

## **Women's Fishing on Kosrae: A Description of Past and Present Methods**

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**Abstract**—Women's fishing and women's knowledge of marine ecosystems has been given scant attention in the literature. The few studies that do exist indicate that women's fishing provides a consistent and stable form of protein for subsistence. In the early part of this century, women's net fishing on Kosrae was a highly developed and varied activity that included specialized gear and techniques. Women's fishing remains an important activity on Kosrae although only a few individuals still practice traditional fishing methods. This paper reviews past and present forms of women's fishing practices on Kosrae and examines the social and technological changes in women's fishing over the last century.

### **Introduction**

A number of studies have addressed human interaction with and use of tropical marine ecosystems (Alkire 1968, 1978, Nietschmann 1973, Nietschmann & Nietschmann 1981, 1985, McCoy 1974, Klee 1976, Bayliss-Smith 1977, Johannes 1978, 1981). Most research, however, has focused primarily on the fishing lore and subsistence fishing practices of men with little or no attention to the role and importance of fisherwomen. Women generally do not participate in "sea" fishing, focusing instead on shallow reef flats, lagoons, or mangrove channels. These areas yield significant and dependable harvests. Nietschmann (1985) found that "women bring in the most fish and are the most consistent fishers" of Maubuiag Island in Torres Strait. In the southern Lau islands of Fiji, Thompson (1940) wrote that "women catch most of the daily supply of fish in nets. Only when fishing becomes a sport, as in spearing, do men participate." Alkire (1977) reported that women throughout central Micronesia are known to fish on the reef using handnets and baskets. Severance (1976:123), writing on the difference between men and women's fishing on Chuuk, stated, "Women's techniques appear to have traditionally provided the bulk of the total production and are generally reliable since they utilize a variety of reef species on the reef flats." Hill (1977) found that approximately 32% of the total fish catch in an American Samoan community came from women's efforts. In south Tarawa, Kiribati, women contribute 20% of the total fish catch (Schoeffel 1985) and 25-50% in

some areas of Papua New Guinea (Haines 1982). These studies indicate that women's fishing differs from men's in that it provides a household with a regular supply of protein, which is especially important when inclement weather makes it either difficult or dangerous for men to fish beyond the reef. Because many Oceanian women are in daily contact with the marine environment, they possess considerable knowledge of marine ecosystems; nonetheless, little research has been conducted to document this knowledge.

On the island of Kosrae, fishing historically has been the domain of women; Kosraean men traditionally have been more involved in agricultural activities and canoe building. In 1989, I spent two months (June and July) interviewing and fishing with Kosraean women studying their fishing practices and knowledge of the inshore environment. This paper will discuss the evolution of women's fishing on Kosrae by describing past and present fishing techniques and examining the technological and social changes in Kosraean women's fishing over the last century.

## Kosraean Environment and Society

### PHYSICAL ENVIRONMENT

Kosrae (formerly Kusaie) is the easternmost island in the Caroline archipelago (Fig. 1), lying mid-way between Pohnpei and the southern Marshall Islands. Kosrae is a high island of 109 km<sup>2</sup> (42 sq mi) surrounded by a narrow fringing reef (Fig. 2). The rugged interior, dominated by sharp peaks and deeply incised valleys and gorges, is densely vegetated with native upland rainforest (Maxwell 1982). The coastal area is low-lying, consisting mainly of mangrove forests and sand beaches. Situated within the equatorial countercurrent, Kosrae experiences northeast trade winds from December to April and southeast trades from July to October. Kosrae receives between 4,670–6,470 mm (184–255 in) of rain per year, the most of any island in the Caroline archipelago. Temperatures and relative humidity range from 25 to 30 C and 80 to 90% respectively (U.S. Weather Bureau 1963–1972, U.S. Army Corps of Engineers 1989).

### SOCIAL ENVIRONMENT

The first known European contact with Kosraeans occurred in 1824 when the French scientific ship *Coquille* anchored for 10 days in what is now called Okat Harbor. After the stay of the *Coquille*, Kosrae became a supply stop for whalers and sailors. During this period (1830–1880) epidemics of influenza and venereal disease swept the island and the population plummeted from 6,000 to 200 individuals (Ritter & Ritter 1981). Concurrently, Kosrae was invaded by a wave of missionaries who managed to destroy nearly all that remained of the traditional culture. Between 1880 and 1976, Kosrae was under the influence of three different colonial powers: Germany, Japan, and the United States. During this period, the population increased from a low of 200 to a current number of nearly 7,000, half of which is under the age of 18 (Federated States of Micronesia 1989). In 1978 Kosrae joined Pohnpei, Chuuk and Yap to become the Federated

