonga. McArthur's statement on the 1854 measles was criticized by Lange. She writes that it could have occurred after Dec. 5, 1854, the date when Buzacott sent the 1854 population count to LMS in London. Then, she hypothesizes from 1855 data – as there is no data for 1854, except the population count – that « *Rarotonga either did not experience an epidemic of measles in 1854-1855 or the mortality in the outbreak was surprisingly low* » (McArthur, 1967: 169-170). From the same sources, Lange (1984, 341, footnote 102) writes that it killed over 100 persons – with a measles death rate of at least 42 p. 1000, well below its estimated impact in Tahiti, about 80 p. 1000 – and he criticizes McArthur for denying that the epidemic hit Rarotonga, quoting only page 109 of Buzacott's *Mission Life* (1866) that he referenced for pages 108-109. Actually, the lack of births and deaths data in 1854 and the end of year population count relating to some time before December 5 make it impossible to assess the impact of the 1854 epidemic as most deaths probably occurred in the last month(s) of 1854. Lange notes, among information on the susceptibility of a population with low immunity to multiple viral infections, that « *a sequel of measles is often an enhanced susceptibility to tuberculosis [...] with extensive glandular swelling.* » (341), which could explain part of the long lasting decline in the 1860s and 1870s. Thus, besides the early severe crisis in 1838-1843, tuberculosis continued to be a major cause of deaths and population decline until the late 19th century.

From 1860, internal migrations increased, mostly from Mangaia to Rarotonga, and later there was emigration from the Cook Islands to Tahiti and New Zealand, making it difficult to assess trends in Rarotonga original population. However, in the late 1870s, « *the number of deaths was only 'very slightly in advance' of the number of births each year (W. W. Gill, 1880), but if later reports are correct, the margin between the two must have widen subsequently.* » (172). In November 1867, a missionary claimed that there were 1,856 people on the island (171) and in 1871-1872, 1,936 persons were enumerated, including increasing numbers of migrants from other islands (183). But in 1881, deaths were still very slightly in advance of births (172). Thus, some, but probably much lower, decline continued « *It is clear, however, that the endemic and epidemic diseases of the period played a major part in diminishing the population and preventing recovery for many generations.* » (Lange, 1984: 346; see also Rallu, 2022).

There are a few strange inconsistencies in McArthur's analysis. In her conclusion, she acknowledges that « ...there is no doubt that Rarotonga experienced a severe decline in population numbers in the 19th century. » (174). But, although she assessed that, in Takitumu district, deaths exceeded births by 200 yearly in 1839-1843 (169), she suggests a major impact of emigration « it is impossible to decide whether the excess of deaths was a more significant factor in the decrease of population for most of the century than were losses through emigration. » (175) that she previously evaluated to a mere 150 people in 1840-1854, becoming more important from the 1860s with also immigration.

Overall view from contact

For the best documented period, from end of 1829 to end of 1854, population declined from about 9,000 to 2,374, by 74 per cent. However, Rarotonga population was certainly much higher in 1820 than in 1829. In 1823, there was a war that caused 730 casualties (McArthur, 1967: 162-164). In 1827, shortly after Pitmans' arrival, the island was affected by a flu that caused 'considerable' mortality (Lange, 1984: 334), and mostly endemic diseases were already widespread in 1823, to the point that Gill considered consumption as a pre-European disease (329). Thus, numbers of deaths were certainly higher than those of births, reduced by venereal diseases, since a few years at the arrival of teachers. The 1827 flu may be the first flu virus encountered by Rarotongans and could have the same disastrous impact as the new strain of flu that caused death rates around 200 p. 1,000 in Tahiti, Samoa and Nauru in 1918. Assuming, very conservatively, that decline due to flu was 10 per cent in 1827 – it reached 17 per cent in Tahiti in 1918 –, adding 730 war casualties in 1823 and a moderate average decline by 1.3 per cent yearly for endemic diseases and occasional food shortages, Rarotonga population in 1820 was about 12,000, with density of 179 p. per sq/km⁸. – Note that density associated with William's higher estimate of 7,000 that would relate to after the 1830 dysentery, is 104 p. per sq/km, which is much higher than estimates for Tahiti and other Eastern Polynesian islands at contact, being respectively 3.6 and 3.1 as high as Tahiti estimates of 30,000 and 35,000 by McArthur and Oliver. – Decline was the most intense from 1820 to 1843, mostly due to epidemics, a severe mortality crisis and secondarily a war, at a yearly rate of 5.5 percent, (reaching 6.9 per cent in 1829-1843), reducing population by 72.5 per cent. Then, it abated to an average yearly rate of 2.9 per cent in 1844-1853, and 1.9 per cent to 1867, resulting in a further reduction by 46 per cent.

