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A Brief Statistical History of Hawai‘i¹

STATISTICS IN ANCIENT HAWAI‘I

Hawaiian statistics go back a long way—at least to the 16th century, and perhaps earlier—but we know relatively little about them. The ancient Hawaiians devised a counting system based on multiples of four and ten. Although words for numbers from one (*‘akahi*) to ten (*‘umi*) were typically short, larger numbers were often polysyllabic. Thirteen, for example, was *‘umikumāmakolu*, and 85,650 was *‘elua kini, ho‘okahi mano, ‘ehā lau, ‘akahi kanahā me ka ‘umi*. Early foreign residents like missionary E. W. Clark recorded numbers as high as 40,000 (*kini*), 400,000 (*lehu*), and even 4,000,000 (*nalowale*). “When they had arrived at 40, they returned to one and counted to 40 again,” Clark noted. “The words *iako* and *kaau* are sometimes used for 40 instead of *kanaha*. *Iako* is used for counting tapas; *kaau* is counting fish; and *kanaha* in counting rope, cord, bundles of food, etc.”²

Arithmetic was primitive and laborious. Clark wrote:

Their computations were all performed in the mind, . . . often making use of the fingers of one or both hands to assist their calculations. They had nothing like arithmetical rules. All their calculations were performed by counting. If they wished to ascertain how much 10 yds. of cloth would cost at \$5. per yard, they would count thus, 1 yard is 5 dollars; 2 yds. is 5 more or 10; 3 yds. is 5 more or 15, and so on to 8

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yds. which would be 40 dollars. They would then begin back and count the remainder until they ascertained the amount, *hookaki kanaha me ka umi dala*—one forty and ten dollars. If at any time they lost their reckoning, as was often the case, they would go back and count over.

The chiefs often had persons about them, more or less skilled in numbers, to keep an account of their tapa, mats, fish, and other property, and divide them out to their dependents.³

Tyerman and Bennet observed that the king's tax collectors,

though they can neither read nor write, keep very exact accounts of all the articles, of all kinds, collected from the inhabitants throughout the island. This is done principally by one man, and the register is nothing more than a line of cordage from four to five hundred fathoms in length. Distinct portions of this are allotted to the various districts, which are known one from another by knots, loops, and tufts, of different shapes, sizes, and colors. Each tax-payer in the district has his part in this string, and the number of dollars, hogs, dogs, pieces of sandalwood, quantity of taro, &c., at which he is rated, is well defined by means of marks, of the above kinds, most ingeniously diversified.⁴

Although this was recorded in 1822, the practice dated from precontact times.

One of the earliest large-scale statistical surveys was Umi's census. According to Albert S. Baker,

Umi became king of Hawai'i about the year 1500, and established his court in Kona. On one occasion he is said to have collected all the people of Hawaii at a small plain between the cones on the inner side of Hualalai, to number them, and this is called the Plain of Numbering to this day, by the older Hawaiians. Two small hills are said to have been the seats of the king and queen, with their retainers, while the census was being taken. Later all the people went down on the plain, where each deposited a stone, the strongest the largest, making huge stone-pile memorials around the heiau, one for each district and on the sides toward the districts. Thus the piles showed the relative size of the population of the districts.⁵

This precontact concern with demographic data extended even to the Menehune, the legendary race of small people who worked at

night building fishponds, roads, and temples. On Kaua'i, the fourth largest of the Hawaiian Islands, traditional accounts described a Menehune population of 480,000, not including children under 17. The ratio of men to women was high, with 320,000 males but only 160,000 females. Katharine Luomala, whose 1951 monograph devoted more than three pages to Menehune demography, calculated their density on Kaua'i at 902 per square mile.⁶

1778 TO 1850

The coming of foreigners precipitated vast changes in Hawaiian culture, not least so in their computational methods and statistical reporting. Between Cook's appearance in 1778 and the arrival of American Protestant missionaries 42 years later, developments of interest to statisticians were relatively few and unimportant. The three decades beginning in 1820, however, witnessed rapid progress.

