

# Tahiti Population (Re)Estimates and Ideologies

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## Abstract

The question of Tahiti population at contact was first addressed by assessing the reliability of early and later estimates, and then by a retrodiction based on the first reliable censuses and data on trends. Cook's famous estimate of 204,000 Tahitians, affected by a wrong number of districts, has been re-worked based on his own and the Forsters' observations, using coast length and the age and sex structure of Tahiti population at contact in relation to infanticide, resulting in a range of 156,000–188,000 persons in 1774, before Boenechea's flu in 1772 and the 1774 flu epidemics. The discrepancies between Wilson's 16,050 and other missionaries' estimate of 50,000 as of 1797 are puzzling, but the 1829–1830 missionary estimates were strongly affected by Tahitians' resistance to Christianization. The twentieth century estimates are affected by a political context related to colonization - decolonisation, leading to the fact that researchers favour low estimates. McArthur uses missionary data, assuming that baptisms are births, although before the conversion was completed, baptisms included adults and children of all ages. She bases her estimate of 30,000 Tahitians at contact in 1767 on Wilson's number of 16,050, who applied the size of nuclear households, 6 persons, to clans. Oliver followed her, however not excluding numbers twice as high or more. Our retrodiction on the 1848 and 1881 censuses, based on qualitative missionary reports on sanitary situation and data of Rarotonga that experienced similar events as Tahiti, yield, with conservative assumptions, 180,000 persons at contact, showing consistent results with early navigators' estimates. My own PhD experience in the late 1980s shows that scholars' re-estimates were constrained, directly or indirectly, by political considerations related to the guilt syndrome and colonialist ideology. This appears in the frequent contradictions found in their works to support low estimates in order to reduce the decline, despite evidence of dramatic epidemics and a steady decline extending almost throughout the 19<sup>th</sup> century. The same attitude of denial is found in some missionary, administrative and medical reports, particularly on the Marquesas in the late 19<sup>th</sup> century. Colonisation was associated with various ideologies, related to anthropology's early attempts based on theories of evolutionism, functionalism and structuralism, occasionally resulting in fictions such as “primitive thinking”, “ahistorical societies” and “collective unconscious”, that were part of the justification of colonisation and its mistakes.

## Keywords

population estimates, missionary data, population decline, “political” pressure on research, guilt syndrome, colonialist ideologies

**JEL codes:** J15, N97

## Foreword

This second paper on post-contact decline in Tahiti population comes in the frame of the two methods to assess contact-era population size, either based on discoverers’ estimates and reports, or by retrodiction based on the late 19<sup>th</sup> century censuses with available missions and colonial administrations’ data and medical reports on the state of health (Rallu 2022). The second method can be more reliable, depending on data quality and eventual corrections, compared to the first one that has given rise to heated debates because of the large variations in early estimates. However, it is important to consider both methods. This paper aims at assessing the quality of Cook and the Forsters’ estimates, based on their precise observations of the fleet review on April 26, 1774, in Pare, and information on the tradition and political division of Tahiti at the time they visited the island. Both methods have yielded rather consistent results with a population in the range of about 180,000 to 200,000 persons at contact.

## Introduction

Estimates of island populations have been a subject of controversies starting nearly from their origins, with very different numbers advanced by early navigators. The most typical case is Tahiti, with Boenechea’s 10,000 and Cook’s 204,000 estimates, and a wide range of numbers between. However, it is quite rare to have several estimates for an island at contact and at the turn of the 19<sup>th</sup> century, making Tahiti a particularly interesting case.

Most of debates are focused on how to reconcile early estimates with later missionaries’ estimates or “censuses”, more or less accurate 19<sup>th</sup> century administrative censuses and scholars’ re-estimates in the 1960s. This endeavour was often affected by guilt syndrome and politics, as shown by my own experience, in the frame of revisionist approaches and post- and neo-colonialist ideologies. It now involves several sciences: archaeology with data on remains of housing structures, superficies of garden land and carrying capacity, medicine and epidemiology, and demography.

We shall focus on statistically based estimates at contact in the frame of the reports of the first European witnesses of Tahiti traditional society, socio-political situation and practices to regulate population growth, such as infanticide, and compare them with retrodictions based on administrative censuses in the second half of the 19<sup>th</sup> century. Later estimates will be evaluated based on trends projected based on early estimates in comparison to retrodictions, using missionary and other reports and, when data are lacking for Tahiti, reliable data of the Marquesas and Rarotonga that experienced similar situations. Re-estimates by scholars in the 20<sup>th</sup> century will be considered in relation to early estimates and population density, and scrutinized for inconsistencies revealing political or other pressure. This will help us to trace ideologies that shaped colonial and post-colonial interpretations of the population decline in Pacific Islands to anthropological theories developed in the early 20<sup>th</sup> century by evolutionism, functionalism and structuralism, and the latter’s return in the 1970s at the time of independences.

# 1. Early and later estimates and re-estimates of Tahiti population

## 1.1. General context

In the late 18th century, discovery expeditions were aimed at gathering information on resources of newly found lands to expand colonisation. They included scientists, botanists and even painters. Most of European discoverers were surprised by a high population density in Tahiti and some other Polynesian islands and attempted to estimate, but the estimates turned out to be often “guesstimates”. However, when opportunities allowed it, some are based on statistical methods.

Polynesian societies were already in the advanced state of development, with large religious structures, *marae*, and double-hulled war-canoes, the largest ones carrying around 100 rowers and warriors, or even more. Tahiti consists of two peninsulas, Tahitinui and the smaller one - Taiarapu, that were divided into districts and sub-districts with various alliances between them, forming a fragmented and unstable political context (Fig. 1). Besides chief families, *arii*, there were priests’ casts, a warrior cast, *taatato’a*, and commoners (Beaglehole 1961; Oliver 1974). On June 24th, 1767, Wallis’ ship was attacked by 300 canoes, small trade canoes and war-canoes, they were dispersed by gun and round shots, killing Tahitians and

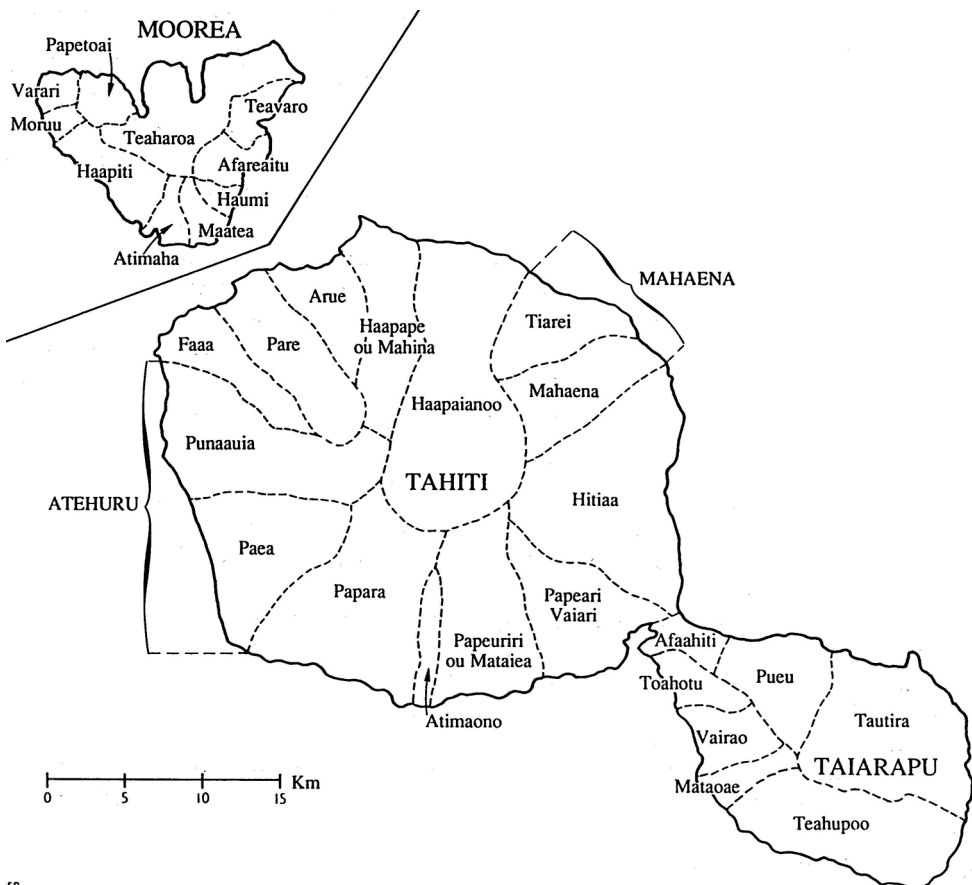


Figure 1. Districts of Tahiti. Source: (Rallu 1990: 220)

breaking apart a war-canoe (Robertson 1948: 153-156 ; see also Annex 3). The power of fire-arms showed Tahitians that Europeans could be prime allies to reign over the whole island. Later, chiefs, mostly Tu, the future king Pomare, tried to monopolize Europeans, limiting their interaction with other chiefs as well as meetings at ship arrivals.

There are several testimonies that the island was crowded. Robertson, Wallis' second mate, reported gardens, plantations, orchards and many houses scattered on the coastal plain (Robertson 1948: 139-141). During a hike five or six miles up in a valley, he found «*great numbers of Inhabitançe*» (Robertson 1948: 221). Bougainville reported a similar landscape of plantations and numerous scattered houses (McArthur 1967: 236). Breadfruit trees' branches were possessed by different families and various practices to reduce population growth were in use, abortive plants and mostly infanticide (see also Kirch 1984, 2000).

### **Data**

Few estimates of island populations in the 18<sup>th</sup> and 19<sup>th</sup> centuries are based on some kind of basic statistical methods, like those done by Cook and the Forsters. Robertson's estimate of over 100,000 in 1767, is based on a circumnavigation of the island and a hike in a valley. The first data available relating to Tahiti population before 1800 is Tupaia's list of numbers of trained warriors, *taatatoa*, by district, equaling to 6,780, given to Banks in 1768, that does not allow for an estimate, because the proportion of its members in the population is unknown. In 1774, Cook and the Forsters were invited to a review of a fleet preparing an attack against Eimeo (Moorea) - according to Cook, the Forsters, Arii Taimai (1964) and Teuira Henry (1968), only two districts participated in this review. Cook, G. Forster and his father J.R. Forster separately counted war-canoes, they also counted warriors and rowers on a few ones to get an average and estimate the number of men of the forces present. They have extrapolated their observations to the whole island with the number of districts and estimated the population assuming that the proportion of adult men was a third. In 1797, missionary Wilson compiled a list of clans and multiplied their number by 6, wrongly assuming that they are nuclear households. These estimates will be corrected for the inaccurate factors they include, using coast length data to avoid variations in district size. The ratio of total population to adult men will be corrected with a model including infanticide.

The reliability of the missionary count in 1829-1830 will be assessed with information on progress of Christianisation while the first administrative census in 1848 will be corrected based on our retrodiction – a method also called backwards projection – based on the 1881 census (section 2). Sporadic missionary data on the late 1820s cannot be used to assess population trends and civil registration data in 1852, with missing years, are incomplete, mostly in terms of deaths, but they can be corrected.

Re-estimates in the 20<sup>th</sup> century will be assessed for their consistency with Robertson, Cook and the Forsters' reports and our retrodiction.