Overall decline from 12,000 in 1820 to 1,856 in 1867 is by 84.5 per cent, or 15.5 per cent of the initial population remaining, including some emigration of Rarotongans, but there was also, and maybe more important, immigration from other Cook Islands, mostly from 1850 (McArthur, 1967: 171). The number of 1,500 Rarotonga-born persons enumerated in 1900 (174) shows further decline, but while it excludes immigrants, their children born in the island are counted, therefore it cannot be used to estimate natural growth of Rarotongan population. Emigration may also have increased to Tahiti, where 289 Cook islanders were enumerated in 1881, and later to New Zealand. Assuming that, like in Tahiti, original Rarotonga population declined by an average yearly rate of 1 per cent from 1867 to 1880 – from 1.9 per cent in 1867 to stabilization by 1880 – the population in 1880 was 1,629 persons, with a decline by

8 Persons per kilometer squared.

86.4 per cent. Note also that there was a very deadly epidemic of whooping cough in 1887 (see above).

We shall now briefly consider what could have happened between ‘first’ contact in 1814 and 1820 and also prior to 1814. Before 1814, there may have been indirect introduction of diseases from other Cook Islands and Society Islands. However, it was probably very limited or even did not happen, as sick people were unlikely to embark on long sea voyages, and the closest islands Mangaia and Atiu are about 100 miles away. It would rather be the consequence of whalers, through returning crews recruited in the islands. It is also unlikely that there were severe epidemics in Rarotonga in the late 18th and early 19th centuries, as population density in 1820 is already high. At their arrival, missionaries reported widespread endemic diseases, probably resulting in a significant fertility decline, due to STDs, and some mortality increase due to other introduced endemic diseases. But, contrary to what they did in Tahiti, they did not comment on population trends. In their first years in Tahiti, missionaries witnessed rapid decline “*As to the Island, the inhabitants are diminished every year*” (Newbury 1961, 75); such *de visu* statement, without any count, suggests rates in the range of 2 per cent to 3 per cent. However, they did not comment on Tahitians’ health status, whenever Morrison already witnessed frequent glandular swelling of the neck among Polynesians. Thus, in the islands, missionaries selected informations they transmitted to London in their reports.

Decline in Rarotonga was certainly much less than in Tahiti, 96.7 per cent, only 3.3 per cent of its population size at contact – similar decline would result in implausible population density at contact. The lower decline in Rarotonga is mostly due to later first contact, reducing the time of exposure to introduced diseases. The westernmost Leeward Society Islands also experienced much lower decline than Tahiti, being less visited because they could not provide abundant supplies to European ships (Rallu, 1990), reducing exposure to introduced diseases. This shows that estimating population decline in an island cannot be only based on what happened in a neighbouring island: it is necessary to consider history of contact, epidemics and mortality crises, when information is available and, if it is not it is better to abstain from indirect estimates. This is true for islands of an archipelago, as shown by the different population declines between Windward and Leeward Society Islands and also within the latter, and it probably also applies to the Cook Islands.