The earliest statistical contributions by non-Hawaiians, unsurprisingly, were made by Captain Cook and his officers and men. Although most were simply measurements of physical and geographic phenomena—distances, elevations, temperatures, and the like—they also included some fairly convoluted population estimates.⁷

At least one important Island series originated abroad. In 1804, Chinese officials initiated annual tabulations on Hawaiian sandalwood landed by American vessels at the port of Canton.⁸

The first population census in historical times was conducted in Wainiha Valley, Kaua'i, sometime between the late 1790s and 1821. "At a time as late as the reign of Kaumualii, the local konohiki making a careful census of the valley by villages from the sea mauka returned upwards of 2000 souls." John M. Lydgate, (founder of the Kaua'i Historical Society in 1914), enumerated in detail all the communities, he gave the exact quota from each, ending with the remotest, Lā'au, which he reported as "Menehunes, 65."⁹

Modern statistical reporting was introduced to Hawai'i in the 1820s, more or less contemporaneously with such other important innovations as schools and churches, written laws, printing, Western medicine, taxes, and a cash economy. By 1850, many of the major social, demographic, economic, and government series used by present-day analysts had been initiated.

Both public and private sources contributed to the proliferation of statistics during this three-decade period. The missionaries were responsible for many new series, including meteorological observations (1821), marriages (1828), educational statistics (1828), publishing (1829), all-island population censuses (1831–1832), and family budgets (1834). Businessmen initiated series on ship arrivals in 1824, imports and exports in 1834, sugar production in 1836, business establishments in 1840, prices in 1844, cattle in 1846, and diversified agriculture in 1850. Statistics compiled under government auspices included series on shipping and customs (beginning in 1836), crime and court activities (1838), hospital admissions (1839), government finance (1843), education (1846), licensing (1846), population, births and deaths (1847), housing (1847), and land claims (1848).¹⁰

Statistical reporting during this era was considerably simplified by standardization of currency, weights, and measures. An early monetary unit was the picul (133-1/3 pounds) of sandalwood, worth approximately \$10; and the first written tax law, enacted in 1826, required each able-bodied man to pay one-half picul of “good sandalwood” or four Spanish dollars. Money of many nations circulated in the Islands, and the first Hawaiian coinage, a copper cent, did not appear until 1847. In 1846, however, Hawaiian currency was officially defined in terms of United States currency, with one Hawaiian dollar (not actually minted until 1883) equal to 100 U.S. cents. Ancient units of length like the *anana*, *muku*, and *iwilei* were meanwhile being supplanted by the inch, foot, yard, and fathom. In 1840, a law stipulated that “the weights and measures approved by the Hawaiian Laws are those of Massachusetts.” From that time forward, virtually all statistical series published for the Islands were routinely expressed in the same units as those in use on the American mainland.¹¹

Western computational techniques and procedures soon supplanted the more primitive Hawaiian methods. Schools operated by the Protestant missionaries added courses in arithmetic around 1828, at first using a simple eight-page primer printed at the mission press. Lahainaluna, the first high school in the Islands, reported an enrollment of 134 students in 1835 and offered courses in algebra, geometry, trigonometry, and surveying, all taught in Hawaiian. Teachers introduced “Hawaiian” words for 50, 60, 70, 100, 1,000, and other

numbers in the decimal system. Soon many Islanders were acquainted with the fundamentals of Western computation. The growing foreign community meanwhile provided a small group of workers experienced in handling some of the more difficult problems in data processing.¹²

One of the earliest calculating aids used in Hawai‘i was a Gunter’s scale, owned by the American James Hunnewell at least as early as 1820. A dictionary definition of this instrument describes it as “a scale consisting of a wooden rule, two feet long, on one side of which are marked scales of equal parts, of chords, sines, tangents, rhombs, etc., and on the other side, scales of logarithms of these various parts.” When Hunnewell donated his old Gunter’s scale to the museum of Oahu College in 1854, he wrote: “This old scale is not introduced as the first that was ever carried to the islands, but as the first that was used as a standard measure, in trade, in Honolulu.”¹³

No record exists of the initial appearance of the slide rule in Hawai‘i, but it was being advertised by Henry Paty & Co. in *The Polynesian*, a Honolulu weekly, as early as 1840.