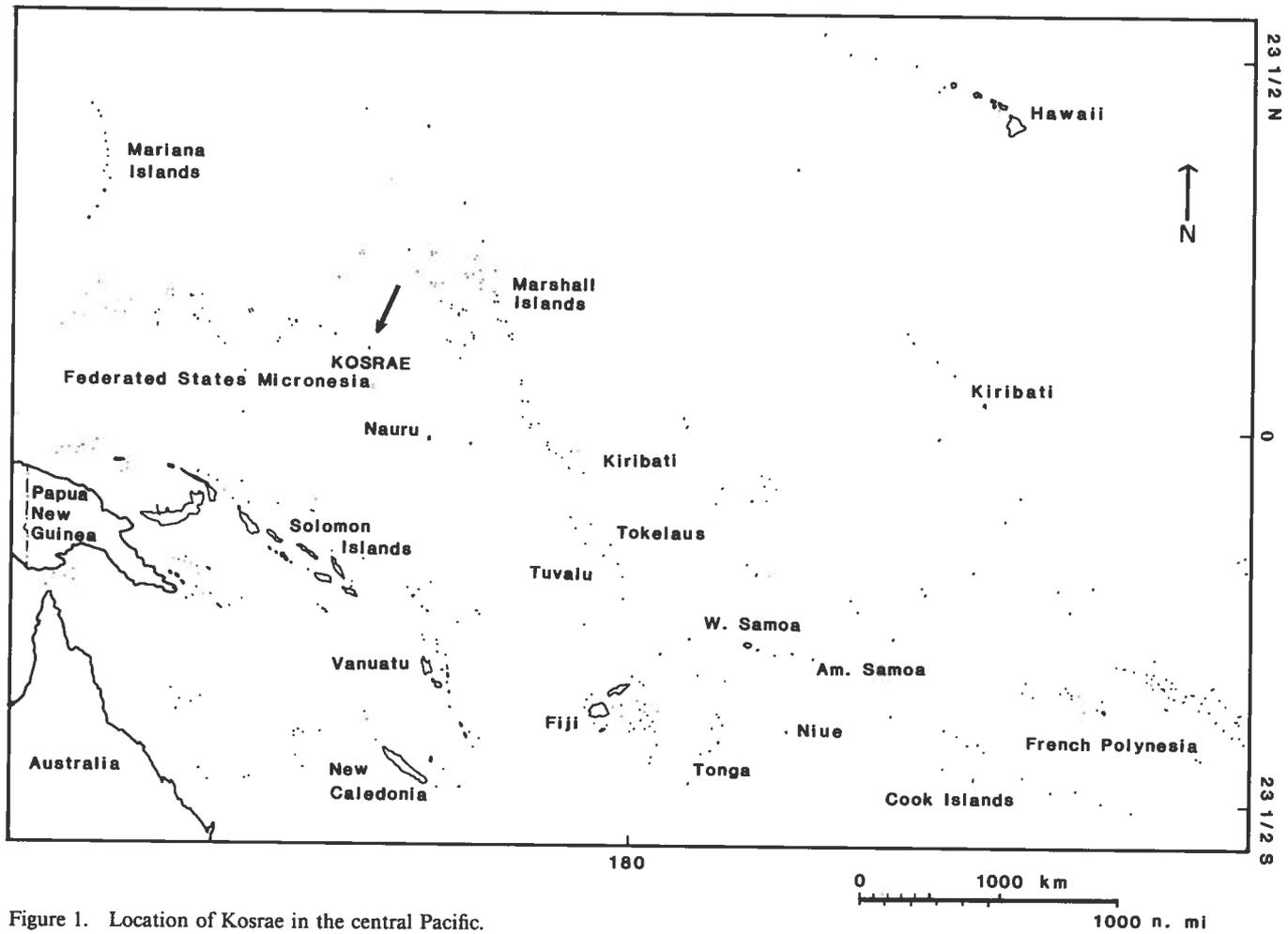


Figure 1. Location of Kosrae in the central Pacific.

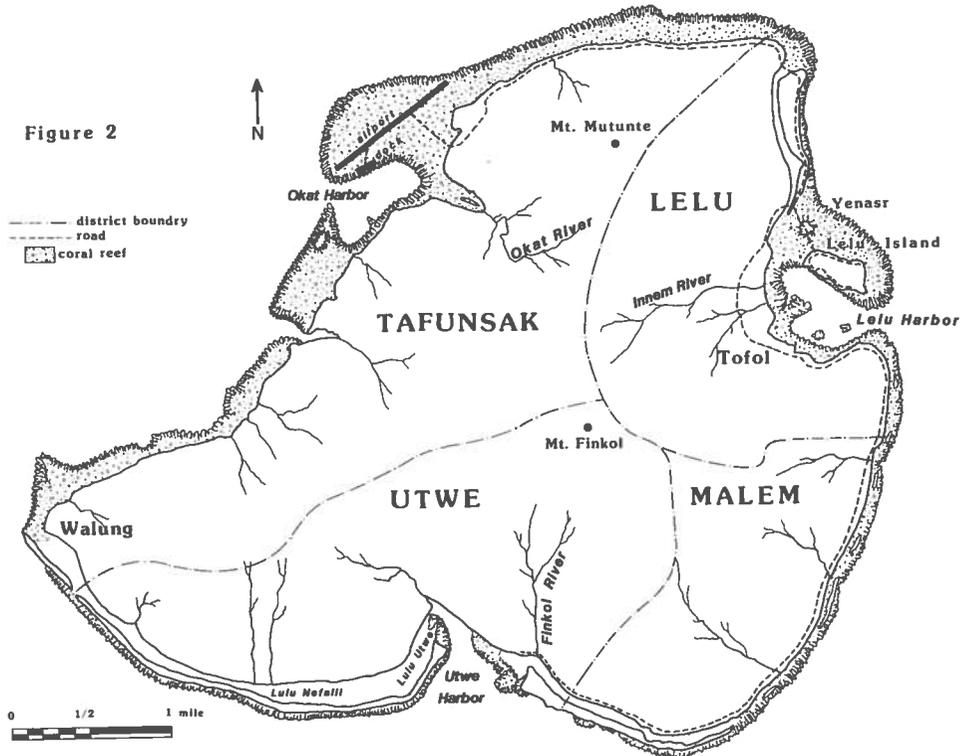


Figure 2. Map of Kosrae.

States of Micronesia. Kosrae State consists of four municipalities: Utwe, Malem, Tafunsak, and Lelu, the government seat.

The church presently plays an important role in Kosraean society, and many of the rigid moral standards set by the first missionary to Kosrae still persist. On Sundays, most Kosraeans spend the better part of the day in church; activities such as cooking and fishing are prohibited on the Sabbath.

Although more Kosraeans are in wage-earning jobs, agriculture and fishing continue to provide the primary means of subsistence. Fishing in particular provides a dependable supply of protein. With the exception of throw-netting and spearfishing, which are men's fishing activities, all inshore fishing is done by women.

### Women's Fishing on Kosrae—Past and Present

The primary sources of information about pre-contact fishing practices are the written accounts of early explorers and naturalists who visited the island (Table 1). It should be kept in mind that the focus of these accounts was the botany, geology, and material culture of Kosrae and not the subsistence fishing

Table 1. Comparison of past and present fishing methods.

Observer	Fishing Method	Gear Used	No. of People	Where Used	When
Sarfert	<i>neklap</i>	<i>nek musra</i>	100 women	reef	day/high tide
	<i>sul</i>	<i>nek musra,</i> torch	large groups	reef	night/low tide
	<i>matan eot</i>	<i>nek musra</i> women	2-3	reef	night/low tide
	<i>moko</i> <i>taptap</i> <i>ta</i>	<i>nek moko</i> <i>nek pukok</i> stone walls, <i>nek musra</i>	large groups large groups large groups	reef beach reef	night/low tide night/full moon night/low tide
Wilson	<i>neklap</i>	<i>nek musra</i>	9-100 women	reef	day/falling tide
	<i>taptap in neklap</i>	<i>nek musra</i>	9-100 women	along shore	day/peak high tide
	<i>eelael*</i>	<i>nek musra</i>	3-10 women	reef	night/until moonrise
	<i>moko</i>	<i>nek moko</i>	1-2 women	reef	night/low tide
	<i>patirtir*</i>	<i>nek moko, op</i>	1-2 women	reef	day/low tide
	<i>punkunse*</i>	<i>nek moko op</i>	2-5 women	reef	day/neap tide
	<i>meku*</i> <i>tu*</i>	<i>nek moko</i> <i>nek moko</i>	1-5 women 1-2 women	reef <i>mutun eka</i>	late afternoon/rising tide morning/high to low tide

Table 1. Continued.