However, if Rarotonga was affected by some indirect introduction of new diseases, which is well possible for STDs, its population in 1814 could have been somewhat above 12,000. According to Chapple (pers. comm. June 7, 2023) ‘the Rarotonga contact-era population is estimated at about 13,000’⁹, which is well possible as it implies a very conservative decline rate of about 1.1 per cent yearly in 1814-1820. Thus, Rarotonga density at contact was 194 p. per sq/km and population declined by 87.5 per cent from contact-era to 1880 – or a reduction to 12.5 per cent of its size at ‘contact’.

Rarotonga density at contact can appear very high. However, density was also very high in other Cook Islands. In 1845, the first resident missionary enumerated 3,547 persons in Mangaia. But, there had previously been an ‘exceedingly fatal’ epidemic following the first

9 But, Chapple did not give me a reference.

visit of the missionship that later brought teachers in 1823 (McArthur, 1967: 175-176)¹⁰. Density associated with this number is 68 p. per sq/km, well above Rarotonga at the same time, 47 p. per sq/km. With the same decline as in Rarotonga from 1823 to 1845, 0.71 per cent, the population would have been about 12,200 in 1823 with density of 231 p. per sq/km which seems too high. Although, missionaries reported a high incidence of tuberculosis and 'glandular disorders' (176), the associated mortality crisis and the previous ('first?') epidemic in Mangaia were probably less fatal than the same crisis and the 1830 dysentery in Rarotonga, as assuming a decline by only 65 per cent yields about 10,100 persons with density of 194 p. per sq/km, like in Rarotonga 'at contact' (see above).

Missionary Royle estimated the population of Aitutaki, 18 sq/km, at 2,000 in 1839 (179), but there were then still many heathens skirmishing with Christians and they continued to harrass them and the missionary after his arrival. Most probably, he was unable to estimate their number or discarded them. Thus, density 'at contact' was most probably well above 109 p. per sq/km.

Cook estimated the population of Atiu, 27 sq/km, 'must have been at least two thousand. For those who welcomed us at the shore bore no proportion with the multitude we found among the trees, on proceeding a little way up.' (181). In 1823, two Raiatean mission teachers were sent to Atiu and the population was then considered to be 'something under 2,000'. A rapid decline occurred as only 985 persons were counted in August 1842 (181).

Davis (1947: 215) quotes a number of 34,000 as the pre-contact population that he considers relating to the Cook Islands (Spoehr, 1947: 25), yielding, with 237 sq/km, 144 p. per sq/km.

Density in the range of 180 to 200 p. per sq/km are well possible in Rarotonga as the coastal plain (land under 100 meter elevation) is on average about 1 kilometer large, and there are several valleys with the same elevation in the mountainous interior; villages and hamlets were scattered up to the slopes¹¹. Coastal villages were built by missions and people abandoned Avarua in the early years of Christianisation by teachers 1823-1827. When Pitman arrived in 1827, he developed a small settlement in Ngatangia that slowly attracted people down to the coast (Spoehr, 1973: 23-24). With 31 km of coastline, a population of 13,000 represent about 420 persons per kilometer, or 4 villages of 105 persons, consisting of 17 or 18 households of 6 persons: given, the average size of the coastal plain and valleys, this is far from overcrowded.

10 Pitman claimed that the population increased from 1841 to 1843 and even to 1847, but he probably considered all baptisms as births, because there was a dysentery in 1843. According to McArthur, his enumeration yields a birth rate twice as high as in Rarotonga at the same time (176), that we calculated to be 29 p. 1,000 (see above), leading to 58 p. 1,000, which is highly improbable given the general incidence of STDs in Eastern Polynesia then, and such level has been rarely, if ever, observed except maybe under special conditions, or from inaccurate data. This enumeration raises questions, while the numbers of adult males and females are rather balanced, the sex ratio is 1.74 among children: it is improbable that infanticide was recently introduced, it is too high to be only due to different estimates of age for men and women, and there may also be under-enumeration of girls.