## **1.2. Early estimates of Tahiti population at contact**

Wallis stayed in Tahiti, in Matavai, for five weeks from June 19, 1767. He circumnavigated the island and his second mate, Robertson, reported seeing houses all along the coast and thought it was “*the most populous country I ever saw*” (Robertson 1948: 139-141). After a stay of five weeks in Matavai (district actually called Mahina or Hapape), he estimated Tahiti population at «*upward of a hundred thousand Men, Women and Children*» (Robertson 1948: 234). Thus, his estimate is not based on crowds at the arrival of ships, that were anyway limi-

ted, because Tahiti was politically fragmented, with rival chiefdoms trying to use Europeans (Beaglehole 1961: 404–406; Arii Taimai 1964: chapter 10).

At his second voyage, on April 26th, 1774, Cook attended the review of the fleet of two districts «*Attahuru and Ahopatea*» (Beaglehole 1961: 386)<sup>1</sup>, in preparation of an attack on Eimeo (Moorea). He counted 160 war-canoes and 170 small transport-canoes<sup>2</sup>, with respectively 40 men and 8 men on average, altogether 7,760 men. However, he wrote that war-canoes were not completely staffed by rowers. G. Forster estimated that there were 1,500 warriors – *taatatoa*, wearing protective gear (Beaglehole 1961: 385) and 4,000 rowers on war-canoes. These numbers represent on average 9.4 warriors – consistent with Cook's note that the raised platform of war-canoes «*will contain Eight or Ten men... the Tataotai*» (Beaglehole 1961: 406) and 25 rowers, against about 30 according to Cook, per war-canoe. G. Forster and Cook's counts of the participants in the review are not much different, if we add 8 men per transport-canoe to the former number - 6,680 versus 7,760<sup>3</sup>. Then, based on 43 districts, only 20 war-canoes per district, each with 35 men – but these numbers are too low<sup>4</sup>, showing that, like his father and Cook, he was hesitant to subscribe to a big population implied by the review, he estimated the number of men at 30,100 and the population at 120,000 at least, which he described as «*most moderate*» and «*very low*» (McArthur 1967: 242), because it did not include men in transport-canoes and on the shore. His father, J.R. Forster estimated Tahiti population at 121,500, of which 81,000 for Tahitinui and half this number for Tairapu, probably based on a coast length ratio of 1 to 2, and he considered it as «*the very lowest computation*» (McArthur 1967: 242). He tried to confirm his number by the estimate of carrying capacity based on breadfruit trees, yielding much higher numbers in the range between 170,660 and 204,800.

Later, Cook was told that the expedition was to include 210 war-canoes, with 4 districts combining forces, the two districts of Atehuru, Faaa and Matavai (Beaglehole 1961: 408). He estimated the number of men required for this fleet, including 170 transport-canoes, at 9,000, with respectively 40 men and 4 men (against 8 men previously) for the two types of canoes. Actually, 4 men seem not to be enough to provide quick attendance to war-canoes, transport arms, equipment and evacuate wounded and killed warriors; moreover, according to G. Forster, some transport-canoes were double-hulled canoes (see footnote 2).

However, Cook's famous estimate is not based on the April 26, 1774 review, but on the review, of Faaa's fleet that took place a few days later; the fleet consisted of 40 war-canoes, yielding, with 40 men per war-canoe and 43 districts (24 in Tahitinui and 19 in Tairapu, but some of the names he considered to be districts, were actually sub-districts), 68,000 men (actually 68,800) and, with adult men representing one third of the population, a total of 204,000 inhabitants (Beaglehole 1961: 409). Note that Cook did not include men in transport-canoes, maybe because he considered that it resulted in a too big number. There are several assumptions in Cook's estimate: Faaa is an average district as regards fleet size

1 Beaglehole's footnote is inaccurate, Faaa was never included in Atehuru - there is no mentioning of such thing by both Arii Taimai and Teuira Henry, and it was reviewed separately (Beaglehole, 1961: 401) - and consisted of Puunauia and Paea. Teuira Henry (1968: 84) and Arii Taimai (1964: 3, 63) use (Te)oropaa for these districts, including a part of Papara (see footnote 7).

2 According to G. Forster, some of the transport-canoes were double-hulled canoes, at a number of 70.

3 Based on Atehuru alone, the coast length method yields 202,000 and 179,000 inhabitants, respectively, for Cook and Forster's (including transport-canoes) numbers of men in the review.

4 According to Arii Taimai, the small districts of Faaa and Matavai had 40 war-canoes each. Moreover, 25 men, including about 10 warriors, are far too little to maneuver a war-canoe.

and population. But it is clear that, given coast length of the small peninsula, with a ratio of about 1 to 2 to Tahitinui, districts (or sub-districts) were smaller in Tairapu. Actually, the number of districts was 21<sup>5</sup>, yielding 100,000 people, which is close to Robertson's estimate, above 100,000, and Forster's first estimate, 120,000. But it is not a proof, because unbased or erroneous estimates can be consistent altogether.

We should also reconsider the ratio of total population to adult men: 3, used by Cook, because it may not apply to Tahiti at contact in the frame of the particular population trends since the arrival of Tahitians about 1200 years before present, leading to infanticide to reduce population growth in the two centuries prior to contact (Kirch 2007: 52-69). This issue will be discussed in Annex 2.

It is possible to do another estimate based on coast length, a method used by Tahitians and Europeans as well. To reduce variations in districts size, we use the four districts preparing the expedition against Eimeo. These districts had 240 war-canoes<sup>6</sup> and, with the same ratio as the 26 April fleet review, 255 transport-canoes, requiring 11,640 men (with 40 men and 8 men in war- and transport-canoes, respectively), but Tahitians said that at least 50 men were necessary to maneuver a war-canoer (Arii Taimai 1964: 3), yielding 14,040 men. Coastlines of Tahiti and the above four districts are 191 km and 40 km<sup>7</sup>, respectively. Thus, with our ratio of 2.81 persons per adult men, including infanticide (see Annex 2), Tahiti population in 1774 was 156,200<sup>8</sup>, or 188,400 with 50 men per war-canoer – note that it was after Boenechea's dramatic flu in 1772. As warriors, rowers and other support people represent most of the able-bodied men, the main assumption is that the population density in these districts is close to Tahiti's density. At the first reliable Tahiti census in 1848, the density was 42 p. per km of coastline; it was 46 p. per km in the three districts (with 38, 52 and 66 p. per km in Atehuru, Matavai and Faaa, respectively). The average of Atehuru and Matavai, 41 p. per km, is close to Tahiti's density, and the difference across the three districts is due to Faaa, near Papeete, that probably witnessed immigration after the French takeover. Note also that the number of war-canoes per km of coastline in the North-West is rather similar, with 7.3 for Atehuru, 6.7 for Matavai, and 5.7 for Faaa. Thus, our estimate seems acceptable, yielding numbers consistent with Forster's lowest estimate of carrying capacity based on staple food, between 170,660 and 204,800. With 1,052 sq.km for Tahiti, our estimates result in population densities of 148 p. per sq.km in 1774, or 178 p. per sq.km with 50 men per war-canoer.

A review of the fleet is an excellent opportunity to estimate population, because it is much easier to count people in a few canoes to get an average number of men in them and extrapolate the results to the number of canoes by type, than to estimate *de visu* a crowd on an open space. Thus, using coast length and information on districts participating in the review, provides estimates that are not far from the number that Cook wrote in his log.

5 Nineteen according to Teuira Henry who aggregates some districts.

6 Atehuru, Faaa and Matavai had 160, 40 and at least 40 war canoes, respectively. The expedition was to consist of 210 war-canoes, Matavai engaged less than a quarter of its fleet (Beaglehole 1961: 408). Teuira Henry (1968: 32) writes that it consisted of 214 war-canoes, with 44 for Matavai, consistently with its engaging less than a quarter of its fleet. However, her reports of the review and expedition are short and unprecise.

7 Coast length is 28 km for Oropaa-Atehuru and 7 km for Faaa (Ahurai), according to Arii Taimai (1964: 3) and about 6 km for Matavai. However, Faaa's coastline is very tortuous, and it is rather similar to Matavai on the map in Newbury (1961), therefore, we retain 40 km for the four districts. Note that Atehuru's (Punaauiua and Paea) coastline is about 22 km, but it included Oropaa, a part of Papara (Arii Taimai 1964: 7, 19).

8  $11,640 \text{ men} / 40 * 191 * 2,81 = 156,400$ . Cook's ratio, 3, yields 166,700 and 201,100.

Based on Faaa alone, our method yields 142,000 and 177,000 inhabitants, respectively, with 40 and 50 men on war-canoes. Cook's estimate is wrong because the number of districts is inaccurate, 43 instead of 21, and second, his ratio of the total population to adult men - 3, is about 6 per cent too high.

Assuming about the same decline - 15 per cent for the flu brought by Boenechea in 1772, the first flu virus affecting Tahitians, and the 1918 flu - 14.7 per cent (Rallu 1990: 264), then Tahiti population at contact in 1767 ranged between 183,000 and 221,000, with a density of 175 and 211 p. per sq.km, respectively, the former being close to our estimates for Rarotonga, i.e. 179 p. per sq.km in 1820. However, some decline most probably occurred in Rarotonga from 1814 or even before, due to indirect introduction of diseases. Thus, the density in Rarotonga at contact could reach 194 p. per sq.km, and in Mangaia it was probably also within a similar range (Rallu 2023a: 10-11). Thus, the highest density estimate for Tahiti seems rather too high, but a lower bound of 170,000 inhabitants at contact is conservative, as Cook said that war-canoes had not all their rowers on board. Probably, the 1772 flu was less deadly than the 1918 flu or not all of Tahiti was equally affected. However, combined, the two flu epidemics in 1772 and 1774 could have caused a higher decline, yet, probably still lower than the one in 1918.

Compared with the above results, Boenechea's estimate of 10,000 in 1772 is totally unbased. As his crew brought a flu that Tahitians reported to Cook to have caused many deaths, they probably kept away from the Spanish. In a strong contrast, Rodriguez, after a tour around the island in 1774, noted that it was «*very populous [...] pretty densely peopled*», etc. Hence, the Vice-Roy of Peru raised Boenechea's number by 50 per cent, resulting in a mere 15,000 inhabitants that is sometimes attributed to Rodriguez (McArthur 1967: 243). These are non-statistically based estimates.

Bligh comments on cured sexually transmitted diseases and mostly, a large excess of births over deaths (McArthur 1967: 244) are doubtful. The estimate of 30,000 Tahitians in 1790 by Morrison, a Bounty mutineer, is unbased and McArthur considers it as a guess (McArthur 1967: 245). According to our retrodiction, it is only about a third of Tahiti population in 1790.

### 1.3. Later estimates and early "censuses"

As soon as missionaries arrived in Tahiti in 1797, they observed that the population was much less numerous than reported by Cook and, after a tour around the island, they estimated it at about 50,000 (McArthur 1967: 246). Wilson attempted to make estimates, but he only did an indirect estimate. With a translator, he asked village chiefs about the number of *matteyna* and *ti* (McArthur 1967: 245-246; see also Wilson 1799: 182-215). According to the Académie Tahitienne dictionary, *mataëinaà* refers to a chief's subjects or a district, and *ti* is a clan, sub-clan, group of several households. There was probably some misunderstanding when Wilson understood *mataëinaà* as a big house and *ti* as a small house, or information given to him was inaccurate because the English supported Tu. Wilson multiplied the number of *matteyna* and *ti* - 2,675 by 6, thinking they were nuclear households, yielding 16,050 inhabitants. But, a clan, or extended family, consists of several households and could include ten or more times as many people as he had originally assumed. A total of 2,675 houses in Tahiti represents an average of 14 houses (or, with six persons each, 84 people), about the population of a small village or hamlet per kilometer of coastline, which is totally inconsistent with reports by Robertson and Bougainville. We can wonder how Wilson could

accept such low density of houses after his tour around the island, dismissing his colleagues' more realistic impression: our reconstitution yields about 68,000 persons in 1797. Should we assume that, seeing many abandoned houses, and as mission boats, like any other boats, introduced diseases, missions tended to minimize the population size at their arrival, to be exempted from a future decline that seemed unstoppable? Note also that with an average of at least ten nuclear households of six persons per *ti* at contact, the population is 160,000 or above.