The abacus or *suan-pan*, used in China as early as the sixth century B.C., was introduced to Hawai‘i before 1842. Sir George Simpson, describing his six-week stay early that year, wrote: “Of the Chinese, there are altogether about forty in this archipelago. . . . Those who are employed as shopmen, keep their accounts with a wonderful degree of exactness, making all their calculations by means of an abacus.”¹⁴

Perhaps the most innovative Island statistician during this period was Robert Crichton Wyllie. He was born in Scotland in 1798, studied at the University of Glasgow, and eventually became a surgeon. He came to Hawai‘i in 1844, and for 20 years, from 1845 until his death in 1865, was minister of foreign affairs for the kingdom. In 1844, he contributed a series of long descriptive articles, crammed with statistics, to *The Friend*, a Honolulu periodical. Published at monthly intervals over an eight-month span, these articles provided the first comprehensive statistical view of the Islands.¹⁵

Wyllie was also responsible for what may well have been the first comprehensive social and economic survey ever undertaken in the Pacific. In May 1846, he sent a list of 116 questions to the general meeting of the Sandwich Islands Mission for distribution to mission-

aries throughout the kingdom. These questions today sound like an agenda for modern social research, requesting data on such subjects as wages and hours, dietary patterns, agriculture, manufactures, imports and exports, retail trade, shipping, demographic characteristics, fertility, morbidity, mortality, housing, land use and tenure, education, religion, crime, life expectancy, depopulation, child care, living costs, poverty, taxation, capital improvements, labor supply, water resources, and interracial marriage. The response to this questionnaire was transmitted to Wyllie by the Sandwich Islands Mission on March 28, 1848, and their report was soon thereafter published by the foreign office as a 95-page document. Wyllie's questions unfortunately required far greater statistical resources than were available to widely dispersed missionaries in an emerging nation, and the answers were considerably less significant than the questions.¹⁶

SINCE 1850

The second half of the 19th century brought continued growth in statistical coverage, as new series were introduced and old ones were expanded and refined. During the 1850s, Hawai'i conducted its first complete official population census (1850), began records on immigrant arrivals (1852), initiated postal statistics (1850), and tallied election results (1851). In the 1860s, Island statisticians added series on assessed valuation (1860), passenger arrivals and departures (1860), and employment by occupation (1866). During the 1870s and 1880s, regular reporting was undertaken on prison inmates (1874), mortality by age, sex, nationality, and cause (1876), telephones in use (1880), and building permits (1888). The 1890s brought the first housing census (1890), railroading data (1890), and information on public water supply (1895).

Hawai'i was annexed to the United States in 1898 and accorded territorial status two years later, events that proved to have important statistical (as well as political) ramifications. As an independent nation, 19th century Hawai'i had enjoyed complete control over all governmental data series. As part of a much larger and often dissimilar country, it lost much of this control. An important example is the population census. The Hawaiian government had conducted cen-

suses at six-year intervals and had routinely obtained data for the various ethnic groups and ethnic mixtures important to the Islands. The U.S. census, in contrast, was taken at decennial intervals, and frequently forced Island populations into mainland classificatory schemes of questionable local value.

Not all of the statistical effects of annexation were negative. In 1901, the Commissioner of Labor published the first of nine exceptionally valuable reports on labor conditions in the Territory; this report included survey findings on family income and expenditure patterns, wage and hour data cross-tabulated by sex, race, and industry, and average prices for a wide range of foods and household goods back to 1890. Other series introduced by the U.S. government were the censuses of agriculture and manufactures (for 1899), mineral industries (for 1909), ocean cargo receipts and shipments (1908), newspaper circulation (1912), taxable income of individuals (1916), national park attendance (1921), and licensed radio stations (1922).

The territorial government and business community likewise developed new series. Examples include data on banking (1900), electrical energy (1901), streetcar passengers (1902), pineapple production (1903), insurance (1903), forestry (1904), automobile registration (1908), the sugar industry (1909), piped gas (1910), visitor arrivals (1922), commercial fishing (1928), and air travel (1929).