Observer	Fishing Method	Gear Used	No. of People	Where Used	When
Wilson	<i>ta</i>	<i>nek musra, ta</i> (stone fish weirs)	1-2 women	shallow edge of reef	night/falling tide
	<i>pukok*</i>	<i>nek pukok</i>	24-60 men & women	shallow areas	day/falling tide; rising tide; high tide
	<i>taptap* in pukok</i>	<i>nek pukok</i>	24-60 women	"side of the land"	day/high tide
	<i>ka*</i>	<i>ka</i>	3-5 men & women	shallows	day/falling tide, rising tide
	<i>kamile*</i>	<i>kan op, nek musra</i>	100 men, women	"specific places"	day/falling tide
	<i>kaluk*</i>	<i>nek kaluk, torches</i>	30 men & women	ocean near Utwe	night/March-August
	<i>op</i>	<i>nek musra, nek moko, op</i>	30 men & women	mangrove, channel	day/low tide
Des Rochers	<i>koa</i> (gill-netting)	gillnet	3-5 women	mangrove channel, sea-grass beds, reef edge	day/low tide
	<i>kosr</i>	gillnet	2-3 women	mangrove channel, sea-grass beds, reef edge	night/falling tide
	<i>moko</i>	<i>nek moko</i>	1-3 women	reef flat, seagrass	night/full moon, low tide

Table 1. Continued.

Observer	Fishing Method	Gear Used	No. of People	Where Used	When
Des Rochers	<i>tuptup</i>	<i>nek moko</i>	1-3 women	reef flat, seagrass beds	day/low tide
	<i>op</i>	<i>Derris</i> roots, gillnet	1-3 women	mangrove channel, reef edge, deep areas in reef	day/low tide
	<i>op sra</i>	<i>Callicarpa candicans</i>	1-2 women	deep holes in reef	day/low tide
	<i>aya</i> (handlining)	15-20 ft. monofilament line	1-2 women & children	deep areas in reef, harbor, reef edge	day/low tide
	<i>ti powa</i> (crabbing)	by hand	1-3 women	mangroves	day/high tide
	<i>fut popol</i> (clamming)	by foot	1-3 women	mangrove channel near Utwe	day/low to mid tide
	<i>sru koet</i>	metal hook	1-2 women	reef flat	day/low tide
	<i>sul</i>	machete, flashlight, kerosene lamp	1-2 women	reef flat	night/new moon, low tide
	reef gleaning	by hand, basket	1-2 women	reef flat	day/low tide

\* These methods are no longer practiced and were reported only by Wilson. For further details on these methods see Wilson (1968).

practices of the islanders. Fyedor Lutke, commander of the Russian exploratory vessel *Senjavin*, made the following observations on Kosraean fishing in 1827:

“ . . . [fishing] is almost exclusively reserved for the women; we saw, at least, very few men engaged in it. They have nets made from coconut cord, with floats very similar to ours, and long nets, four feet by two, spread with sticks with which they lift the fish from the water. They pierce the big fish with little wooden picks; they also have for this a little instrument composed of three fish teeth, which they tightly attach to the end of a handle. They do not have lines because they never go fishing out to sea; all their fishing is done inside the reef. They have erected in several places, on the shallows, stone dikes which form reservoirs where the fish enter when the tide is high and in which, when it goes down, they find themselves trapped and can thus easily be caught” (Ritter & Ritter 1981:128).

Friedrich Kittlitz, senior naturalist aboard the *Senjavin*, noted the following: “Numerous fish of awe inspiring diversity were in motion around these stems of stone plants [corals]; but for want of tools and practice, we were not in the position ourselves to catch them and obtained them only from the natives, who attended to the fishing with the ebb tide. We especially saw the females, sometimes in large groups, engaged in it almost daily. They especially made use of hand nets with arched frames. Only occasionally were the women, whose task it was especially to catch the beautiful, non-social coral fish, accompanied by men” (Ritter & Ritter 1981:172).

According to another account, “ . . . deepsea fishing has apparently never been of special significance . . . the Kosraeans applied themselves all the more to reef fishery, which was in its heyday since time immemorial, and is pursued with virtually all the fishing methods commonly practiced in Oceania. In particular, the lucrative net fishery has developed in many and varied forms” (Sarfert 1919:101).

The German ethnographer Ernst Sarfert suggested that Kosraean women were able to participate extensively in the net fishery because of its simple gear and skill requirements. A more likely reason for women’s extensive involvement in near-shore fishing is that it is easily combined with childcare responsibilities. It is a common sight in Kosrae and elsewhere in Oceania to see women net fishing and reef gleaning accompanied by small children.

#### NET FISHING

Historically, traditional net fishing has been a highly developed and varied activity on Kosrae. During the early part of this century, nine different types of fishing nets were reportedly in use (Sarfert 1919). Each was designed for a specific fishing technique, marine habitat (i.e., reef flat, mangrove channel, or outer reef), tide (high or low), and number of individuals. Of these, two were specifically used by women: the *nek musra* and the *nek moko*, both of which were used in pairs. The *nek musra*, “the everyday handnet of women,” was approximately six feet long and traditionally made from hibiscus fiber (*Hibiscus tiliaceous*). The nets were attached to two pieces of *fienkek* (*Premna obtusifolia*), a salt-tolerant shrub commonly found near the shore. One piece was long and curved and the

other T-shaped with the edge of the net attached to it. The two pieces were lashed together with twisted lengths of hibiscus fiber. The net arched upwards slightly and lay slack on the wooden frames, forming a pocket which held the fish. Similar nets have been used throughout Micronesia and Polynesia (Thompson 1940, Severance 1976, Alkire 1977, Falanruw 1987).

### *Neklap*

Individual fisherwomen used pairs of *nek musra* to practice *neklap*, a popular form of women's fishing. *Neklap* (named after the reef heron, *Egrata sacra*) was undoubtedly the fishing activity that the crew aboard the *Senjavin* noted in 1827. *Neklap* continued to be a popular form of net fishing up until the late 1960s.

As many as 100 women participated in *neklap* at any one time. One woman, designated as "captain," led the others to a particular spot, directing them where to set their nets. The women would form a large circle and then move towards the center, closing it by breaking off into several smaller circles until the fish ran into the nets. Each woman carried a fish basket (*foto in patur*) made from palm leaves tied around her waist.

*Neklap* required not only a large number of women, but also much coordination and cooperation. Although *neklap* reportedly has been practiced during high tide, many of the older women interviewed said the best time was mid-tide. The fish caught by *neklap* include mullet, parrotfish, and surgeonfish.