We evaluate the 1829-1830 missionary "census" in relation with our retrodiction of the 1881 administrative census. The missionaries' estimate of 8,674 Tahitians in 1830 was carried out from July 1829 to June 1830, a too long span to be accurate, and it is not clear whether all the population was counted. Davies and Darling «*listed the numbers of church members, baptized adults and children and unbaptized adults and children*» (McArthur 1967: 249), but missions did not baptize all their followers at once, waiting they were fully taught Christian faith and changed behaviour as a proof of their belief. Therefore, it is well possible that only church members, baptized and unbaptized, were enumerated, because some missionaries claimed that there was no way to know the number of those «*not united with them*» (McArthur 1967: 249), the heathens in 1847 (see below). Thus, there were discordant positions among missionaries, some of them having little interest in people who had resisted Christianisation for thirty years or more – as soon as in 1802-1803, Scott and Jefferson estimated Tahiti population based only on the people they preached to (McArthur 1967: 247). In 1829, Tahiti conversion was far from being completed, the rapid increase in 1813-1814 after Pomare's victory being followed by a strong decline, in the frame of a severe mortality crisis reported by Wilson in the 1820. It resulted in a revival of customs, with tattooing and emergence of Mamaia sect in 1826 (Newbury 1861). We have retrodicted the 1881 census to 1848 with the corrected civil registration data, yielding 9,360 persons, showing that the latter, i.e. 8,082, is the underenumerated population by about 15 per cent (Rallu 1990: 233). Civil registration data in the 1850s were corrected based on the average birth rate in the 1860s and 1870s; and improbably low death rates were corrected based on data on the 1910s (Rallu 1990: 248). Between 1830 and 1848, there were four epidemics and a constant decline of about 1.5 per cent yearly. Therefore, it is well impossible that the population increased, or even was stable between 1830 and 1848. Thus, the 1829-1830 "census" is a gross underestimation and, according to our retrodiction, Tahiti population was then between 16,000 and 15,000.

#### 1.4. Recent re-estimates

##### ***Beaglehole, McArthurs and Oliver's estimates***

Beaglehole (1961), who has edited Cook's log, provides the first scholarly re-estimate of Tahiti population based on various early estimates, but without any methodology. However, his hesitations reveal a difficult context in which the 1960s (re)estimates of Tahiti population at contact were made. At first, he seems not to exclude Cook and the Forsters' numbers or «*perhaps halve their two estimates [...] 102,000 and 60,750*» (Beaglehole 1961: clxxv). A few lines below, based on Wilson's estimate, he accepts a halving in twenty years «*and we have something from 32,000 to 40,000 about 1780*» (Beaglehole 1961: clxxvi). It was after Boenechea's flu, which as he reckons could have been as deadly as Vancouver's dysentery. But, he does not retrodict his numbers at contact. Instead, he takes Tupai'a's list of *taatatoa* (6,780)



that he cannot ignore to be a warrior cast, as conservatively representing a fourth or a fifth of the total population, yielding between 27,120 and 33,900. Finally, after «*something beyond 40,000*» at Cook's first visit, he states «*We may then (again cautiously) take 50,000 as the upward limit for population in the eighteenth century*» (Beaglehole 1961: clxxvii).

After considering the completeness of Tupaia's list of warriors, McArthur (1967: 260) gives a pre-estimate: «*the population of Tahiti in 1769 may have scarcely been more than 35,000 persons and it may have been smaller*» (McArthur 1967: 240). She assumes that the districts reviewed on April 26, 1774, included forces of the two "great political divisions" (not 2 districts), from Atehuri to the isthmus and even some from Tairapu (McArthur 1967: 241), ignoring that Tea i Uta of Papara and Teva i Tai of Tairapu refused to attack Eimeo. As these districts represent about 3,000 *taatatoa* on Tupaia's list, she rejects Cook's report that about 7,760 men were present in the review (McArthur 1967: 241-242), discarding that Tupaia's list relates only to *taatatoa* warriors, not including rowers. Later, she assumes that the review included men from most of Tahiti districts, and even the Leeward Islands and nearer Tuamotu (McArthur 1967: 260-261).

McArthur mostly bases her estimates on Wilson's number of 16,050 in 1797, discarding that *ti* and *matteina* are clans, rather than nuclear households of six persons on average. She estimates population at contact in 1767, using a model resulting in a decline by 50 per cent in 30 years, based on a stable population with life expectancy at birth of 30 years for males and females, increasing by 1 per cent yearly (in the absence of infanticide) and a rate of infanticide of 75 per cent – that we assume to be non-sex selective because she does not state it (McArthur 1967: 262-263). Note that such level of infanticide seems too high (see Box 1). However, she does not present any table of her model that, she writes, results in halving the population in 37 years; and, although she mentioned the deadly epidemics following contact (McArthur 1967: 240-246)<sup>9</sup>, she presents her calculation «*in the absence of epidemics*» (McArthur 1967: 263). However, she acknowledges that «*this process could be accelerated by the intervention of wars and sporadic epidemics of high mortality*». Finally, she assumes that Tahiti population was less than 35,000, setting a range of 2,000 around Wilson's number, «*between 14,000 and 18,000 by 1797, but this total could have been reached with less extensive infanticide from fewer than 35,000 inhabitants in 1769*» (McArthur 1967: 263). Thus, the demonstration of her estimate is imprecise and nearly neglects the epidemics' impact.

### **Infanticide**

Missions probably have exaggerated infanticide. Williams estimated its frequency on accounts of only three women reporting having killed 21 newborns altogether, without stating how many were allowed to live (McArthur 1967: 263; see also Ellis 1835: 249-253). However, Bligh reports that three children were left alive per family. He also reports that 3 to 8 infants were killed by assistants of chiefs' women who visited the ship (McArthur 1967: 244). It should be reminded that infanticide was more frequent in chief families, that were less likely to accept adulterine bastards and tried to avoid conflicts between numerous heirs.

9 McArthur lists different epidemics in these two references: Boenechea flu in 1772 and a flu in 1774, a Peru disease (undated) and Vancouver dysentery (McArthur 1967: 262); however, she previously (McArthur 1967: 245) mentioned two other epidemics with intermittent fever, with no comment on its severity, and "scrofula", Morrison's «*Swelling under their ears like the Evil* », that could also be the Peru disease (McArthur 1967: 262), and Martin and Combes' "Pulmonary TB" (1996: 360).

Oliver analyzes Cook's review of the fleet on April 26, 1774, and, similar to McArthur, he attributes it to the whole island, discarding Cook and the Forsters' reports and a fragmented socio-political situation presented in both Arii Taimai and Teuira Henry's books that he could not ignore. Moreover, he considers that *taatatoa* represent all adult men which is surprising for a specialist in Tahitian history. After rounding Tupai'a's total to 7,000, he estimates the total Tahiti population at 35,000, with a factor 5. However, in the last section of his book, he writes that the population of Tahiti in 1797 was «*by conservative estimate ... about a quarter of its previous size*» (Oliver 1974: 966-968), or «*from 64,000 to about 76,000*»<sup>10</sup> (Stannard 1989: 91-92), a strong and discreet dismissal of his own and McArthur's estimates.

There is little (much less than in Cook and the Forsters') methodology in McArthur, Oliver and Beaglehole's estimates, except for the former's model of decline associated with a hypothetical estimate of the level of infanticide that is hardly documented. All reject Cook and the Forsters' observations and estimates, assuming that all the forces of Tahiti participated in the April 26 review, dismissing their reports that there were only 2 districts, Faaa being reviewed on May 14 (Beaglehole 1961: 401), and the expedition was to include forces of 4 districts, including Matavai (Beaglehole 1961: 408). Moreover, discarding Banks, Cook and the Forsters' reports that *taatatoa* were a cast of trained warriors (Beaglehole 1961: 386), they use Tupai'a's number of 6,780 as representing all adult men. Note that Tupai'a's list is not much reliable: Atehuru has only 400 *taatatoa* (Table A1, Annex 1), with a ratio of warriors to coast length half than that of Faaa and Matavai, while their ratios of war canoes are similar. Papara has more than twice the number of warriors compared to Atehuru, but its coast length is only half; probably, Atehuru and Papara's numbers of warriors are inverted or Tupai'a knew very approximatively the forces of Tahiti districts. He also gives a total for Tairapu and lists separately three of its districts (see footnote 16).

McArthur and Oliver's estimates of 30,000 and 35,000 people represent between 157 and 183 persons, or 26 and 30 households, per kilometer of coastline. What would be the need of practicing infanticide of 75 per cent of births with such a low population density? Mostly, it is inconsistent with Robertson and also Rodriguez – observations of a dense population, that the former estimated at over 100,000. How could these authors consider that the witnesses of Tahiti at contact, Robertson, Cook, Forster, etc., the latter two having statistical skills, circling the island and walking through the valleys during their stays of altogether six months or more, were mistaken to the point of confusing such sparse villages with a dense population of 100 or 150 persons or more per sq.km?

It is still more surprising that such widely acknowledged specialists in Tahiti history and demography as Beaglehole, Oliver and McArthur contradict themselves so frequently: Beaglehole hesitantly balancing between high and low estimates; McArthur mentioning several severe epidemics yet making her calculations excluding epidemics; Oliver contradicting his own estimates. This shows that they were all subject to pressures to produce low estimates of Tahiti population at contact. Note that before the takeover by France in 1842, Tahiti was mostly 'administered' by missionaries of the London Missionary Society (LMS), receiving supplies from Australia. Therefore, they couldn't but consider Tupai'a's list of *taatatoa* as representing all adult men and the fleet review including all Tahiti forces.

McArthur carried out a detailed study of demographic trends in Pacific islands, based on the mission data, but she also quoted missionaries' reports around 1829, claiming that they

10 Note that the latter part of the quotation is Stannard's text based on a bracket of 16000-19000 in 1797. Oliver did not spell out the implication of his rough estimate of decline.

did not know the number for those «*not united with them*» (McArthur 1967: 249) and still in 1847 «*the people being so far from the station scattered about that they neglect to give in the account [...] when either a birth or a death takes place*» (McArthur 1967: 255). Actually, she could only use baptisms as a substitute for “births”; however, she wrote baptisms three times in her text, for Tahaa and Bora-Bora (but LMS was the only mission in Society Islands with the same recording practices everywhere), probably to distance herself from the “requested” low estimates and incomplete data<sup>11</sup>. Similarly, after carrying a relevant analysis of trends in Rarotonga – with more than a population halving in 1838-1854, but she did not spell it out (Rallu 2023a) –, assessing that births and deaths records are consistent with censuses and about 100 or 150 net emigration, she contradicts herself in her conclusion «*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*» (McArthur 1967: 175), while emigration became important only in the 1860s with probably even higher immigration from other islands of the archipelago. Such contradictions reveal direct or indirect constraints by politicians, academics or others.