Progress was especially rapid during the Depression and World War II. Some of the most useful new series were by-products of tax programs: fuel consumption from the liquid-fuel tax base (1932), business income from the general excise tax base (1936), and employment, payrolls, and unemployment insurance from the employment security tax (1939). Important studies of land use were undertaken in 1930 and 1939, and a pioneering survey of visitor expenditures was made in 1931. The Honolulu Police Department adopted the Uniform Crime Reports program in 1932 and soon thereafter began publication of greatly expanded statistics on crime and law enforcement. Census tracts were defined on all islands in 1937-1939 and were used for small-area tabulations of the 1940 census. New social programs contributed data on public welfare caseloads and expenditures (1939), public housing (1939), and social security (1940). In 1939, for the first time, the U.S. Bureau of the Census included

Hawai'i in its Census of Business, providing data on retail trade, wholesaling, and hotels and other services. The 1940 decennial census added questions on educational attainment and housing. In 1943, the income and expenditure patterns of Honolulu families were surveyed to obtain weights for the consumer price index inaugurated that year. In 1945, the first comparative study of living costs in Honolulu and the mainland was conducted.

With the lifting of wartime security restrictions, older series were given belated release and new ones were developed. Some of the most important new series were regular reports on agricultural production (1946), *County Business Patterns* (1946), labor force status (1947), mineral production (1947), air cargo (1947), beach pollution (1949), military expenditures (1949), and the Territorial balance of payments (1950). At least one serious setback occurred when the legal requirement for reporting cargo movements between Hawai'i and the mainland was repealed (1948).

Additional social and economic statistics emerged during the 1950s and 1960s. Many concerned recreation and tourism. In 1950, the Hawai'i Visitors Bureau began the regular distribution of questionnaires to arriving passengers, thereby obtaining data on intended and returning residents as well as on visitors. State park visits were first estimated in 1951–1952, and hotel occupancy rates in 1954. A report released in 1953 supplied estimates of total and per capita personal income back to 1939; thereafter, Hawai'i data regularly appeared in federal publications on this subject. Other new series included annual surveys of pay rates (1951), current estimates of the housing inventory (1954), air pollution estimates (1957), studies of military personnel and dependents (1959), estimates of the number of "top wealthholders" (1962), comparative family budgets (1966), and data on foreign investment (1973).

PUBLICATIONS

These series and others of general statistical interest have typically appeared in a variety of basic reports, reference books, and annual compilations. Thomas G. Thrum initiated his statistics-filled *Hawaiian Almanac and Annual* in 1875 and issued it regularly until his death in 1932. Renamed *All About Hawaii* in the 1940s, it survived until the

late 1960s. From 1900 until 1958, many official series appeared regularly in the annual *Report of the Governor of Hawaii to the Secretary of the Interior*. The Chamber of Commerce of Honolulu and its successor organizations issued *Hawaii Facts and Figures* at irregular intervals for many years. *Statistical Abstract of Hawaii*, initiated by the Hawaii State Department of Planning and Research in 1962, was retitled *State of Hawaii Data Book* in 1967 and became an annual publication in 1970. Its current compiler and publisher is the Hawaii State Department of Business, Economic Development and Tourism. A 711-page compilation by the present writer, *Historical Statistics of Hawaii*, was published in 1977 by the University Press of Hawaii. Unfortunately, it has never been updated.

DATA PROCESSING¹⁷

This great expansion in statistical coverage could not have occurred without a corresponding improvement in data processing technology. Reference has already been made to Gunter's scale, the abacus, and slide rule, all introduced to Hawaii before 1850. Other devices included tally sheets, individual data cards, and mechanical aids to guide the eye in tabulating data. These primitive techniques seriously limited statistical work in Hawaii throughout most of the 19th century.

The first major breakthrough came with the introduction of the adding machine around 1896. That was when A.V. Gear began advertising the Comptometer (a simple key-driven reciprocating machine developed around 1884) in the Honolulu dailies. The Burroughs Adding Machine arrived in 1904.

Desk calculators were first sold in the Islands a few years before World War I. Fred R. Harvey was the first distributor of Marchant Calculators, beginning either late in 1911 or early the following year. By May 1916, 40 machines had been sold in Honolulu. The Marchant was followed by the Monroe desk calculator, introduced locally in 1916, four years after its first mainland appearance. These pioneering models were hand-cranked.