Today *neklap* is no longer practiced, although many older women can vividly describe this method, taught to them by their mother or grandmother. Younger fisherwomen generally have heard of *neklap* but do not possess sufficient knowledge of either the technique or the steps involved in making the nets in order to practice it.

Three other forms of net fishing—*matan eot*, *sul*, and *ta*—reportedly made use of the *nek musra* in the earlier part of this century. Little is known about *matan eot*; Sarfert (1919) reported that two or three women would block off the reef channels at night using a stick to drive the fish into the nets of other fisherwomen. Sarfert described *sul* as a kind of night fishing in which "One takes the fish by surprise as they sleep, surrounds them, then wakens them and drives them into the net." *Sul* continues to be a popular method of night fishing although it is a different activity today from that which was first reported (*sul* will be discussed in further detail under Miscellaneous Fishing and Invertebrate Collecting). *Ta* made use of stone fish weirs in conjunction with the *nek musra* and was intended for catching nocturnal species of fish. Rocks and coral were piled up to form a series of "V"s whose wide ends were positioned in such a way that when the tide was either rising or falling the fish were forced to enter at these ends and exit through the smaller ends where they were netted with the *nek musra*. Although *ta* was commonly practiced as late as the 1960s (and possibly into the 1970s), this method of fishing was not observed by the author.

### *Tuptup*

Two distinct forms of *tuptup* fishing (also spelled *taptap*) are known to have existed. *Tuptup* in the early 1900s made use of the *pukok* net (commonly used

by men) and was practiced at night by a large number of men and women. *Tuptup*, which means "to hold the net in such a way that the fish leap into it," was described as follows by Sarfert: "On the two nights of full moon, lofsen and olman, the sand crabs of the ein variety swarm on the beach in order to spawn at high tide; for this reason, these nights are also called fon in ein. The kerat fish, which is half as long as an arm, and which has a yellow tail, likes to eat the spawn. For this reason the fish at this time come close to the beach in great numbers. Men and women then set out, and holding the pukok nets on the water, swim or walk in a long, unbroken line to the shore. The fish try to escape by leaping over the chain of people, and in so doing, fall into the nets. In this manner, the beach is cleared of fish stretch by stretch."

*Tuptup* in the 1960s was practiced during the day with the *nek musra* and was reported to have involved only women. Today *tuptup* refers to a type of women's fishing which uses the same technique and gear as *moko* (see below) and differs only in that it is practiced during the day.

#### *Moko*

The *nek moko* was the other commonly used traditional women's hand net and of the same basic design as the *nek musra* but approximately half its size (Fig. 3). *Moko* is the primary method for which these nets are used and requires only one woman and a pair of handnets. It is practiced at low tide during a full moon. The nets are placed in a "V" around a loose coral head or rock which is

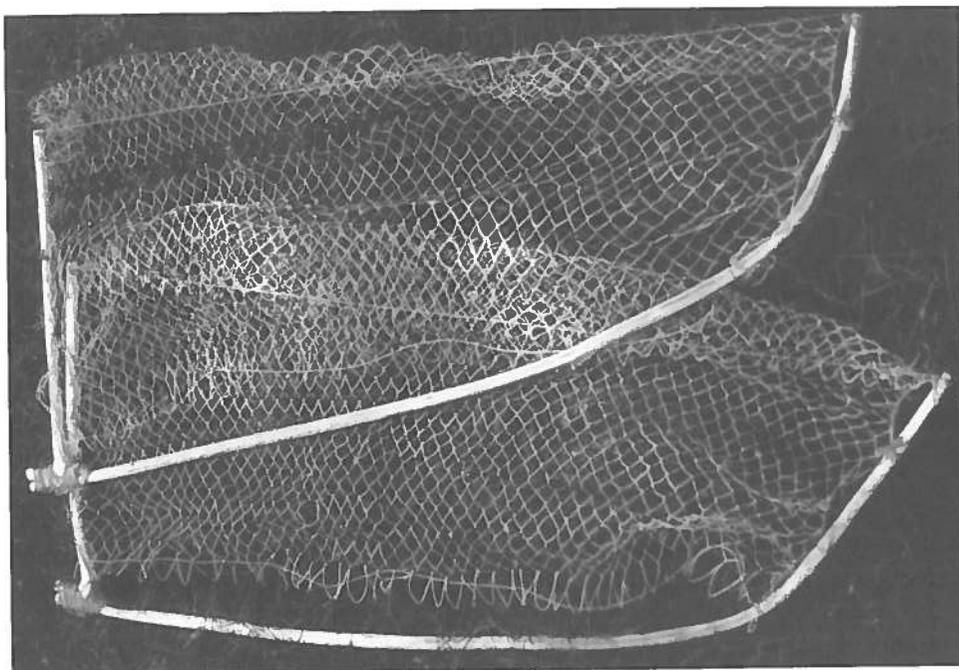


Figure 3. *Nek moko*—traditional hand net made from hibiscus fiber.

then turned over to scare the fish out from underneath and into the nets. Today several women still practice *moko* but their nets have been modified in order to take advantage of new technology and materials. The frames are still made from *fienkek* but the net has been replaced with a section of discarded monofilament gill net. This has the advantage of being stronger, more durable, and less visible to fish than the traditional hibiscus net. Fish caught by this method include groupers (*kalsrik*), parrotfish (*mesrik*), surgeonfish (*lasrfof*), rabbitfish (*mweosra*) and mullet (*ac*) (Table 2).

#### POISON FISHING

Poison fishing with *op* was once practiced in conjunction with the *nek musra* and the *nek moko*. The roots of *Derris* sp., which grow mainly in areas of swamp forest, is gathered and placed in a small bundle, 18 to 24 inches long. The bundle is pulverized to release a milky sap and then fanned near a rock or coral head. The sap drugs the fish, which then are caught either with a gill net or which float to the surface to be picked up by hand and placed into a basket. The women repeat the same procedure at various locations along the beach. Formerly, the roots were actually placed under the rock and left for a period of time rather than being fanned underneath it. Perhaps women have since learned the serious effects of poisoning with *op* (which include the killing of larvae and untargeted species of fish) and are less liberal with its use. According to Eldredge (1987), the active ingredient in the root of *Derris* is rotenone, a respiratory inhibitor which kills the fish by depriving oxygen exchange. Rotenone drugs most species of fish although many aquatic invertebrates appear to be unaffected by it.

During the 1960s, it was reported that approximately 30 or more men and women cooperated in poison fishing. The author observed only women poison fishing and never more than three women at a time.