#### ***Missionary data***

Missions recorded baptisms and deaths of the converts. In the early days of Christianisation, baptisms mostly included adults who eventually baptized their children as well, therefore, it is impossible to know the number of infants/newborns who have been baptized. We can estimate infants at 14 per cent of the baptisms in Rarotonga, based on returns from missionary Pitman in 1827-1833 (Rallu 2023a) and it was about 10 per cent in 1875-1882 in Havannah, Efate (Vanuatu) (based on data communicated by C. Ballard), showing that baptisms cannot be used as birth data. As regards data on deaths, older people are more reluctant to abandon their tradition, resulting in a young age structure of the converts. They were eventually baptized a few hours before passing away, if their children had been converted, and were recorded as both baptism and death on the same date. Thus, missions' data are irrelevant to assess population trends, until the whole population is converted, all infants are baptized within a few days, and records of births and deaths are completed.

McArthur and Oliver's official estimates of 30,000 and 35,000, respectively, are also flawed for a simple reason, they imply that annual rates in 1767-1848: -1.4 per cent and -1.6 per cent<sup>12</sup>, respectively, were less negative than between the 1848 and 1863 censuses: -1.7 per cent (Rallu 1990: 233), while ten epidemics (Martin and Combes 1996; see also McArthur 1967: 248, 253-255) occurred before 1848, and only one in 1848-1863. Moreover, from their arrival, missionaries report a very rapid annual decline, most probably by about 3 per cent, to be obvious without data, and by about 6 per cent to 7 per cent around 1820 as, in 1827, Wilson reports a halving of Tairapu's population over 10 years. Based on our retrodiction from 180,000 in 1767 to 16,000 in 1830, the average annual decline rate is 3.8 per cent, and 2.7 per cent in 1830-1848 when small epidemics occurred. A constant decline was recorded in the 19<sup>th</sup> century in many Eastern Polynesian islands.

11 Similarly, as births and mostly deaths were underrecorded, she published the birth rate (30 p. 1,000) from Davies data for 1829-1843 in Tahiti, but not the unrealistically low death rate (17 p. 1,000, 25 per cent below the 1830s level in England) that she most probably calculated too (McArthur, 1967: 249-250).

12 Using our corrected population of 9,360 in 1848. However, the rates that McArthur and Oliver could calculate using the published in 1848 population number, -1.6 per cent and -1.8 per cent, respectively, are nearly similar to our corrected rate for 1848-1863.

## 2. Consistency of estimates at contact with retrodictions

### My PhD estimates

When I started my PhD in 1985, I was planning to correct Cook's 204,000 estimate for the erroneous number of districts, 21 instead of 43, yielding 100,000, and raise it to 110,000 to be in the average with Forster's 120,000 estimate. I was strongly suggested by my demographer colleagues, who knew only of the two numbers, Cook's 200,000 and McArthur's 30,000, to stay on the conservative estimate of Tahiti population. They stated that the former was «*pure fantasy*» or «*totally irrational*» while the latter could be «*reasonably revised*» by 20 per cent or so, which is an important revision in contemporary demography. I answered them that it was useless to do a PhD and write a book on this issue, and I insisted that it was necessary to, at least, double McArthur's number to be in agreement with recent archaeological findings.

Following these suggestions/constraints, I have extrapolated Cook's estimates of men, 7,760, participating in the fleet review on April 26, 1774, based on Tupiai's numbers of *taata-toa* by district, despite the weaknesses of his list (see above). To remain within the acceptable range I was given, it was necessary to discard Cook's report that two districts participated in the review, therefore I included seven districts, from Faa'a to Vaiari<sup>13</sup> (1,980 *taata-toa*). And, as Tupaia gave numbers for Tairapu and separately for the 3 of its districts, I assumed double-counts and reduced the number of warriors to 5,780<sup>14</sup>. Thus, the equation was:  $7,760 / 1,980 * 5,780 = 22,653$  yielding, with a ratio of total population to adult men of 2.92, slightly below three, due to moderate infanticide, 66,147 inhabitants in 1774. Assuming that Boeneche's flu in 1772 and the 1918 flu death rates were similar - 190 per 1,000 (Rallu 1990: 248), which is rather possible as it was the first flu virus encountered by Tahitians and much higher rates were observed in some isolated populations, resulting in a decline by about 15 per cent, Tahiti population would have reached nearly 80,000 persons at contact. It was considered too high and the jury president requested to have it dropped. I wrote «*Tahiti population at discovery could have been a little above 70,000*» (Rallu 1990: 221-222) and my PhD was not signed before it was published by INED. A member of the jury had views on higher administrative positions in French Polynesia and the French government was unlikely to support higher estimates. Similar "political" constraints might have affected Beaglehole, McArthur and Oliver's estimates.

### Retrodictions based on the 1848 and 1881 Tahiti censuses

Talks with Patrick Kirch and his team in Maui in 2002 showed that much higher numbers than 70,000 or 80,000 are possible, and they advocated for sticking to Cook's estimates. But I was still reluctant to accept a density of 150 p. per sq.km or more. Thus, returning to my PhD project, I suggested to finalize a draft retrodiction of population based on the corrected 1848 and 1881 censuses, yielding 110,000 at contact (Rallu 2007: 29). Kirch was disappointed that I did not go higher. I said that we couldn't assume the same high annual decline in Tahiti as in Hiva Oa - I was yet to analyze Rarotonga data then. He finally agreed with this suggestion as a first step.

<sup>13</sup> Excluding the Teva i Tai of Tairapu who, according to Arii Taimai, were at odds with the Teva i Uta of Tahitinui.

<sup>14</sup> Tairapu has 1,800 *taata-toa*, but 3 of its districts are listed separately, with 1,000 *taata-toa*, and a total of 2,800, representing 41 per cent of Tahiti forces, I assumed it to be too high, whenever it is consistent with Tairapu being more heavily armed than the big peninsula.

The second reconstitution scenario (Rallu 2022) assumes that Tahiti population was stable, spared of a tremendous decline within five years following contact in 1767. The only new disease that Tahitians reported to Cook at his first voyage was *assa no Pritane*, syphilis, that causes few deaths before it reaches the tertiary stage. But, at his second voyage in 1774, they vehemently reported many deaths and were very scared of *assa no pepe*, the name they gave to Boenechea's flu epidemics in 1772 and 1774 (Beagelhole 1961: 215). Cook and the Forsters' estimates in 1774 are proofs that Tahiti population was still very numerous then. However, Cook noted that not all of the rowing posts of war-canoes were occupied. It is surprising that a crew of a military fleet missed a review, it may rather be a consequence of deaths associated with the flu. Thus, the epidemic would have affected districts as far as the West coast, from Spaniards' anchorage in the isthmus. However, we cannot assume a much larger population than our above estimates between 155,600 and 187,700. Probably, Boenechea's flu was not as severe as the 1918 flu in Tahiti, Samoa and Nauru, with death rates around 200 p. 1,000, or some districts managed to somehow isolate themselves.

Later mentions of epidemics are often very imprecise. According to Martin and Combes (1996: 360) and McArthur (1967: 248, 253-255), there were four major epidemics before the mission arrival: flu epidemics in 1772 and 1774, pulmonary TB in 1775 – possibly McArthur's scrofulous or Peru disease (no precise date available) reported by Morrison – that seems to be a lingering disease rather than a short epidemic, and dysentery in 1792. In the early 19<sup>th</sup> century, there was a dysentery brought by the whaler *Britania* in 1807, and a disastrous flu in 1820 (Martin and Combes 1996: 360), while McArthur mentions dysentery and «*a heavy affliction which... carried off many adults*» (McArthur 1967: 248), probably the same disease, scrofulous tuberculosis, that has made Wilson report on halving Tairapu's population that could have affected other areas.

I assume that a decline during the flu epidemics in 1772 and 1774 was 17 per cent and 13 per cent, respectively, on average similar to the 1918 flu in Tahiti (Rallu 1990: 264), and half the value (7.5 per cent) of the 1820 flu. I also assume that the first dysentery in 1792 was as deadly as in Rarotonga in 1830, with a decline by 20 per cent, McArthur estimates death rate at between 20 and 25 per cent (McArthur 1967: 165, 174), however, I calculated that, including other deaths, it could probably reach 25 per cent (Rallu 2023a), and 10 per cent for the 1807 dysentery. There were four epidemics in the 1840s, whooping cough (1840); smallpox (1841) with limited impact as the missionaries carried out vaccination; dysentery (1843); and scarlet fever (1847) (Martin and Combes 1996: 360; McArthur 1967: 253-255). Probably, scarlet fever did not cause many deaths, and whooping cough mostly affected children; but, smallpox, despite vaccination by the missionaries, and dysentery might have been more lethal. However, they probably caused a much more moderate decline than earlier epidemics, with altogether about 15 per cent, in addition to an annual decline by 1.5 per cent on average. But the 1854 measles, the last important epidemic of the 19<sup>th</sup> century in Tahiti, resulted in a 9.5 per cent decline, based on the corrected civil registration data (Rallu 1990: 229-233).

I assume a steady decline in non-epidemic years after the 1772 flu, reaching 2 per cent by 1785, and increasing to 3 per cent by 1795, as contacts have intensified since 1788, mostly due to tuberculosis with "*Swellings under their ears*"<sup>15</sup> mentioned by Morrison in 1791 (McArthur 1967: 245). Soon after their arrival in 1797, the missionaries noticed

15 Tuberculous cervical lymphadenitis related with multiple viral infections, according to Lange (1984: 339).

much lower population than early navigators' estimates and a constant rapid decline: "As to the Island, the inhabitants are diminished every year" (Newbury 1961: 75). Therefore, I assume a decline at 3 per cent until 1810 – the rates around 3 per cent were commonly reported for several years in Rarotonga and Hawai'i in the mid-19<sup>th</sup> century and in the Marquesas in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. I assume that the decline increased to reach 5 per cent in the late 1810s, peaking at 5.5 per cent in 1820-1827<sup>16</sup>, following Wilson's report in 1827: «*In the smaller peninsula the people were dying very fast. There are not half the inhabitants [...] that there were ten years ago and they decrease rapidly*» (McArthur 1967: 248). Wilson did not give information on the type of disease; but, Lange (1984: 337-338) found references in Tyerman and Bennet's Journal of Voyages and Travels that «*consumptive cases occur and cut off many of the young*» in Society Islands in the 1820s, it may be scrofulous disease that has spread following the promulgation of the Pomare Code in 1819 making attendance to Sunday services and daily prayers compulsory. The same disease, brought in Rarotonga in the mid-1830s by a teacher from the Society Islands (McArthur 1967: 166), caused a much higher decline at a rate of 10 per cent in 1838-1843 (Rallu 2023a) when the conversion of Rarotonga was nearly completed, with the compulsory attendance at Sunday services and daily prayers, like in Tahiti<sup>17</sup>. It also resulted in a decline by 5.9 per cent in Hiva Oa in 1916-1925, with higher rates in 1912-1923 after opening the mission schools, and much higher rates in some valleys (Rallu 1990: 158, 171); 8.8 per cent in Maui, reaching 9.7 per cent in Makawao and 11.2 per cent in Lahaina, between 1831-1832 and 1835-1836 after the opening of a school in Lahaina in 1830 – based on the census data, possibly including some outmigration - however, Oahu population was still declining by 1.7 per cent at that time (Schmitt 1977: 12)<sup>18</sup>. In Maui, Rarotonga and Hiva Oa, the whole islands were rapidly affected and the latter two islands' population was halved in 10 years or less.

