Composition and Nutritive Value of Palolo (*Palola siciliensis* Grube)[1]

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PALOLO is the Polynesian name of an annelid worm, which rises to the surface of the sea from the coral reefs of a number of tropical islands in the Pacific Ocean. For generations the native people have been able to predict the day and approximate hour in October and in November, which is their spring, when this swarming will take place. Sometimes it is November and December, or even later, as the time of the risings, both dates and hours, differs for the various locations and the phases of the moon.

According to Dr. Olga Hartman (1958), the annelid is designated *Palola siciliensis* (Grube) 1840, (=*Palola viridis* Gray, 1847). (In the past, the names *Eunice viridis*, *Eunice siciliensis*, and *Palolo viridis* have also been used.)

PALOLO IN THE SOUTH PACIFIC

The areas in the South Pacific Ocean where the palolo has been observed and where the natives have long used it as food have been reported by a number of scientists. Burrows (1955: 154) lists the following from the evidence which he has collected: "Fiji; Western Samoa; American Samoa; Tonga; Rarotonga (Cook Group), but not in the northern atolls; New Hebrides, but not in the three southern islands; Solomons, in a number of places."

The famous navigator, Mr. Harold Gatty,[3] who with Wiley Post flew around the world in 1931, and who collected the sample which we analyzed, was mainly interested in the "remarkable periodicity" of the rise. His investigations covered Samoa, the Fiji group, the New Hebrides, and the Solomons. In Fiji the worm is called "mbalolo," and in a letter dated January 21, 1954, Suva, Mr. Gatty wrote as follows:

From records over many years, there has been no deviation on the date of its two risings per year. If the last quarter of the moon is after the 15th of October, it will rise then and again on the last quarter of the moon in November, but if the last quarter of the moon is early in November, it will rise then and again on the last quarter of the moon in December. The rising is most exact on those days but only between the hours of four and eight a.m. The rising is usually continued on the next two succeeding mornings.

They (palolo) rise everywhere on and inside the reefs but are very few in numbers where they are in proximity to fresh or brackish water. The quantities that rise have to be seen to be believed. For instance, throughout the Fiji group there are actually many thousands of tons rising at the same instant. One can remain stationary either wading in shallow water, or anchored with a small boat in deeper water, and not fail to scoop up many pounds from any one spot.

In conversation with the senior author, Mr. Gatty stated in October, 1954, that the palolo rose not merely in thousands of tons, but, he estimated, in hundreds of thousands of tons.

COLLECTION OF PALOLO

Stair (1897: 142) describes collection of the palolo in November, 1843, near his residence on Upolu, Samoa, as follows:

"The worms are caught in small funnel shaped baskets, beautifully made, with handles about the centre. These baskets are skillfully glided over the surface of the ocean, and the worms emptied out as required into

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[3] Mr. Gatty died in Fiji, August 30, 1957.

another receptacle. When taken on shore, the worms are tied up in leaves in small bundles and baked. Large quantities are eaten uncooked, but, either cooked or uncooked, they are universally esteemed a great luxury. Such is the strong desire to eat palolo shown by all classes, that, immediately the fishing parties reach the shore, messengers are dispatched in all directions, bearing large quantities to parts of the islands on which none are found."

Buck (1930: 440) found that the coconut fiber scoops and those made from the coconut leaflet midrib were no longer in use in Samoa in 1927, as thin gauze or scrim which could be easily obtained from the traders made better scoops.

Figure 1, from photographs taken by Mr. Gatty in November, 1953, shows the Fijians collecting the palolo, using various kinds of homemade scoops, mostly of cloth. Since at this location the palolo start to rise about 4 o'clock in the morning, Mr. Gatty took these pictures as soon as it was light. When the sun rises, the worms disappear rather rapidly.

Kramer (1903: 405) observed that the rise of the palolo was an occasion for special feasts with singing, dancing, and general rejoicing among the Samoans.

NATURE OF PALOLO

Figure 2 shows broken specimens of the palolo. In the original fresh state, Wood-

FIG. 1. Natives collecting palolo in Fiji.