11 The island was traditionally divided like Hawaiian ahupua'a, running from coast to mountains.

Rarotonga had a long history of teeming, as it is the origin of the peopling of Aotearoa - New Zealand. Given its geographical landscape of a relatively large coastal plain and deep valleys, it could well support a population density of about 200 p. per sq/km, as the ratio of coastline to superfcy is higher in small than in large islands. Moreover, the lagoon and mostly the open sea were abundant sources of proteins.

Conclusion

Reliable data on births and deaths, due to rapid conversion of Rarotonga enable us to assess precisely population trends from 1838, which is a unique case in Pacific islands at that time. Yearly decline rates reached 10 per cent, with tremendously high mortality between 120 and 130 p. 1,000, during the 1838-1843 crisis, resulting, with its aftermath, in a halving of the population in less than a decade. Such data, equivalent to civil registration, bring light on mortality levels due to tuberculous cervical lymphadenitis, a disease also reported in Hiva Oa in 1912-1923, Maui in the 1830s, with rather similar declines, and Tahiti in the 1820s from missionary reports. Beside the 1838-1843 crisis, the dire state of health of the population, regularly reported by missionaries from their arrival, resulted in a steady decline for most of the 19th century, at yearly rates of about 2 per cent in 1824-1837 – excluding the 1830 dysentery with a death rate of about 20 per cent – and around 3 per cent in 1844-1853, due to frequent epidemics and high mortality from endemic diseases, as well as low fertility due to venereal diseases. Decline extended at lower rates until at least the 1870s and probably much beyond, but lacking data and increasing migration do not allow to estimate natural increase after 1854. A retrodiction from 1840 shows that Rarotonga population was most probably around 12,000 in 1820. Contact-era estimates of 13,000 persons are associated with density of 194 p. per sq/km, and a decline by 87.5 per cent to 1880. These numbers may be higher, depending on the severity of the 1827 flu and the prevalence of diseases before 1820.

Such high density would have been rejected straight away five or six decades ago, but archaeologists progressively assessed higher densities in Eastern Polynesian islands. It is quite possible as, due to the ratio of coastline and land below 100 meter elevation to superfcy, it represents only 4 small villages per kilometer of coastline. Estimates of carrying capacity usually show numbers well above highest population estimates, which is consistent with surpluses for ceremonies, rituals and gifts to chiefs, priests and other dignitaries. While urbanisation of Tahiti makes further archaeological research impossible, it would be interesting to attempt at estimates of density at contact from remains of housing structures in the coastal plain and valleys of Rarotonga.

Figure 1: Rarotonga population from 1814 to 1867.