I assume that the decline remained high in the 1830s, at an average rate of 3 per cent in the aftermath of the 1820s crisis, like in Rarotonga (Rallu 2023a). The average annual decline in the 1840s is about 1.5 per cent, excluding epidemics, progressively returning to 1 per cent at the end of the 1850s and hovering at this level until 1880.

Under the above assumptions, Tahiti population was somewhat above 180,000 at contact in 1767; around 100,000 in 1790-1791 when Morrison did his estimates, and about 68,000 in 1797 – his colleagues' estimate was much closer to the real situation, and between 16,000 and 15,000 in 1829-1830. The overall decline by 1881, with 5,960 Tahitians (Rallu 1990: 233) is by 96.7 per cent, or 3.3 per cent of the population at contact.

While, based on the European historical demography, most demographers consider that epidemics were followed by recovery in Tahiti as well as anywhere else (see below), reliable data of many Eastern Polynesian islands suggest a constant decline throughout most of the 19<sup>th</sup> century. The Tahiti population growth recorded by civil registration data

16 Still conservative, as population halving in a decade implies 6.7 per cent. In my retrodiction to 110,000, the rates were 3 per cent during the 1820s crises and between 2 and 3 per cent in the previous and next decades.

17 The Covid epidemic has shown that large numbers of people singing indoor were at the origin of the first clusters. People returning from a Congress of the Eglise de la Porte Ouverte have spread Covid in various cities in mainland France and as far as French Antillas and French Guyana. A choral concert that was not cancelled resulted in a very high Covid infection rate among the singers.

18 Thus, Wilson's impression of a population halving in a decade seems conservative. As there was no medical doctor in Hiva Oa at that time, a lower decline than in Rarotonga could be due to Marquesans being better immunized after a century of contacts.

in 1852–1863 and quasi stability until the late 19<sup>th</sup> century are just artifacts of incomplete data. In 1852–1863, birth rates were just slightly above 30 p. 1,000, which is consistent with STDs, and death rates were between 20 p. 1,000 and 25 p. 1,000 (Rallu 1990: 229). Such death rates are well below the levels recorded in France at the same time and remained unreached in French Polynesia until the 1940s. Moreover, the censuses show that Tahiti population declined by about 1 per cent yearly from 1848 to 1881 (besides the 1854 measles). Thus, the death rates for the period from the 1850s to the early 1900s were probably around 40 p. 1,000. Actually, deaths remained underrecorded until the 1910s in Society Islands, with uncorrected death rates still above 30 p. 1,000 (Rallu 1990: 230), and the corrected death rate was 35 p. 1,000 in 1917 (Rallu 1990: 248). As census and civil registration data do not separate Polynesians after 1881, it is not possible to assess further Tahitian population trends.

### Data from other Eastern Polynesian islands

The population trends in Tahiti are similar to those in other Eastern Polynesian islands. Reliable Rarotongan data from the late 1830s, enable us to assess a long-term decline with the balance of births and deaths remaining negative until at least 1860 and most probably the 1880s (McArthur 1964: 172–174; see also Rallu 2023a). Recovery and population growth were impossible because of the «*devastating acute and chronic diseases*» (Lange 1984: 345), and «*the lowest recorded figure was 1,865 in 1867 [...] no recovery is discernible before the first decade of the twentieth century*» (Lange 1984: 346). Hawai'i censuses also show a constant population decline from 1831 to 1872 (Schmitt 1977: 12)<sup>19</sup>.

Based on Cook and Forsters' reports on the 26 April fleet review and probable impacts of the flu epidemics in 1772 and 1774, Tahiti population in 1767 was between 170,000 and 200,000 or somewhat above, suggesting that, with 180,000 inhabitants at contact, our second retrodiction is within the acceptable range and still conservative, because the input rates of declines due to epidemics and endemic diseases are below those recorded in other Eastern Polynesian islands where data are reliable. Thus, both approaches produce consistent results and Tahiti population at contact was most probably around 200,000, with a density of 190 p. per sq.km, which is considered acceptable by many archaeologists, because houses of commoners, without stone platforms, cannot be identified.

### 3. Ideologies behind population estimates and collapse

Given possible coercion, it is useless trying to guess various reasons, ideological, political or else, why a researcher – on her/his own or under pressure – favours lower or higher population estimates at contact.

The passionate debates on the island population estimates at contact reveal a wide range of attitudes from guilt, denial, and acknowledgment to justification, related with moral, po-

<sup>19</sup> Note that the population trends in Hawaiian Islands are mostly surprising because of the low annual decline for the period from contact to 1832, 130,393 persons, by 57 per cent (from an estimate of 300,000 at contact) against 92 per cent in Tahiti, at annual rates of 1.5 per cent versus 3.8 per cent, and rather similar declines in 1832–1850: 37 per cent and 35 per cent. Most probably, the decline before 1832 was much higher in Hawai'i than it appears judging from the estimate of 300,000 at contact.

litical and ideological attitudes, embracing many disciplines: medicine, political science, anthropology, etc.

The first navigators understood that they had broken into a pure state of mankind and brought new diseases that were deadly for Polynesians. This raised the question of guilt and the dilemma of acknowledging or denying, which still appears in physicians' reports on the Marquesas Islands in the late 19<sup>th</sup> century, in the frame of the well-established justification practices by colonial administrations. In the early 20<sup>th</sup> century, several anthropologists, mostly in Melanesia, suggested various, sometimes fancy, interpretations of the reasons for decline, avoiding to mention the lack of health services available to native populations. In the second half of the 20<sup>th</sup> century, demographers, anthropologists, historians and other scholars entered the scene with a strong denial of the huge population decline, slashing early navigators' estimates to minimize Europeans' responsibility in the context of the political shock of independence. Early anthropological theories, evolutionism, functionalism and structuralism fueled the ideologies inferiorizing native population, with "primitive thinking", based on structuralism's inaccurate kinship systems, ignoring the complexity of Pacific islands' societies, considered as ahistorical by functionalism (Rallu 2023b).

### 3.1. Responsibility and the guilt complex

Responsibility and self-esteem, or the guilt complex, have an important role in attitudes towards collapses of native populations after their discovery. It started with a feeling of culpability for breaking into a "pure state of mankind", and soon resulted in accusing others, as was the case with the introduction of syphilis: Wallis, Bougainville or Cook?

As regards epidemics, the discovery expeditions wrongly considered that the duration of travel would prevent the spread of viruses, discarding American experience that resulted in a quarantine being occasionally enforced in New York and Boston from the first half of the 18<sup>th</sup> century (Rallu 2022). Moreover, nothing changed after it was known that dramatic epidemics occurred, even in case of diseases on-board, because fresh food supplies were necessary and, later, captains were reluctant to lose days stuck in a quarantine. Thus, quarantine was not, or inadequately, enforced at arrival of ships in Pacific islands, including after they became colonies or protectorates, until the second half of the 19<sup>th</sup> century; and even later, in the case of the 1918 flu, except for rare cases, among other American Samoa, the Marquesas and the Austral Islands.

Ignorance of an incubation period made it possible to deny the introduction of diseases throughout most of the 19<sup>th</sup> century (Lange 1984: 333). Unprecise medical knowledge has also hindered disease detection, for instance as regards syphilis and yaws. Thus, some diseases common in Europe were considered as native diseases, missionary Gill wrote «*consumption*» was the most formidable pre-European disease» (Lange 1984: 329) and «*in the missionary list of Cook Island diseases, syphilis was listed as an indigenous disease "aggravated by foreign contacts"*» (Lange 1984: 343). However, as ships arrived, including missions' ships, the arrival was often followed by epidemics, «*missionaries [...] wrote only reticently of what they sometimes called "the imported disease"*» (Lange 1984: 343). For Rarotongans, it was clear that diseases came from ships and missionaries had difficulties dissuading them as they sometimes saw disembarking sick people or victims of diseases that affected them shortly afterwards. Therefore, they rejected that dysentery or other diseases were due to their diet or living conditions, unchanged for centuries without anything similar happening.



### 3.2. Doctors, health and colonial administration

The Marquesas, with extremely high mortality until 1923, reveal interesting attitudes as regards responsibility for a population decline. With little reliability of early estimates, Du Petit Thouars' estimate at takeover in 1842 - 20,200 is usually used as a reference. However, Jouan's rough estimate of 11,900 in 1856 was often preferred by colonial administration because it reduces the decline under the French rule.

Dr. Lesson should be praised for a rare acknowledgement of a terrible meningitis epidemic – or rather a kind of genocide – in a valley of Nuku Hiva in 1844, linking it to the recent arrival of French colonists who gave Marquesans adulterated alcohol (Lesson 1981: 924-927). However, following a common attitude among civil servants at that time, he denies the introduction of syphilis (and also consumption) that, if not a native disease, he assumes to have been introduced by Mendana. He vehemently rejects Roblet's statement, a surgeon of Marchand's expedition in 1792, attributing syphilis cases appearing among the crew members as much to what they had brought and what they had received<sup>20</sup> (Lesson 1981: 919-920), and he fustigates a scholar, Claret de Fleurieu, for strongly incriminating Europeans for spreading the disease all over the world.

A similar attitude towards the claim that syphilis was not the cause of low birth rates because yaws confers immunity against it was common. However, yaws does not affect fertility, except maybe in its late phase, and not all suffered from yaws, therefore high rates of spontaneous abortions and still-births show that many people were affected by syphilis. Gonorrhoea, a cause of sterility, was also present, but it is rarely mentioned because women ignore that they are infected and it is a cause of sterility, making it little visible (Lange 1984: 342-344; Rallu 2022: 97-98). After a detailed list and description of diseases, both local and introduced, Lesson rejects early visitors' reports that Marquesans – whom he calls “the savages”, like Radiguet, Du Petit Thouars' secretary did – enjoyed good health, discarding that he arrived in the islands after fifty years of contacts with whalers, traders, etc.

In 1881, Dr. Clavel (1884) accurately described the fertility crisis with many of the children being still-born and many others dying soon after birth, a typical effect of syphilis. Nearly half of women of fertile age were sterile in the context of a rapid increase in the acquired sterility with age (Rallu 2022: 97). But he does not mention it, saying that he saw a few syphilitics, mostly in Taio Hae, where most ships anchored, but they were not numerous in other valleys.

Then he states that Marquesans are affected by rather banal diseases, «*except leprosy that, alone, kills more indigenous people than all other diseases together*» (Clavel 1884: 494), at least one tenth of the population being affected, either by tuberculous or aphimatode leprosy that he said to be present in the islands from immemorial time. He also reports examining Marquesans who coughed, some of them had cavernous breathing, but most of them had only symptoms of unspecific bronchitis, concluding that phthisis was less frequent in the islands than in France. In a strong contrast, soon after the takeover by France in 1842, Dr. Lesson noticed that syphilis was already widespread and tuberculosis was the most common pulmonary disease, resulting in deaths among young adults within a year after the onset of coughing (Lesson 1981: 923, 938). A few years after Clavel, Marestang (1892) and Tautain (1898) reported the same situation. Clavel concludes that diseases, including sexually transmitted diseases, and alcohol, often of “*low quality*” are not the cause of population decline,

20 Our translation «autant à ce qu'ils avaient apportés qu'à ce qu'ils avaient pu recevoir».

and he stresses a deplorable effect of kava on older men. According to Clavel, the cause of high mortality is behaviour changes, from an active traditional life to an idle lifestyle, or “bastardisation”. In a final glimpse of a mocking acknowledgement, he states that the change in lifestyle «*prepared a disease-friendly ground that multiplied the effect of these causes, unable by themselves to kill them. But the real cause lies in this change, other causes being only auxiliary*» (our translation) (Clavel 1884: 496).