Calculators were at first bulky and slow but eventually became faster and more compact. By the late 1920s, many were electrically powered, and electronic desk calculators, produced by Friden, March-

ant, and Wang, were being sold in Honolulu by 1966. In June 1971, the Shirokiya department store advertised what appears to have been the first electronic pocket calculator to be sold in Hawai'i, the Sharp Compet ELSI-8. The ads boasted of their "full four functions . . . 8 digit display panel" and small size (4 by 6.5 by 3 inches); their price was only \$345.00.

The next important step in data processing in the Islands was the introduction of punched-card equipment, late in 1930. Punched-card tabulation had been first developed in the 1880s and given its earliest large-scale application in processing the 1890 U.S. census. The first punched-card equipment in Hawai'i was installed in the Iwilei offices of the Hawaiian Pineapple Company two days before Thanksgiving, 1930, more than four decades after its initial appearance on the mainland. Eleven months later, the Board of Health became the first Territorial agency to obtain punched-card equipment. The first county agency to do so was the Honolulu Police Department, chiefly in response to the controversy caused by the Massie case: the subsequent investigation of the police department revealed serious deficiencies in their statistics on crime and law enforcement and brought about their conversion to automated data processing in May 1932.

The modern computer came to Hawai'i in 1956, twelve years after it was first developed and five years after its first commercial manufacture. The first electronic computer in Hawai'i was an IBM 650 installed in the Honolulu offices of Libby, McNeill & Libby in November 1956. The first true computer installed by a government agency, another IBM 650, was put into operation at the U.S. Army Hawaiian Base Command in July 1957. The University of Hawai'i Statistical and Computing Center was established in April 1960. Its IBM 650, installed April 1, 1960, was the first electronic computer in a state or county government agency in the Islands.

A statewide information system was initiated in 1962 and 1963. The 1962 State Legislature mandated a study of a proposed statewide data processing system. The resulting report, prepared by the consulting firm of Cresap, McCormick and Paget, was presented to the Legislature in 1963. Governor John Burns established the position of Director of Data Processing shortly thereafter. This post was initially filled by Edwin H. Mookini and subsequently by KeNam Kim and

Eugene Harrison. A similar agency, the Information System Center, was established by the City and County of Honolulu in 1967.

STATISTICIANS

Statisticians in Hawai'i, as elsewhere in the world, have for the most part remained faceless and anonymous. In part this obscurity is inherent in the very nature of statistical work, which typically requires input from a wide variety of enumerators, clerks, programmers, analysts, and other contributors. Anonymity also stems from the decentralized character of statistical reporting in Hawai'i. Each government agency and industrial firm has its own statistical unit, and there is no state-wide central bureau of statistics headed by a highly visible director. Finally, many Island residents who might have become known for their statistical contributions have instead been identified with their subject-matter fields, as educators, economists, government officials, or businessmen.

The title of "statistician" is in fact a relatively new one in state and county governments in Hawai'i. Most of the early statistical programs were under the direction of political appointees, or persons with different technical backgrounds, such as engineering, law, or teaching. Day-to-day responsibilities for the data were assigned to poorly paid (and sometimes poorly motivated) clerical workers. Few if any of these program chiefs and underlings had much training in statistical work. It was not until 1963, for example, that the position of State Statistician, entailing strict technical prerequisites, was created. (This position, held by the present writer from 1963 until his retirement in 1992, is currently vacant.)

The only professional society in the Islands devoted entirely to statistical matters is the Hawai'i Chapter of the American Statistical Association, organized in 1947 and continuously active since that time. Although its membership has generally hovered between 25 and 50 or so, few would claim to be full-time professional statisticians. Most of the members have been professionals in other fields that bring them into frequent contact with statistics.

Notwithstanding this pervasive anonymity, both today and in the past, several individuals may rightly lay claim to statistical eminence

in Hawai'i. Any selection of names is of course subjective and likely to dissatisfy other persons with other choices. Even so, few would dispute the contributions of the four here listed: Robert C. Wyllie, Richard Armstrong, Thomas G. Thrum, and John F. Child Jr.