The use of *op bosbos* (made from the fruit of *Barringtonia* sp.) was reported by Sarfert but was not observed by Wilson in the 1960s nor by the author in 1989. *Op sra*, a poison not noted by Sarfert, appears to have taken its place.<sup>1</sup> *Op sra* is made from the leaves of *Callicarpa candicans* and is considered to be the most potent form of naturally occurring fish poison on Kosrae. *Op sra* kills both small and large fish as well as other marine organisms and consequently has been banned in Kosrae State. The leaves of *C. candicans* are crushed and mixed with sand before being thrown into a channel or deep hole in the reef during low tide (the author never observed poison fishing with *op sra* and many of the women interviewed were hesitant to discuss its use). As with *op*, once the fish are drugged, they are gathered by hand or with the aid of a net. Consuming fish poisoned by either *op* or *op sra* has no ill effects, and one cannot taste the difference. The use of explosives such as dynamite to kill fish has not occurred on Kosrae as it has on several other islands in Micronesia. Pesticides and other household chemicals

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<sup>1</sup> *Op* and *op sra* are not distinguished by Sarfert as being either a men's or women's fishing activity. I assume, however, that they were primarily used by women because they were employed in shallow reef waters.

Table 2. Fish and other marine organisms collected by Kosraean fisherwomen.

Kosraean Name	English Name	Scientific Name
<i>kaput</i>	surgeonfish (general)	Acanthuridae
<i>lasrfol</i>	convict tang	<i>Acanthurus triostegus</i>
<i>kwi</i>	lined-surgeonfish	<i>A. lineatus</i>
<i>palpal rangrang</i>	yellow tang	<i>Zebrasoma flavescens</i>
<i>kalsrik</i>	groupers	Serranidae
<i>mulap</i>	rabbitfish	Siganidae
<i>nuesron</i>	"	"
<i>ollol</i>	squirrelfish	Holodentridae
<i>srol</i>	cardinalfish	Apogonidae
<i>ariaf</i>	butterflyfish	Chaetodontidae
<i>alsru</i>	wrasse	Labridae
<i>foul</i>	triggerfish	Balistidae
<i>mwesrik</i>	parrotfish	Scaridae
<i>won</i>	rudderfish	Kyphosidae
<i>srinkap</i>	emperorfish	Lethrinidae
<i>kuraf</i>	milkfish	<i>Chanos chanos</i>
<i>polyah</i>	"	"
<i>ac</i>	mullet	Mugilidae
<i>apel</i>	goatfish (juvenile)	Mullidae
<i>fufut</i>	goatfish (adult)	Mullidae
<i>mokol</i>	flying fish	<i>Cypselurus</i> spp.
<i>ik sok</i>	"	"
<i>srihnac</i>	snapper	Lutjanidae
<i>ku</i>	"	"
<i>lalot</i>	jack	Carangidae
<i>srapsrap</i>	"	"
<i>semis</i>	salt water eel	<i>Echidna nebulosa</i>
<i>koet</i>	octopus	Cephalopoda
<i>powa</i>	mangrove crab	<i>Scylla serrata</i>
<i>aie</i>	coconut crab	<i>Birgus latro</i>
<i>aieng</i>	land crab	<i>Cardisoma</i> spp.
<i>wurur</i>	sea cucumber	<i>Stichopus variegatus</i>
<i>el</i>	sea urchin	Echinoidea
<i>lut</i>	anemone	Cnidaria
<i>kuku</i>	jellyfish	Cephalopoda
<i>netula</i>	giant clam	<i>Tridacna gigas</i>
<i>takasungai</i>	trochus	<i>Trochus niloticus</i>
<i>kawang</i>	cat eye	<i>Turbo argyrostoma</i>
<i>kufal</i>	nerite	<i>Nerita</i> spp.
<i>punak</i>	—	<i>Asaphis violescens</i>
<i>wal</i>	—	<i>Strombus gibberulus</i>
<i>popol</i>	mangrove clam	<i>Anodontia edentula</i>

are not commonly used although a few people interviewed mentioned that bleach is occasionally used in certain areas of the island.

### Present-Day Net Fishing

Gillnetting (*koa*) is the most common type of net fishing technique used today. Introduced during the 1960s, gillnetting is presently the second-most productive fishing method in Kosrae State, accounting for over twenty-four percent of the total catch (Kosrae State Marine Resources Division 1987). Most monofilament gill nets average 100 feet in length, three feet in depth, and have a mesh size of one to two inches.

Gillnetting, which is generally practiced at high tide, requires two to three individuals (Figure 4). Two women take hold of opposite ends of the net and set it across a reef flat, channel, or embayment. A third woman walks towards the net driving the fish by kicking and slapping the water. Fish caught on the reef flat and in the mangrove channels by this method include parrotfish (*mwesrik*), rudderfish (*won*), goatfish (*fufut*), groupers (*kalsrik*), emperors (*srinkap*), surgeonfish (*kwi*, *lasrfol*, *palpal*), and mullet (*ac*, *apel*). Most women gillnet for two to four hours, resetting the net in a slightly different location after each catch.

#### KOSR

*Kosr* was not reported by Sarfert or Wilson but appears to be a new technique developed since the advent of the gill net. In *kosr*, the gill net is laid just before



Figure 4. Kosraean fisherwomen gillnetting near Utwe.

the tide falls so that the fish become trapped as they swim to deeper water. The net is often left in one spot overnight and retrieved the next day at low tide making it possible to net nocturnal species of fish (e.g., squirrelfish). *Kosr* requires only two women and a gill net and has superceded the aforementioned traditional technique of *ta*, which was more labor intensive and time consuming.

#### GILLNET EFFICIENCY

The quantity of fish caught by any method depends on the tide, the phase of the moon, and with whom one talks. Many of the women interviewed said a typical catch using a gill net ranged from 10 to 30 pounds while others claimed to be able to catch up to 100 pounds in the same period of time. The Kosrae Marine Resources Office reports an average of 1.6 kg of fish are caught per person hour using a gillnet (Kosrae State Marine Resources Division 1987). This figure, multiplied by four hours and converted to pounds gives 14 pounds per person per trip, a figure well within what was observed by the author.