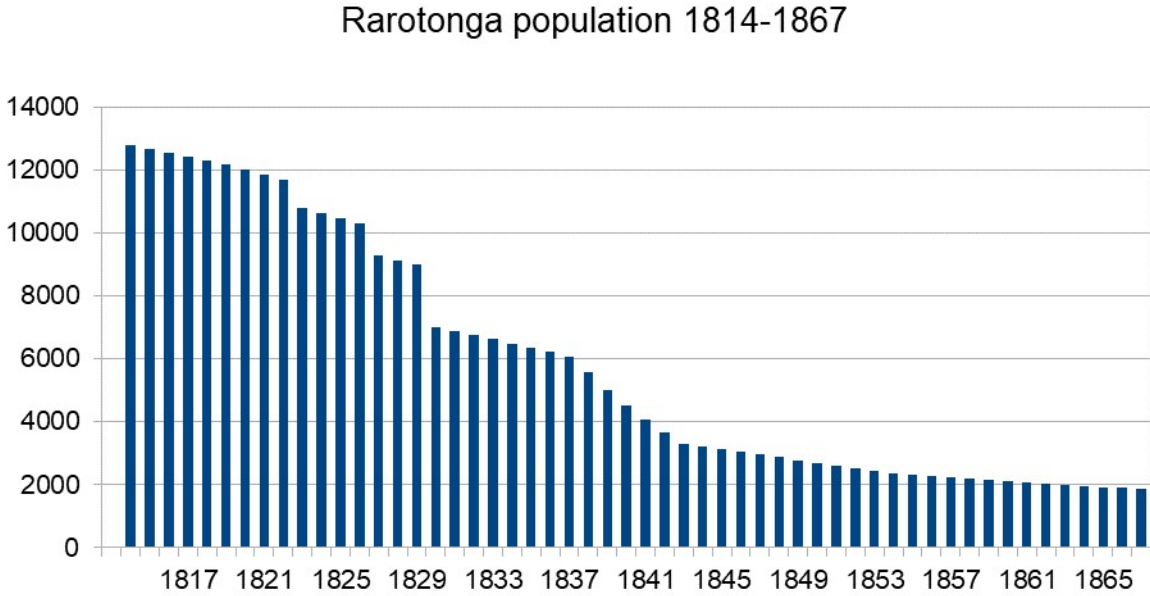
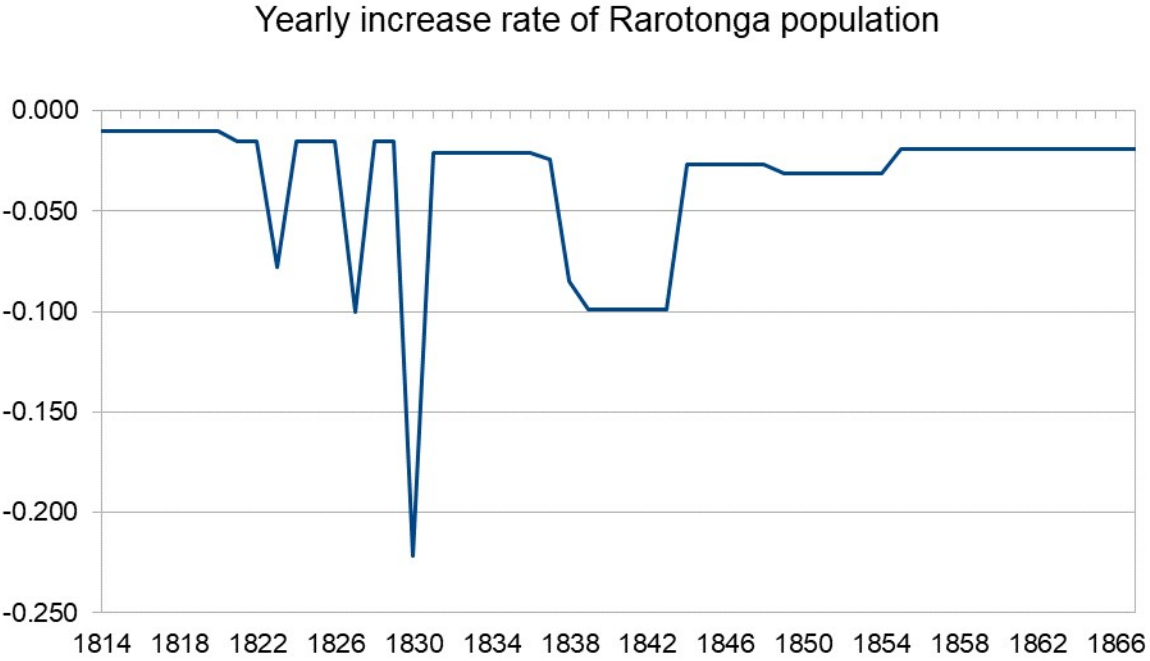


Figure 2: Yearly increase rates of Rarotonga population from 1814 to 1867.



'-0.05' means decline by 5 per cent yearly ; '-0.1' by 10 per cent, etc.

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