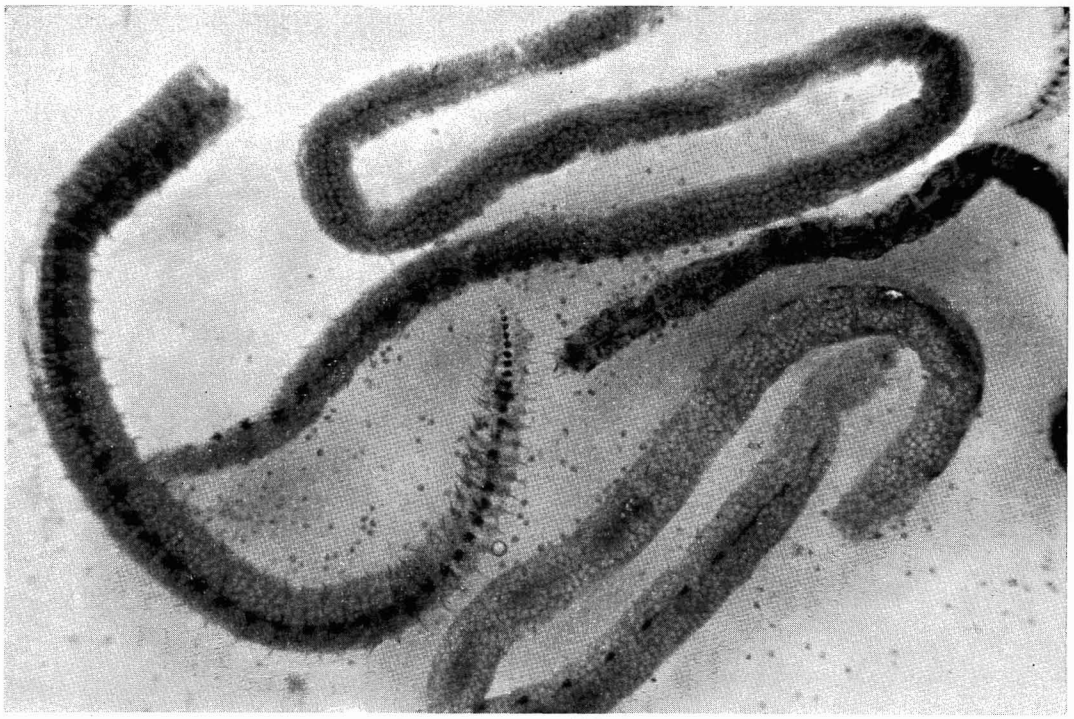

FIG. 2. Palolo showing eggs. About 5 × natural size.

worth (1907: 7) reports the longest one he measured was 30 centimeters (about 12 inches) in length, which is also "the average of the measurements given by seven authors." Our fresh-frozen specimens were 1 to 1½ millimeters in diameter. The females are filled with eggs, green in color, and the males with reddish-brown sperm. Since there are more females than males, the entire mass has a green color, resembling some of the edible sea weeds of the *Enteromorpha* species. In reality, the palolo which rises is the epitokal or long posterior end, i.e., the tail, of the worm. The head portion (atokal), which makes up about one fourth of the total length, stays in the coral rocks and generates a new body (Woodworth, 1907: 7).

Although marine biologists have been interested in the palolo for many years and the literature relating to taxonomy, morphology, and periodicity is extensive, the only chemical analyses we have found for *Eunice siciliensis* are those published by von Brand (1927: 688–691) as follows: dry matter, 31.19 per cent; ash, 2.94 per cent; and fat, 2.97 per cent.

PROCEDURE

Sample Analyzed

The sample of palolo analyzed was obtained by Mr. Harold Gatty on November 30, 1953, in the Fiji Islands. Immediately after it was collected it was placed in a refrigerator on his launch and taken to Suva where it was quick-frozen a little less than 24 hours after it was gathered. The day that a Pan American plane was due from the Antipodes on its way to Honolulu, a thermos jug containing the frozen palolo was flown in one of Mr. Gatty's planes from Suva to Nandy. At Nandy, it was kept in a refrigerator until placed on the Pan American plane (via Canton to Honolulu) and in less than 20 hours it was in our own freezer.

Analytical Methods

The methods used for the determination of

the approximate composition, minerals, and vitamins of palolo were the same as those previously outlined for pandanus (Miller, Murai, and Pen, 1956: 9).

RESULTS AND DISCUSSION

The composition of palolo is given in Table 1 along with a familiar protein food, raw beef round, for purposes of comparison. Although primitive people with a limited food supply usually make good use of all foods available, the enthusiasm of the Samoans and Fijians for palolo seems justified, as the analyses prove it to be a food of high nutritive value.

Palolo has 15 per cent of protein compared with about 20 per cent in beef; and the fat content is about half that of beef. Palolo has three times more calcium, about twice as much phosphorus, and about the same quantity of iron as beef. Beef would furnish no vitamin A or carotene, but palolo is an excellent source, having a greater vitamin A value than whole eggs. The thiamine content of both foods is low. Palolo has almost four times as much riboflavin as beef, but beef has almost four times as much niacin as palolo. Sufficient material was not available and we were not prepared to make analyses for additional vitamins or for amino acids.

TABLE 1
COMPOSITION OF PALOLO COMPARED WITH BEEF, PER 100 GRAMS

	PALOLO (raw)	BEEF (raw round)
Water, per cent	76.2	69.0
Protein, gm	15.1	19.5
Fat, gm	4.9	11.0
Crude fiber, gm	0.78	0
Ash, gm	2.42	1.0
Calcium, mg	37	11
Phosphorus, mg	310	180
Iron, mg	2.9	2.9
Vitamin A, I.U.	514	0
Carotene, mcg	1,350	0
Thiamine, mg	0.07	0.08
Riboflavin, mg	0.59	0.17
Niacin, mg	1.3	4.7
Ascorbic acid, mg	1.6	0

The palolo are eaten in the raw state just as they take them from the ocean; they are also eaten in the cooked state, and after cooking, they may be sun-dried to preserve them for future use. In Samoa the palolo are wrapped in leaves and cooked in the native oven of hot stones, often with coconut cream.

Mr. Gatty thought that palolo made the finest soup he had ever tasted and considered it warranted commercial exploitation as an Epicurean food. It is said to have a very delicious flavor, something like a cross between oyster and lobster, but superior to either.

Since palolo is a good protein food, rich in vitamin A, riboflavin, phosphorus, and iron, it seems unfortunate that it cannot be utilized to better advantage in the areas where it swarms. Because of the extremely short period when it can be gathered, the problem of reaping this nutritious harvest of the sea in any quantity will probably always remain a difficult one.

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