It is clear that he avoids to incriminate colonists, nearly supporting sales of adulterated alcohol, and colonial administration for the quasi absence of health services. It is a complete denial, ending with a strange diagnosis of «psychological disease» that Rivers was the first anthropologist to make into a theory in the 1920s.

### 3.3. Demographers

In the 1970s, many demographers in Europe believed that plague, smallpox, and dysentery were the only catastrophic epidemics; while measles, flu, whooping cough, etc., were just minor epidemics. Most of them, except for those who worked in rural Africa in the 1960s, Caldwell, Canterelle – who have warned me that a population decline in the Marquesas and Tahiti population at contact was not a good PhD topic, etc., ignored the dramatic impact of epidemics on populations lacking immunity after centuries of isolation. Based on the European historical demography, they argued that epidemics mostly anticipate deaths and are followed by recovery. But it does not always happen. Deaths among the elderly rejuvenate age-pyramids, but this beneficial effect fades rapidly away, and epidemics affecting young children reduce birth rates when they enter reproductive ages. However, in the case of low immunity, people of all ages are more or less affected and there is little or even no rejuvenation of the age structure. In Pacific islands, epidemics were too frequent to allow for recovery and, due to low fertility and increasing mortality from endemic diseases there was no recovery at all (Lange 1984: 346; Rallu 2022: 95).

Thus, many demographers I talked to about my PhD project have rejected a high impact of diseases that are common in Europe. They have also rejected a long steady decline that is a major component of depopulation in Pacific islands (Lange 1984; Rallu 2022). As regards the Marquesas, where an annual decline between 2 and 3 per cent is well documented by reliable civil registration data for the period from 1886 to 1923, they blamed administration for inadequate recording of vital events. When I reminded them that deaths were more underrecorded than births everywhere, they imagined faked death reports – while “gendarmes” (police) checked all deaths for a possible murder – and asked me if I would get money for writing such a book. I replied that birth and death records are consistent with the censuses (see also Valenziani 1940). Then, some of them said that there was no need to assert that such things did happen and I was kind of ostracized by others for jeopardizing the institute’s professional fame.

### 3.4. Political and economic aspects

There are obvious political reasons, behind the denial of steep demographic declines by Beaglehole, McArthur and Oliver in the 1960s. First, the fear that newly independent governments request compensation – like African countries did for slavery – for recruitment and a long-term unavailability of health services for native people resulting in population decline and reduced size of their work force.

The colonial goal, or justification, was to civilize and modernize; a failure to achieve it in areas such as health and social equity was difficult to acknowledge. In the social, economic and political fields, colonisation was marred with disorders, discrimination, injustice, exploitation of resources and labour force. Colonies had to be profitable and they limited expenditures on health and social services for native populations to a minimum, if any, for instance in the South-west group of the Marquesas Islands.

A quick look at health services shows a lot about French administration's attitude towards Polynesians. A military hospital was built in Papeete in 1845, while an outpatient facility for Polynesians was opened in the late 1850s. It became a place of debauché and abuse, and was closed in 1865. Despite numerous claims since 1868, including by Governor Petit, concerned with the rise in sexually transmitted diseases among troops and civil population, it took more than a decade to reopen it. In the Marquesas, there was only one navy medical doctor, based in Nuku Hiva, without a boat to visit other islands. In the South-Eastern group, a physician was appointed in Atuona in 1898, but the position was closed in 1901 due to lack of funds, and it was not restored until 1923 (Rallu 2022: 100).

It would have been easy to reduce the Marquesan population decline. Vaccination against smallpox was carried out in Tahiti in the 1840s, but not in the Marquesas where vaccine was sent and arrived too late in 1863, resulting in death rates above 400 p. 1,000 in Nuku Hiva and Ua pou. Dr Rollin estimated that infected wounds and tuberculosis, with cervical tuberculous lymphadenitis (purulent infected ganglions) accounted for four fifths of all deaths in 1923 (Rollin 1929: 293). He treated sick people with basic disinfectants and colloidal silver that is very effective to kill a variety of germs and prolong life of tuberculosis patients, however without curing them, and mortality declined by 50 per cent in 1924. My demographer colleagues contested that such a rapid decline can occur. Actually, all tuberculous patients were treated and, if the treatment postpones death of half of them by one year, the number of deaths is halved. Then, the decline becomes slower as all patients are already under treatment that has limited efficacy over time; however, still with a rise in survival rates of patients at various stages of the disease. These drugs were available in Europe since the late 19<sup>th</sup> century and a further halving of Marquesan population could have been prevented (Rallu 2022: 100-101).

### 3.5. Pseudo-scientific and ideological aspects

We shall now focus on the following two demographic interpretations of the population decline that are pseudo-justifications of the demographic impact of colonisation: pre-contact decline and psychological shock as a cause of post-contact decline.

Some colonial administrators and scholars stated that Pacific island populations had been already declining before contact, without any scientific evidence. It is only in the early 1990s that a number of dated archaeological sites showed a growth profile of Hawai'i population, the Dye-Komori curve, that Kirch (2007: 64) cautiously interprets as stabilisation, because its strongly wavy profile is an artifact of calibration. It is well acknowledged that practices, such as abortion and infanticide, were introduced in Hawai'i in the two centuries before contact, probably from Tahiti, to limit the population growth. Construction of monumental religious structures, human sacrifices, and wars have certainly affected the population growth, mostly among commoners. However, the warrior population was likely to be growing to protect and maximize the limited resources. The goal to limit family size to three children in Tahiti reported by Bligh (McArthur 1967: 260) clearly aims

at ensuring stable population, given the probable level of mortality at that time. It does not make sense to aim at population decline in the context of rivalry between chiefdoms to dominate the entire islands or archipelagos. However, there were certainly cases of population decline before contact, more or less temporary and mostly associated with natural disasters or eventually wars, but they are little documented.

In *Essays on the Depopulation of Melanesia*, Rivers (1922) has developed his psychological factor theory. However, his contributors show diverse and non-exclusive positions on the causes of post-contact decline. Many of them acknowledge that the introduced epidemics and diseases had important impacts on population, but they also incriminate induced abortion, unsanitary modes of living, harmful development of native customs and wars, discarding the natives' claims that alimentary, sanitary and other customs have not caused such diseases before contact. In Tahiti, naval tactics of *taatatoa* fights limited the number of casualties; the loser was vassalized (Beaglehole 1961: 406-407) and all his war-canoes were destroyed. But there were also wars with massacres of those who did not flee, for instance in 1768 (Arii Taimai 1964: 63). In Melanesia, a traditional war was limited to retaliation for murders and important misdeeds, in a kind of talion law, with months between attacks, but this process became faster with firearms, enabling to nearly annihilate the enemies. Several authors share Rivers' views on the breakdown of traditional society and resulting apathy, weakening immune response to diseases, however probably less than the effect of alcohol, eventually adulterated, a major trade of recruiters in (to be) colonized areas. There were also lots of fancy theories related to polygamy, as well as monogamy, to abortion or infanticide, and unbalanced sex-ratios being inherited through selecting male-producing families (Colonel Marshall, cited in Baker 1928: 294). High sex ratios can be due to excess female mortality as well as selective infanticide. Rivers' emphasis of the role of psychological factors reminds Clavel's position, that he probably has ignored, but it is less outrageously provocative. These interpretations of the causes of decline are interesting as regards naive viewpoints. However, Lange (1984) has undertaken a very relevant medical analysis of the tremendous impact of the incidence of multiple endemic diseases.

J.R. Baker, who conducted a census of Eastern Santo in 1927, rejects psychological causes associated with the socio-cultural change, because the situation was the same in heathen bush villages, where tradition was still well alive, and in missionary coastal villages. He noted the important role of abortion, a lady «*indicating all the children who were sitting round about her...[said] Close up all piccaninny here ol e die finish*» (Baker 1928: 292). And she explained recurring to abortive plants as a consequence of the feeling that it is useless to produce children who will all die in epidemics. There may have been a feeling of despair, although neither man nor woman would want to give birth to babies to see them dying soon, or working on colonists' plantations where some men were beaten to death. Moreover, abortion reduces fertility rates but it is not related to the increased mortality, the main cause of population decline that the psychological effect theory aimed to explain.

The interpretation of the psychological cause of the decline was sometimes recast as an inability of native people to adapt to modernity, if not being supplanted by a superior race. There were also reports of native beliefs that increases in mortality were due to sorcery, eventually involving missions, which some Europeans interpreted as a proof that native people were irrational and believed in dark powers. However, Rivers and his collaborators' work was, at that time, one of the few addressing population decline without attempting at quan-

tifying it. The impact of huge declines in native populations, associated with unbalanced sex ratios hindering marriages, and the functioning of kinship systems, is totally missing in structuralist kinship studies.

### 3.6. Colonial ideologies

Colonialism refers to “*an ideology advocating the exploitation of territories that are not part of a political power and are considered as under-developed (economically, technologically and also culturally) [...] justifying colonisation on differentialist arguments that Frederick Cooper calls «politics of difference» (Cooper 2010: 36) [...] resulting in hierarchies between people based on loosely defined criteria: language, ethnicity, race, religion [...]» (Van Den Avenne 2021, author’s translation).*”

Thus, justifications of colonisation’s negative impact on Pacific island populations can be traced to evolutionism, functionalism and structuralism that consider primitive societies as ahistorical and native people following immutable and stereotyped behaviours that are more or less unconscious. It was mostly the result of inaccurate kinship systems developed by structuralism, according to which native people, following collective unconscious models, marry nearly exclusively matrilineal cross-cousins, as it appears in ethnocentric diagrams – with classificatory kinship terms translated into Western non-classificatory terminology – that in no way represent the Pacific kinship systems. Structuralism totally ignores the strategic role of matrimonial alliances in the frame of “networks”, including power, ceremonial and “religious” functions, and class status that make native peoples’ behaviours similar to Europeans’ (Rallu 2023). These pseudo-theories have inferiorised the colonized people and were used by colonialist propaganda to picture native societies as small groups of people, withdrawn and constantly at war, and Europeans were taught that colonisation was “civilizing” native people who ignored reading, writing and counting, the major themes of the justification of colonisation. But it is false for the latter, because social life is based on matrimonial, economic, ceremonial and other exchanges that involve some skills in numeracy; bride price, funeral contributions, etc.<sup>21</sup> were precisely recorded to be returned years later, counting on palm leaves (Beaglehole 1961: 136). In Hawai’i, they used sophisticated calculation methods (Schmitt 1977: xv–xvi).

It is noteworthy that structuralism returned on the academic and political scene in the 1970s, mostly in France, at a time when it was trying to keep confetti of its former empire and as migration from former colonies was on the rise. It was a post- or neo-colonialist reaction to recent independence, and became a justification of discrimination, that followed colonisation.

Thus, there was a large political, social, etc. consensus, including among scientists, to support the existence of intellectual differences between Europeans and former colonised people while they were becoming politically equal, despite a low educational level of the majority of their population – due to a lack of schools. In Pacific islands, education was left to missions who mostly taught reading the Bible, a proof of the failure of the colonisation goal to “civilize” – or rather modernize – that was impossible to acknowledge then. Similarly, throughout most of the 19<sup>th</sup> century and sometimes until

<sup>21</sup> In Melanesia, they also carried out *namanggi* sacrifices of hundreds of tusked pigs that were returned by their partners years later. They used cycas leaves, breaking 9 pinnates and leaving the 10<sup>th</sup>, 20<sup>th</sup>, etc.

the early 20<sup>th</sup> century, colonial governments largely neglected health of the colonized populations (Rallu 2022).