On Kosrae, the introduction of the gill net has dramatically improved fishing efficiency. Small groups of women are now able to catch a greater number of fish in considerably less time than was previously possible using the traditional hand nets. The introduction of the gill net has led to a complete abandonment of group fishing activities such as *neklap*, thereby changing the social structure of women's fishing. Traditionally, groups of women cooperated in the capture of fish. Now, however, only three to five women, often from a single household or extended family, tend to fish together. In addition, women in Kosrae have recently begun to sell a portion of their catch to local markets. The proportion sold from each catch varies from woman to woman or, perhaps more accurately, from household to household according to their cash needs. The women who sell a portion of their harvest estimate they sell approximately 10% of their catch to local stores. A very small number of women report that the primary purpose of their fishing is to supplement the earnings of others within their household (in 1989, women earned US \$0.65 per pound of fish). Although not all fisherwomen sell part of their catch, it appears that women's fishing is changing from an activity that was once purely subsistence-oriented to one of wage-earning.

No study to date has examined the cultural and ecological impacts of the gill net on Kosrae's reef fishery. It is obvious, however, that without strict monitoring and regulation, new fishing technologies such as the monofilament gill net will result in increased pressure on marine resources. According to a survey conducted by the Marine Resources Management Division (MRMD) in Yap (Price 1988), the greatest proportion of fish caught by gill nets were in the immature and young stages of development. The Yap MRMD suggested that the use of small mesh sizes (i.e. 1-2½" inches) be discouraged in order to allow juvenile fish to reach maturity and thus spawn before their capture. A parallel situation exists on Kosrae, where most women use gill nets with mesh sizes of one to two inches. On many occasions the author witnessed the capture of fish as small as three inches long. When asked why the fish were not thrown back to mature, the women stated that the smaller fish, particularly *Acanthurus triostegus*

and *Mulloidichthys* spp., were considered a delicacy among Kosraeans. It is clear, however, that the capture of fish before they reach maturity will have serious adverse impacts on future fish yields.

### Miscellaneous Fishing and Invertebrate Collecting

#### HANDLINING, AYA

Handlining is practiced using a small steel hook attached to 15 to 20 feet of monofilament line. The line is secured to and wrapped around an aluminum beverage can or plastic bleach bottle. The intestines of the sea cucumber, *Stichopus variegatus*, are generally used for bait although pieces of cut up fish are also used. In Lelu, nearly all handlining takes place in the harbor and in several of the reef holes accessible from the causeway. Women handline for both fish and crabs. Several women stated that carnivorous fish are generally caught by handlining, whereas herbivorous fish are caught primarily with the *nek musra* or gillnet. This is to be expected: *musra* nets are used predominantly on the shallow reef flats where most herbivorous fish are found feeding on algae; handlining is done in deeper water, often in reef holes where the larger carnivorous fish (e.g. jacks, squirrelfish) tend to be found.

During the early 1960s, Wilson (1968) described *aya* as a men's fishing activity in which "only the largest Kusaian canoes or whaleboats are used. This type of fishing is increasing in popularity except inside the reef." In contrast, in 1989 the only place the author observed this fishing technique was inside the reef or at the front edge of the reef. Additionally, handlining is now an activity primarily engaged in by women and children.

#### SUL

Sarfert wrote that *sul*, a type of night fishing, was practiced during a low tide and required the use of the *nek musra*. Wilson (1968) later reported that *sul* was a type of men's fishing. As observed by the author, however, *sul* is practiced at night during a new moon by both men and women (generally only one or two) using a machete and a flashlight or kerosene lamp (traditionally, a coconut frond torch was used as a light). During low tide, small rocks or loose coral boulders on the reef flats are overturned in order to scare out small surgeonfish, squirrelfish, goatfish and eel (*semis*). Mangrove crabs (*powa*) are also caught by this method. The fish and crabs are killed by a swift and well aimed blow of the machete.

#### MANGROVE CRABBING, TI POWA

Peoples (1970) reported that mangrove crabs were not a particularly valued food on Kosrae and were being consumed in decreasing quantities due to the increased consumption of canned fish and meats. The author's observations in 1989, however, suggest that crabs now are a highly prized food item that have also become an important source of supplementary income for many households.

The area in and around Utwe (Figure 2) is an important habitat for the mangrove crab, *Scylla serrata*. Crabs are caught by *sul*, handlining, or by hand

during periods of low tide and full moon. They are particularly sought between the months of April and July, the period in which they spawn.

#### MANGROVE CLAMMING, *FUT POPOL*

Mangrove clams, or *popol* (*Anodontia edentula*), are found in the brackish water areas associated with mangroves between Lulu Nefalil and Lulu Utwe, near Utwe village. In *fut popol* women search the black mangrove mud with their feet while standing in water that is up to their shoulders or neck. Some women stated that they can collect up to 50 clams in one hour while several elders claimed that in their time they could collect hundreds of them. Several women felt that the time of the month (i.e. phase of the moon) made no difference on the harvesting of *popol*; traditionally, the "season" for *popol* is when breadfruit begins to ripen. There are over 15 species of breadfruit on Kosrae, however, and not all species bear fruit at the same time, so that breadfruit can be found at any time of the year. It is possible that the correlation between ripe breadfruit and the season for *popol* originated when there were only a few species of breadfruit found on the island. Wilson (1968) noted that of the 15 types of breadfruit recognized by Kosraeans, one is called *popool*; the *popol* clam may be a slightly different spelling of *popool*. The clams, which have a slightly egglike taste are eaten raw with lime juice.

#### OCTOPUS FISHING, *SRU KOET*

Jabbing a hooked piece of metal or wire into small holes, women occasionally comb the reef flats during low tide in search of octopus, *koet*. Experienced fisherwomen are able to detect *koet* holes by the pile of small stones and sand built up in front of them. Once caught, the octopus is killed by biting the area between the eyes. Before metal hooks came into use, the hanging hypocotyl from the mangrove tree was used. A Lelu woman, who claims her Pohnpeian mother introduced octopus fishing to Kosrae in the 1920s, reported that the best time for *sru koet* is during the months of May, June, and July. This same woman catches up to 20 octopus in one day, often selling part of her catch for \$1/lb. In addition to being a food item *koet* is used for bait.

#### EEL FISHING, *SRU SEMIS*

The author observed a second technique for catching eel in addition to the primary method of *sul* (discussed above). *Sru semis* uses a dried narrow length of *Pandanus* frond with a nail (or hook) attached to one end of it. A piece of fish is placed on the nail and the frond is set in several inches of water on the reef flat. The frond is anchored with a rock so that the baited end floats free. As the eel approaches the bait it is killed with a machete. Although eel is presently a fairly common food in Kosrae, it was once considered tabu and not eaten. Formerly, it was believed that if one killed an eel it would come and sleep with the person, causing illness and eventually death (Sarfert 1919).