Wyllie (1798–1865) has already been mentioned. His series of articles in *The Friend*, published in 1844, for the first time compiled much of the relevant data on the kingdom:

“Notes on the Shipping, Trade, Agriculture, Climate, Diseases, Religious Institutions, Civil and Social Condition, Mercantile and Financial Policy of the Sandwich or Hawaiian Islands, viewed in Relation to Other Groups of Islands, and to the Natural and Acquired Advantages of the Sandwich or Hawaiian Islands.” His 1848 report, *Answers to Questions Proposed by His Excellency, R. C. Wyllie, His Hawaiian Majesty's Minister of Foreign Relations, and Addressed to all the Missionaries in the Hawaiian Islands, May 1846*, was a pioneering social and economic survey, many years ahead of its time.

Richard Armstrong (1805–1860), a contemporary of Wyllie's, was the official responsible for not only the development of Hawaiian educational statistics but also the first successful government censuses. He was born in Pennsylvania and graduated from Dickinson College and Princeton Theological Seminary. After working as a surveyor and teacher in his home state, he came to Hawai'i in 1832 and saw service as a missionary on Moloka'i, the Marquesas, Maui, and O'ahu. In 1848, he became minister of public instruction and remained in government service until his death. Regarded as “the father of public education in Hawai'i,” Armstrong contributed to the growth of data on schools and enrollment. He was also in charge of the 1849, 1850, and 1853 census enumerations. These were the first censuses taken under government auspices to achieve a reasonable degree of completeness and accuracy, and provided the earliest available Islandwide information on fertility, mortality, and the age, sex, and national origins of the population.

Thomas George Thrum (1842–1932) was an indefatigable compiler and publisher of Hawaiian statistics. Thrum was born in Australia. His formal schooling ended at 14. After migrating to Hawai'i in 1853, he worked as a seaman, printer, bookstore owner, publisher, and scholar. From 1888 to 1904, he served as registrar of conveyances

and did much to improve statistical reporting on land transfers. He founded the *Hawaiian Almanac and Annual* in 1875 and lived eventually to publish 58 issues. In addition to numerous scholarly articles, the annual volumes of this series contained many pages of statistics from both governmental and private sources.

John Francis Child Jr. (1912–1970) contributed to market research, census geography, and tourism statistics in the Islands. He was born in Honolulu and educated at the Wharton School of Finance and Commerce, University of Pennsylvania, where he received a degree in economics. From 1937 until his death, he headed firms engaged in real estate research and appraising, market and survey research, and tourism studies. With Romanzo Adams, professor of sociology at the University of Hawai‘i, he delineated in 1937 the nation’s first state- or territory-wide census tract system. A decade later he was the prime organizer of the Hawai‘i Chapter, American Statistical Association, and served as the chapter’s first president. In 1950, he originated the Hawai‘i Visitors Bureau’s basic data and visitor reaction surveys, and conducted them under contract until 1957.

STATISTICS IN THE CLASSROOM

Classroom instruction in statistics was a relatively recent development, in view of the long history of statistics in the state. Hawai‘i, however, was not unique in this respect; many mainland states were similarly slow in providing course work in the subject.

The University of Hawai‘i, founded in 1907, was the first Island school to teach statistics. In the spring semester of the 1924–1925 school year, the UH Mānoa campus offered a new two-credit course in “Statistics” in its Commerce program. The instructor was Gerald R. Kinnear, a 1921 graduate of Oberlin College with an M.B.A. (1923) from Harvard University. The printed description of the course, repeated annually without change for almost a decade, promised “Statistical indices of business conditions; averages and means of determination; graphic presentation; methods of eliminating seasonal variation and secular trend; moving averages; dispersion, skewness, correlation; internal and external financial and business statistics; index numbers; weekly problems.”¹⁸

By 1936–1937, three additional courses were being offered: ele-

mentary statistics, advanced statistics, and, “when there is sufficient demand” the theory of probability. Many courses were offered only in alternate years.¹⁹

The last half of the 20th century brought a rapid expansion in statistical instruction. By 2001–2002, the UH catalog listed classes with such titles as econometrics, survey research design and analysis, factor analysis, computer programming for economic research, multiple regression in behavioral research, multivariate analysis, non-parametric methods, regional analysis, advanced computer-assisted cartography, geographic information systems, statistical inference, stochastic processes, demographic surveys, social statistics laboratory, information systems technology in the travel industry, and many others. A casual count of statistical offerings yielded 46 titles, probably an underestimate.²⁰