Thus, the former colonial states denied, or at least minimized the tremendous declines that had affected the colonized populations. It seemed unnecessary, or a useless debate, to estimate the extent of past declines, when fertility was increasing in the developing countries and declining in the West, offering a good opportunity to obliterate the question. Although African populations were growing then, there were still pockets of temporary declines in some rural areas of Africa (Caldwell, Canterelle). The major change resulting from independence was a feeling that «White supremacy» was in question. In France, it had repercussions on politics until the 1980s and beyond, with a disastrous immigration policy in a social context prone to discrimination, and harsh responses of the Chirac government to requests for emancipation by its last colonies with the «Events» in New Caledonia and a ransacking of Papeete center by Tahitians on strike, not to mention foreign policies related to newly independent states.

## Conclusion

The debates on population decline have mostly focused on Tahiti due to wide controversies on the size of its population at contact. However, it was too quickly stated that early navigators, some of them mastering statistical skills, were mistaken by crowds at the arrival of ships, forgetting their meticulous observations over several months. Based on the reports of reliable witnesses of Tahitian society, we can estimate its population at a range of 170,000 to 200,000 in 1774 and, as a lower bound, probably 200,000 at contact, if not slightly higher.

Pacific Islands provide well documented cases of dramatic epidemics and a long-term decline due to endemic diseases, with extreme crises over several years, halving the population in a decade or so. A retrodiction on the 1881 and 1848 censuses, based on rather conservative rates comparative of those recorded in other Eastern Polynesian islands, yields 180,000 persons at contact, showing that the above estimates of early navigators are rather plausible. These two different approaches show that in 1881 Tahiti population was reduced to about 3 per cent of its size at contact. Archaeological and carrying capacity data now show that Pacific islands populations at contact were much closer to early navigators' than to scholars' estimates in the 1960s.

It was difficult to acknowledge such a disastrous outcome of an enterprise that was supposed to civilize other people, and colonisation was related with various ideologies. In the frame of unprecise medical knowledge in the 19<sup>th</sup> century, doctors were at the forefront of interpreting, acknowledging, justifying or denying population collapses. Early anthropological theories have been affected by ethnocentric misunderstandings resulting in fictions, such as «primitive thinking» and its various forms, including by renown scholars, and used as justifications of colonialism. Thus, there was a large consensus to minimize the responsibility of colonisators for numerous failures.

There are reports on a rapid decline in native populations in the Caribbean islands and mainland Americas, with population being reduced by 95 per cent or more (Stannard 1989). Colonisation of Pacific Islands followed on the same processes as in the Americas, first affecting Micronesia, with similar dramatic epidemics, a constant rapid decline and... denial: after Guam 1699-1700 smallpox epidemic, «*Father Palomo vehemently denied that any loss of life occurred in the event*» (Underwood 1973: 18).

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## ANNEX 1

**Table A1.** Numbers of warriors *taatatoa* by district on Tupaiā's list

District		Warriors	District		Warriors
(a)	Present name		(a)	Present name	
Oteihouroo	Atehuru	400	Whapiano	Hapaino	200
Parapara	Papara	900	Whidia	Hitia	600
Wyriridde	Vaiuriri (Papeuriri)	300	Whahite (b)	Afaahiti	400
Opora	Pare-Arue	800	Tiarreboo (b)	Taiarapu	1800
O'whao	Mahaena	200	Wyourou (b)	Vairao	200
Tettahu	Faaa	200	Matawii (b)	Mataoae	400
Matavii	Matavai (Mahina)	200	Wyarū	Vaiari	180

(a) Orthographe du journal de Banks

(b) McArthur (1967: 237) assumes that Taiarapu regroups several districts of the small peninsula and 3 others are listed separately.

**Table A2.** Estimates of Tahiti population in the 18<sup>th</sup> century

<b>Author of estimates</b>	<b>Dates in Tahiti</b>	<b>Duration of stay</b>	<b>Estimates</b>	<b>Method</b>	<b>Circumstances/Comments</b>
Robertson	19.06-27.07.1767	~5 weeks	>100,000	Observation	Circumnavigated and visited a valley
Bougainville	April 1768	9 days	No		Same description of the island as Robertson
Cook	13.04.1769	3 months	No		Tupaia's number of warriors <i>taiatatoua</i> cast - 6,780 provided to Banks
Boenechea	20.11.1772	1 month	> 10,000	unbased	Brought the flu
Boenechea	11.1774	A few weeks	No		Brought the flu
Rodriguez	1774-1775	1 year	~15,000	Corrected by the king of Peru	Dense population; missionaries rejected/confined
Boenechea	11.1775	< 2 weeks	No		Repatriate missionaries
Cook	April-May 1774		204,000	Faa'a's fleet	Count of war-canoes, warriors, rowers; adult men = 1/3 total population (see text)
Forster G.	April-May 1774		>120,000 <sup>(1)</sup>	26.04.1774 fleet review	id.
Forster J. R.	April-May 1774		>120,000 <sup>(2)</sup>	26.04.1774 fleet review	id. separately for Tahitinui and Taitarapu
Forster J. R.	April-May 1774		170,660-204,800	carrying capacity	Estimates based on bread fruit trees
Morrison	1789-1791	19 months	~30,000	unbased	
Missionary Wilson	1797		16,050	List of 2,675 clans	Done soon after his arrival, assumes a clan is a nuclear household of 6 persons
Other LMS missionaries estimate	1797		50,000	unbased	Travel around Tahiti

(1) considered it "most moderate", "very low".

(2) considered it "the very lowest computation".

## ANNEX 2

### Structure of Tahiti population at contact

#### *Infanticide, population trends and structure*

The question of the age structure of Tahitian population at contact is important because it directly affects the estimates based on Cook and the Forsters' observations in 1774. They used a factor 3 to estimate the total population based on their counts of adult men in the fleet reviews of 2 districts and later Faaa, on which Cook based his estimate, after extrapolating to all of Tahiti.

Archaeological data show that the population of Hawai'i stabilized in the 16<sup>th</sup> century, about 200 years before contact, and oral tradition reports that infanticide was introduced from Tahiti, that certainly experienced a similar population development. The absence of most diseases, including childhood diseases, common in Europe and other continents in Polynesia resulted in lower infant and children mortality and higher life expectancy at birth than recorded in historical demography of Europe, for 30 years. Life expectancy before contact might have reached 40 years or somewhat above, resulting in a rapid growth since the discovery of the Eastern Pacific islands by Polynesians between 1000 and 800 years before contact according to archaeological data.

The level of infanticide is not well-assessed, and it was probably exaggerated by missionaries, based on a few women of Tahitian aristocracy, without mentioning if it was sex-selective. Bligh was told that 3 children were left alive, but it is not clear what Tahitians meant by this. As other people, they were well-aware that mortality reduces the number of children, making it necessary to have more children to achieve an ideal family size, that would be 3 children, to avoid population decline and loss of power in a context of rivalry to reign over the whole islands or archipelagos. There were also probably different behaviours as regards fertility and infanticide between aristocracy and commoners.

We estimate infanticide based on a TFR of 6.9 without infanticide – a rate recorded in the Marquesas islands in 1936–1945 – and “3 children”, resulting in a rate of 57 per cent. But it is an indirect and biased estimate, because the decision to kill, or not to kill a newborn was probably related with the survival of previous children, and some children we assume to have been killed, actually replaced natural deaths.

Note that this exercise differs from MacArthur's model because it seeks to estimate the structure of Tahiti population at the time of contact, whereas MacArthur aims to assess the decline from contact in 1767 to Wilson's estimate in 1797, assuming a population structure at the time of contact based on a 30-year life expectancy and an annual growth rate of 1 per cent, and dramatically introducing an infanticide rate of 75 per cent. We now know from Hommon's (1976) and Cordy's (1981) studies of prehistoric Hawaii what MacArthur could not have read that the population of Hawaii, where infanticide was brought from Tahiti, stabilised two centuries before contact.

In model A, we estimate the structure of Tahitian population at contact based on life expectancy at birth of 30 years, and 40 years in other models, using West Regional Model Life Tables (Coale and Demeny 1983); TFR is 3 in all models. The age pattern of fertility used in our models is that of the Marquesas in 1936–1945, in the frame of very permissive sexual behaviour from a young age making missionaries desperate to eliminate sexual promiscuity, with high rates in 15–19, peaking at 20–24 years (Rallu 1990: 81). In models C and D, we introduce sex-selective infanticide, without changing the overall infanticide rate. Thus, we

have four models with infanticide of 57 per cent of births, life expectancy at birth of a) 30 years; b) 40 years; c) 40 years, with moderate sex-selective infanticide rates of 52 per cent for boys and 61 per cent for girls; and d) 40 years, with infanticide rates of 49 per cent for boys and 64 per cent for girls.

#### *Model A*

With life expectancy at birth of 30 years and a rate of infanticide of 57 per cent for both sexes<sup>22</sup>, with the usual sex ratio at birth of 105<sup>(2)</sup>, the population declines at a yearly rate of 1.3 per cent or by 48 per cent in 50 years. The overall sex ratio is 95 men for 100 women, because of the male excess mortality. It is clear that, if only 3 newborns were allowed to live, life expectancy at birth was well higher than 30 years, or Tahiti population would have declined steeply in 50 years before contact, which is unlikely<sup>23</sup>.

#### *Model B*

With life expectancy at birth of 40 years and the same infanticide rate as in model A, the population still declines, but only at a rate of 0.4 per cent or by 18 per cent in 50 years. The overall sex ratio is 95. Most probably, life expectation was a little higher than 40 years or fertility was somewhat higher than 3, to allow for a stable population, in the political context.

#### *Model C*

With life expectancy at birth of 40 years, and a moderate sex-selective infanticide of 52 per cent for boys and 61 per cent for girls, and a sex-ratio at birth of 128<sup>24</sup>, the population declines at a rate of 0.7 per cent or by 30 per cent in 50 years. The sex ratio of the population after 50 years is 122.6.

#### *Model D*

With life expectancy at birth of 40 years, and sex-selective infanticide rates of 49 per cent for boys and 64 per cent for girls and a sex ratio at birth of 150, the population declines rapidly, at a rate of 1 per cent yearly, or by 39 per cent in 50 years. The sex ratio of the population at the end of our simulation is 143.

### ***Environmental and social factors***

It would be surprising that a high sex-selective infanticide was practiced in Tahiti where the social status of women was rather high, with women owning land and accessing chieftom. Nevertheless, as a minor sex-selective infanticide rate of females strongly increases the sex ratio, its consequences are important for marriages. However, the permissiveness of Eastern Polynesian sexual life made it possible to reduce its consequences on population trends. In the Marquesas, polyandry was attested for some women, mostly chief women. In Tahiti, some women were district-chief or “queen”, as Europeans called them, but without any mention of polyandry. However, adulterine bastards are reported in chiefly families, sometimes

22 This overall rate of infanticide of 57 per cent applies to all models, but rates are different for boys and girls in models C and D.

23 McArthur's model (McArthur 1967: 262-263) based on a population growing at 1 per cent yearly before contact does not represent the age-structure at contact, because infanticide had already long been in use in the context of high population density.