#### MISCELLANEOUS SHELLFISH AND INVERTEBRATES

In addition to finfish, crabs, octopus and eel, a variety of shellfish and other invertebrates are also collected on the reef flats by women and children. These include sea urchin (*el*), sea anemone (*lut*), sea cucumber (*wuror*), clams (*punak*), and a variety of shells such as cowry (*kawak*) and nerite (*kufal*). These organisms are generally not sought after specifically, except for the small money cowry (*Cypraea moneta*) which is used in the making of handicrafts. In the past, *punak* (*Asaphis violescens*) shell was used as a scraper and as a weight for fishing nets. The collection of the shellfish trochus (*Trochus niloticus*) is forbidden except during certain "seasons" which are designated by the Kosrae Marine Resources Division.

#### Frequency of Fishing

If asked how often they fish, most fisherwomen will say, "it depends on the tide." According to the author's observations, three to four times a week is average, although the older women claim that when they were younger they fished six times a week (fishing was forbidden on Sundays as it is today). The author inquired whether they fished more, less, or with the same frequency as they did when they first began fishing. Most women felt they fished for the same number of days in a week as they did in the past; what had changed was the number of hours spent per fishing trip. Several women remarked that in order to catch the same number of fish today as they did 10 to 20 years ago, they had to fish for more hours during each trip. Several of the more successful fisherwomen stated that they knew of good fishing spots where they were always guaranteed a good catch and therefore found there was no difference in either the time spent fishing or the number of fish caught. Although women fish mainly for subsistence purposes, it is apparent that fishing is an enjoyable activity which enables them to get away from the more mundane household chores and to chat with friends.

Nearly all women interviewed stated that they began fishing between ages eight and thirteen and learned techniques and appropriate times from their mother or grandmother. Women who were over 45 years of age said *neklap* was the method of fishing they first learned, while younger women stated it was gillnetting.

#### Environmental Factors Which Affect Women's Fishing

##### TIDES

The most important environmental factor affecting women's fishing activities is the lunar tides, *ahlong* (Kosrae experiences semi-diurnal tides); the level of the tide determines the type of fishing technique which can be used. As an example, invertebrate collecting (reef gleaning) occurs on the shallow reef flats during periods of low tide (*mwes*). Gillnetting is commonly practiced within the mangrove channels and requires a mid or high tide, *ahlong*, to prevent the net from becoming snagged on the bottom. The speed with which the tide rises is

also of importance, as it determines the length of time a particular fishing technique may be used. A falling tide is called *mwesi*, and a particularly low tide (which would typically occur during a new or full moon, *malem*) is known as *mwes luhlap*. *Ahlongluhlap*, an exceptionally high tide, also occurs during a new or full moon.

In former times, the names for each night of the lunar month were known. The Kosraean fishing calendar assigned a specific name to each lunar date and included a description of the activities which were best suited for that day (see the lunar fishing calendar, Table 3). The various nights of the moon represent one example of the intimate knowledge Kosraeans once had of the habits and life cycles of marine organisms.

#### WEATHER

The weather is the second-most important environmental consideration in fishing. Kosrae has two seasons during the year. The months of September through February, *enganen*, are associated with strong easterly winds, high waves, and less frequent rain. *Muis*, which corresponds to the months of March through August, is a period of little wind and wave action but more frequent rainfall.

#### Conclusion

Women's fishing on Kosrae is not a static occupation that has remained unchanged for centuries. Instead, it has evolved in response to cultural, technological, and social changes within Kosraean society. The major changes that have occurred can be summarized as follows:

- 1) The many techniques and specialized gear of traditional net fishing have all but been replaced by the monofilament gill net. In the late 1960s and early 1970s, over 10 different net fishing techniques were in use on Kosrae. Twenty years later, only a handful of women are still practicing traditional fishing methods and even these women predominantly use the newer and more efficient gill net. Evidence indicates, however, that the increased efficiency of the gill net in combination with a rapidly expanding population will endanger Kosrae's fragile reef resources.

- 2) Fishing is changing from a strictly subsistence-oriented activity to one important for both subsistence and wage-earning. The fish catch from a single trip is still divided among the participants but a portion of the catch is likely to be sold for cash to a local retail store so that imported goods such as flour, sugar, tea, and even imported fish and meat may be purchased.

- 3) Group fishing activities have been abandoned in favor of gillnetting which is less time consuming and less labor intensive. As a result, there is less opportunity for the exchange of information regarding good fishing times and places, habitats of fish and other organisms, the importance of conserving and preserving certain species of fish, etc.

- 4) Modern Kosraean fisherwomen no longer possess the intricate and detailed marine environmental knowledge which was characteristic in their grandmothers'

Table 3. Lunar fishing calendar.

Kosraean Name	Description	English Equivalent
1. <i>maspang</i>	<i>fong in af</i>	new moon
2. <i>masulum</i>	<i>fong in af</i>	new moon
3. <i>musaan</i>	<i>fong in af</i>	new moon
4. <i>museit</i>	<i>sikyak mwo ke patur</i>	good day and night for fishing
5. <i>musaoal</i>	<i>koluk ke patur u a oalla</i>	not a good day for fishing
6. <i>latlato</i>	"	"
7. <i>matail</i>	<i>pal lun ngoe</i>	good day for catching turtle
8. <i>sriafong</i>	<i>koluk ke patur u (srensrenfong in kofu)</i>	not a good night for fishing. (phosphorescence in water)
9. <i>arfoko</i>	<i>areni ik in kais sie foko mweoa</i>	fish begin gathering according to species
10. <i>sukanpur</i>	<i>mwo ke pakpuk sukan lom u</i>	good day for gathering wood for house construction
11. <i>lafsan</i>	<i>fong in aeing se meet mwo ke patur (koa a neksisi)</i>	first night to catch crab, also good for fishing
12. <i>olwen</i>	<i>fong in aeing ak luo (2) oapana fong se meet an</i>	—
13. <i>fwakfong</i>	<i>mwo ke kain patur nu kewa</i>	good day for any kind of fishing
14. <i>mesr</i>	<i>len in yok (san) a kapak mwo mesrmesr na fako an</i>	good day to begin planting crops
15. <i>ell</i>	<i>siepa len in yok sra san an a ellalalik na e infok an</i>	"
16. <i>lulti</i>	<i>fong in ngunin losr se meet (mwo ke patur)</i>	good day for fishing
17. <i>kawula 1</i>	<i>mwo ke patur</i>	good day for fishing
18. <i>kawula 2</i>	"	"
19. <i>sopasr</i>	<i>ik u mutawauk in bia (akola nu ke srupup)</i>	fish have eggs and begin to make one school of one species
20. <i>apnuk</i>	<i>apun rauni inkofu suk iku in toeni in (srupup)</i>	each species of fish looking for their individual school
21. <i>sopasr</i>	<i>sessesla bien iku</i>	eggs are really full inside of fish
22. <i>oslun</i>	<i>iku osun</i>	all the various species of fish have grouped in their respective groups
23. <i>kusaf</i>	<i>safla forfor lun iku</i>	no more fish roaming about searching for their specific group
24. <i>sunak</i>	<i>iku sunakin in tiya lieyuk ku sruo</i>	fish are trying to hide from people catching them
25. <i>sroanpur</i>	<i>iku fwasr wukwuk sroan saku</i>	fish hiding underneath branches hanging over the water's edge
26. <i>eirpi</i>	<i>pal in u fwasr in som sista bia insialos an</i>	time for fish to release their eggs
27. <i>ii</i>	<i>illa nu meoa</i>	fish return to the sea or deeper water
28. <i>srupup</i>	<i>srupup</i>	regrouping of fish species
29. <i>lungani</i>	<i>fong in losr 1</i>	
30. <i>lungalum</i>	<i>fong in losr 2</i>	