NOTES

- ¹ Revised and updated from a paper presented by Robert C. Schmitt at the Quantitative Literacy Conference sponsored by the Hawai'i Chapter, American Statistical Association, at the Sheraton-Waikiki Hotel, Honolulu, Mar. 20–21, 1992. Parts also appeared in the author's article, “Early Hawaiian Statistics,” in *The American Statistician*, 35 (Feb. 1981) 1–3; and in his article “Survey Research in Hawai'i Before 1950,” *HJH*, 21 (1987) 110–125.
- ² E.W. Clark, “Hawaiian Method of Computation,” *The Hawaiian Spectator*, II (1839) 91–94.
- ³ Clark 93–94.
- ⁴ Daniel Tyerman and George Bennet, *Journal of Voyages and Travels*, vol. II (Boston: Crocker and Brewster; New York: Jonathan Leavitt, 1832) 71.
- ⁵ Albert S. Baker, “Ahua a Umi,” *HAA* 1917: 62–70.
- ⁶ Katharine Luomala, *The Menehune of Polynesia and Other Mythical Little People of Oceania* (Honolulu: BPBM Bull. 203) 10–13.
- ⁷ Robert C. Schmitt, *Historical Statistics of Hawaii* (Honolulu: U P of Hawaii, 1977) 365, 368.
- ⁸ Charles Gutzlaff, *A Sketch of Chinese History, Ancient and Modern*, vol. II (London, 1834).
- ⁹ John M. Lydgate, “The Affairs of the Wainiha Hui,” *HAA* 1913, 125–137.
- ¹⁰ Schmitt, *Historical Statistics*, xvi–xviii
- ¹¹ Bruce Cartwright, “The Money of Hawaii,” *HAA* 1929, 70–77; Ralph S. Kuykendall, *The Hawaiian Kingdom*, vol. I 1778–1854, *Foundation and Transformation* (Honolulu: U P of Hawaii, 1938) 91–92; George E. Mattimoe and Robert H. Nagao, *A Brief History of Weights & Measures in Hawaii* (Honolulu: Hawaii

- State Department of Agriculture, Weights And Measures Branch, 1967) 1-2, 11-12, 14-15.
- ¹² *Aritemetika Oia Ka Hoike Helu* (Honolulu: Mission Press, 1828; Clark 1839); Benjamin O. Wist, *A Century of Public Education in Hawaii* (Honolulu: Hawaii Educational Review, 1940) 90.
- ¹³ *Webster's New International Dictionary of the English Language*, 2nd Ed. (Springfield, Mass.: G. & C. Merriam Co., 1941); James Hunnewell, quoted in "According to Gunter," *F* vol. III Oct. 3, 1854: 66.
- ¹⁴ George Simpson, *Narrative of a Journey Round the World. During the years 1841 and 1842*, vol. II (London: Henry Colburn, 1847) 151-152.
- ¹⁵ Robert Crichton Wyllie, "Notes on the Shipping, Trade, Agriculture, Climate, Diseases, Religious Institutions, Civil and Social Condition, Mercantile and Financial Policy of the Sandwich or Hawaiian Islands, Viewed in Relation to Other Groups of Islands, and to the Natural and Acquired Advantages of the Sandwich or Hawaiian Islands," *F*, II, May-December 1844.
- ¹⁶ *Answers to Questions Proposed by His Excellency, R.C. Wyllie, His Hawaiian Majesty's Minister of Foreign Relations, and Addressed to all the Missionaries in the Hawaiian Islands, May 1846.*
- ¹⁷ This section is based largely on Robert C. Schmitt, "From Umi to UNIVAC: Data Processing in Hawaii, 1500-1965," *HHS Annual Report 1965*: 17-28.
- ¹⁸ *University of Hawaii Quarterly Bulletin*, vol. III, No. 2, Apr. 1924: 67.
- ¹⁹ *University of Hawaii Bulletin*, vol. XV, No. 6, Apr. 1936: 110.
- ²⁰ University of Hawai'i at Mānoa, *Catalog 2001-2002*: 364, 365, 367, 369, 370, 385, 386, 388, 417, 420, 421, 446, 451, 455, 459, 460, 475.