24 Models A and B include a usual sex ratio at birth of 0.512 for boys and 0.488 for girls, adjusted for infanticide levels in models C and D.

resulting in arguments. In the frame of very unbalanced sex ratios, a family size of 3 children could be, not per mother, but per father, i.e. patrilineal families. Permissive sexual behaviour and unstable unions easily allowed to have on average 3 children per male head of the family, with an average number of children per women to achieve this goal according to the sex ratio of the population of reproductive age, which could be reached with less infanticide. There was no need of frequent polyandry, strictly speaking, to achieve this. However, practices were different in aristocratic families, as regards both fertility and infanticide.

Our 4 models just replicate stable populations associated with model life tables. Yet no population has experienced a stable fertility and mortality over 50 years. Following several centuries of rapid growth, Eastern Polynesian populations progressively resorted to infanticide to reduce growth and stabilize population in the 200 years preceding contact. Moreover, Pacific islands were affected by famines and tsunami, frequently reported in the Marquesas and affecting also other islands. There were cases, however rarely, of slaughter or forced emigration following wars, but people also emigrated in search of new islands to settle. Besides the need to protect their resources and political influence, the Polynesian islands populations used various ways to survive on tiny lands.

### **Population structure and estimates**

Let us return to the question of the age structure of Tahiti population at contact.

Cook and the Forsters counted men on a few war- and transport-canoes and multiplied the average numbers by the number of canoes by type. G. Forster said that there were men on the shore, but he did not include them, and he probably did not attempt at counting them, because people on the shore were constantly moving. We can assume that, if *taatatoa* warriors were adults in the prime of life, rowers were of varied ages; thus, all the men in canoes could be in the age group of 15-59.

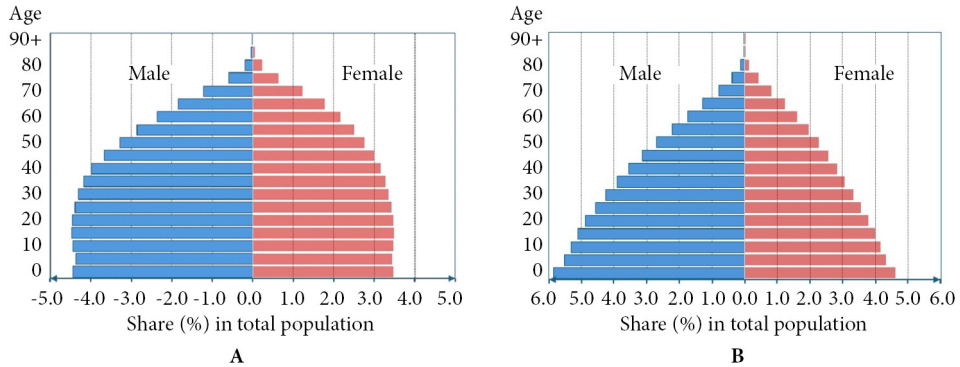
The ratios of total population to men aged 15-59 are 3.14 and 3.12 in models A and B, respectively; they are little different because the age structure is mostly related to fertility (the same in all models) and the age pattern of mortality is little different in life expectancies of 30 and 40 years.

This ratio is 2.81<sup>25</sup> in the third model with a moderate sex-selective infanticide. It is 2.60 in the fourth model that is associated with high sex ratio and mostly a rapid decline that seem unlikely. Thus, we shall discard models A and D, both resulting in steep declines, inconsistent with the socio-political situation and archaeological data for Hawai'i that has experienced a similar situation.

Population estimates with the ratio of total population to men aged 15-59 years in model B adding up to 3.12, are 173,400 and 209,200, respectively with 40 and 50 men per war-canoes, which is 4 per cent higher than with Cook's ratio of 3: 166,700 and 201,100; and model C, with a ratio of 2.81, yields 156,200 and 188,400 persons, respectively, which is a 6.3 per cent lower than with Cook's ratio.

We think model C is acceptable, however is rather conservative as infanticide is based on an indirect estimate and includes children allowed to live to replace elders (Fig. 2). Let us make a model Ca, assuming that a) infanticide is not purely random, weaker children or with birth defects being systematically killed, b) 25 per cent of those allowed to live die before being 10 years old and c) half of them are replaced, then infanticide is 44 per cent

25 In our PhD, we used a ratio of 2.92 from a model with lower infanticide rate.



**Figure 2.** The age pyramid of Tahiti population at contact (model C). **A** Model C (life expectancy = 40; TFR = 3; infanticide – 52% of boys and 61% of girls; sex ratio at birth = 128). **B** Model C(a) (the same input that in the model C + 50% replacement rate for children died before age 10)

and fertility is 30 per cent higher,  $3.86^{26}$ . The population is nearly stable, increasing by 0.2 per cent yearly or 11 per cent over 50 years. The proportions by age are respectively 30, 62 and 9 per cent for age groups 0-4, 15-59 and 60 years and over. The age-structure is much younger because, replacing dead children is actually increasing the TFR. Overall sex ratio is unchanged, but the ratio of total population to men 15-59 is 2.91, because the age structure is younger, and our estimates are 161,700 and 195,100 respectively with 40 and 50 men per war-canoes, which is 3.5 per cent higher than our estimates with a ratio of 2.81.

If only boys are replaced (model C(b), the sex ratio at birth is 150. The population declines by 0.5 per cent, or 22 per cent over 50 years, the proportions by age are 25, 63 and 12 per cent for age groups 0-4, 15-59 and 60 years and over, respectively; the overall sex ratio is 144 and the ratio of total population to men aged 15-59 is 2.63, because there are much less girls and women in this scenario. This scenario results in a rather high decline, which is not sustainable over a century or more, as Tahiti has been seemingly experiencing the same trends as Hawai'i for about 2 centuries before contact. Moreover, a rapid decline of Tahiti population over the one or two pre-contact centuries is unlikely both for 'political' and demographic reasons, as it would imply much higher density than estimated at contact, which is highly improbable. There were reports of many more men than women in Tahiti by visitors in the late 18<sup>th</sup> century and until the mid-19<sup>th</sup> century. The same was noticed in the second half of the 19<sup>th</sup> and early 20<sup>th</sup> centuries in Melanesia where there was no infanticide. It was due to the excess female mortality because women cannot get isolated as they take care of sick people. The same cause has increased the effect of infanticide in Tahiti, but its use was most probably much reduced in the first- or second-decade following contact, given the *rapid* decline due to the introduced diseases. This scenario, compared to the previous one, shows the impact of high sex-selective infanticide on population trends and structure, because the number of births is much lower due to infanticide of girls that are not replaced in case of deaths at young ages.

While the old age structure and the rather rapid population decline in model C were dubious as regards sociopolitical and cultural Tahitian practices, and implied a very high density one or two centuries before contact, its first revision with replaced dead children,

<sup>26</sup>  $6.9 * 0.25 = 1.73$ , and half deceased children being replaced, TFR is  $3 + 0.86 = 3.86$ .

model C(a), is more consistent with Tahitian historical and sociocultural features and demographic trends derived from Hawaiian archaeological data. It shows a more likely and, on the long term, sustainable pre-contact demographic situation of Tahiti, with nearly stable population size, moderately imbalanced sex ratio and younger age structure. Note that the same result could be reached with slightly different life expectation, fertility and infanticide rates.

## ANNEX 3

### Tahiti at discovery in Robertson's log

When the Dolphin sailed along Tahiti coast, Robertson<sup>27</sup> reports «*we saw the whole coast full of canoes [...] the whole shore side was lined with men women and children, all the way we sailed along*» (Robertson 1948: 139-140). Everywhere they stopped to find a good mooring, hundreds of canoes – small outrigger canoes and larger canoes with sails – came around the ship to trade, sometimes trying to attack. When they attempted to sound in Matavai bay on June 24, «*a large double canoe [war-canoe] came off from the shore*», with chiefs, most probably war-chiefs, and trade turned into a surprise attack that was repelled (Robertson 1948: 153-156). On the morning of June 26, before dawn, the English took possession of the island, planting a flag. Soon after, hundreds of men and «*a great number of large canoes<sup>28</sup> [...] all full of men*» (Robertson 1948: 161-162) arrived from the South-West of Matavai bay (West of Cook's Venus Point), and «*several thousands of men comeng along shore*» (Robertson 1948: 162). There were then «*upward of seventy or Eighty large canoes at the North End of Skirmish Hill*»<sup>29</sup> (Robertson 1948: 164) - it is probable that these were war-canoes, because Robertson previously wrote «*a hundred of large-canoes were in the bay and others still coming*» (Robertson 1948: 163) which would make well above 100 large canoes. Several firing of «*round and Grape shot*» quickly made the Tahitians give up and flee.

The number of war-canoes in the second attack is consistent with Arii Taimai's report that Hapape, the district of Matavai, had 44 war-canoes, and its western neighbor, Arue, with about the same coast length, could have about the same number of war-canoes. Thus, the first attack involved only Hapape, with the assistance of part of the forces of its western neighbor in the second attack. However, Robertson does not give a number of men on war-canoes because, given the tense situation, he had no time to count them. But the carpenters sent to destroy the war-canoes abandoned on the shore after Tahitians fled provided more precise information, they were «*forty to fifty foot long and capable of carrying upwards of thirty men*» (Robertson 1948: 164), which is a minimal guess from their real capacity. Wallis reported that several were sixty feet long. However, as Robertson noted that all canoes with sails «*appear to sail about one forth faster nor our ship when we made all the sail*» (Robertson 1948: 140) and as the Dolphin was anchored in the bay with only smaller boats around, the Jolly boat, barge, cutter and launch, Tahitians did not need to have the war-canoes fully manned, mostly to avoid making the English suspicious.

The English had little, or even avoided, contacts with what they called or believed to be the 'principle people', trading mostly with an old man whom later Cook called Owhaw

<sup>27</sup> Wallis being stuck onboard in very bad condition, Robertson's log provides the most detailed information.

<sup>28</sup> Robertson seems to use «large canoes» for double hulled transport canoes with sails (described by G. Forster) and war-canoes (a word used by Cook and the Forsters) alike.

<sup>29</sup> Cook's «One tree hill».

(Robertson 1948: 170; 173-174). Purea, whom Robertson calls queen, came to meet them on July 19. She was the wife of Amo, the important Teva chief of Papara, whose mother was a daughter of the chief of Hapape that included Matavai (Arii Taimai 1964: 32-33). On July 22, Robertson was invited by the queen in her «palace» - it was actually the Fare-hau of the Council of Hapape (Arii Taimai 1964: 43) -, and he was taken to «several Houses full of the principle people of the island» - they were actually the main dignitaries of Papara (Arii Taimai 1964: 33). Purea met Wallis and Robertson several times in their last days in Tahiti, trying to get support from the English.

In a walk along the Matavai River, Robertson noted that there were no other trees than breadfruit, vi-apple and plantain trees, assuming that «they permit no barren trees to cumber the low grounds» (Robertson 1948: 183-184). He also «*saw some nurseries of young trees Walld in with Stones about three foot hight*» to keep pigs away (Robertson 1948: 191). Thus, Tahitians used good soil exclusively for food supply and intensified plantations; the lagoon and the open sea were also major sources of proteins.

Thus, it is clear that all the population of Tahiti did not assemble at the arrival of the Dolphin, because it did not stop and continued sailing outside the reef to find a safe pass to search for a mooring inside the lagoon. It is also clear that the fragmented political situation and the competition between district chiefs did not allow for a united attack on the Dolphin, and the same applies to the fleet reviews later seen by Cook and the Forsters.

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