time. When asked whether or not they had a "secret" fishing spot where they caught special or preferred species of fish and other marine organisms, older fisherwomen invariably answered in the affirmative (without, of course, revealing the location of this spot). Younger women seemed to find the question strange or amusing and answered no. But in order to capture a specific species of fish or invertebrate, one needs to know something of that organism's behavior, habitat, and life cycle. The younger women appear to lack this knowledge.

In his discussion of traditional systems of time reckoning and resource utilization, Gary Klee (1976) asserts that a loss of knowledge regarding nature's cyclic rhythms and interrelationships will lead to the eventual destruction of the environment. It is ironic that this loss of traditional environmental knowledge is occurring at a time when western science seeks ways to understand and use natural resources without harmful consequences. Although Klee was referring specifically to Palau, a similar situation exists on Kosrae. A number of elder fisherwomen told me that the younger generation of Kosraeans is ignorant of and uninterested in learning many of the finer points of fishing such as proper fishing times, behavior patterns of marine organisms, habitat location, and conservation practices. This situation is unlikely to change because young Kosraeans today are educated in public schools and therefore spend very little time with their elders learning traditional environmental knowledge.

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#### References

- Alkire, W. H. 1968. An atoll environment and ethnogeography. *Geographica* 4: 54-59.
- Alkire, W. H. 1977. *An Introduction to the Peoples and Cultures of Micronesia*. Cummings Publishing Co., Menlo Park, California.
- Alkire, W. H. 1978. *Coral Islanders*. A.H.M. Publishing Corp., Illinois.
- Bayliss-Smith, T. 1977. Energy use and economic development in Pacific communities. In T. P. Bayliss-Smith, and R. G. Feachem (eds), *Subsistence and Survival: Rural Ecology in the Pacific*, pp. 317-389. Academic Press, London.
- Eldredge, L. G. 1987. Poisons for fishing on coral reefs. In B. Salvat (ed.) *Human Impacts on Coral Reefs: Facts and Recommendations*, pp. 61-66. Antenne Museum E.P.H.E., French Polynesia.
- Falanruw, M. & M. Faimau. 1987. *Traditional fishing on Yap*. unpublished manuscript.
- Haines, A. K. 1982. Traditional concepts and practices and inland fisheries management. In L. Morauta, J. Pernetta, and W. Hearney (eds), *Traditional Conservation in Papua New Guinea: Implications for Today*, pp. 279-291.

- Institute for Applied Social and Economic Research, Boroko, Papua New Guinea.
- Hill, H. B. 1977. The Use of Nearshore Marine Life as a Food Resource by American Samoans. M.A. thesis in Pacific Island Studies, University of Hawaii.
- Johannes, R. E. 1978. Traditional marine conservation methods in Oceania and their demise. *Ann. Rev. Ecol. System.* 9: 349-364.
- Johannes, R. E. 1981. *Words of the Lagoon*. University of California Press, Berkeley.
- Klee, G. A. 1976. Traditional time reckoning and resource utilization. *Micronesica* 12: 211-246.
- Kosrae State Marine Resources Division. 1987. *Annual Fisheries Statistics Report for 1986-1987*.
- Maxwell, B. D. 1982. Floristic description of native upland forests on Kosrae, Eastern Caroline Islands. *Micronesica* 18: 109-120.
- McCoy, M. A. 1974. Man and turtle in the Central Carolines. *Micronesica* 10: 207-221.
- Nietschmann, B. 1973. *Between Land and Water: The Subsistence Ecology of the Miskito Indians, Eastern Nicaragua*. Seminar Press, New York.
- Nietschmann, B. 1985. Torres Strait Islander sea resource management and sea rights. In K. Ruddle and R. Johannes (eds), *The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific*, pp. 125-154. UNESCO/ROSTEA, Jakarta, Indonesia.
- Nietschmann, B., & J. Nietschmann. 1981. Good dugong, bad dugong; bad turtle, good turtle. *Natural History* 90(5): 54-63.
- Peoples, J. G. 1970. *Deculturation and Dependence in a Micronesian Community*. PhD Dissertation in Anthropology, University of California at Davis.
- Price, C. 1988. Report on the Selectivity of Monofilament Gillnets on the Reef Fish in Yap. Yap Marine Resources Management Division. Yap State Department of Resources and Development.
- Ritter, L. T. & P. L. Ritter. 1981. *The European Discovery of Kosrae Island: Accounts by L. I. Duperrey, J. S. C. Dumont d'Urville, R. P. Lesson, F. Lutke, and F. H. von Kittlitz*. Stanford University Press.
- Sarfert, E. G. 1919. Kosrae. In G. Thilenius (ed.), *Results of the 1908-1910 South Seas Expedition*, vol. II: *Ethnography*. L. Friederichsen and Co., Hamburg, Germany.
- Schoeffel, P. 1985. Women in the Fisheries of the South Pacific. In *Women in Development in the South Pacific: Barriers and Opportunities*, pp. 156-175. Development Studies Centre, Australian National University.
- Severance, C. J. 1976. *Land, Food, Fish: Strategy and Transaction on a Micronesian Atoll*. PhD dissertation, University of Oregon.
- Thompson, L. 1940. Southern Lau, Fiji: An Ethnography. *Bernice P. Bishop Museum, Bulletin* 162.
- U.S. Army Corps of Engineers. 1989. *Kosrae Coastal Resource Inventory*. Environmental Resources Section, Honolulu, Hawaii.

**Wilson, W. S. 1968. Land, Activity and Social Organization of Lelu, Kosrae. PhD dissertation in Anthropology, University of Pennsylvania.**

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